THE UNIVERSITY OF HULL

An Ethnographic Evaluation of the Design, Development and Deployment of a Multimedia Mandarin Learning Software Package for non Mandarin Adult Learners in Macao

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Doctor of Philosophy

By

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Abstract

This study examines the design, development and deployment of a multimedia CD-ROM for beginning Mandarin learning for adult learners in Macao. It focuses on three major issues: first the development, from existing textbooks and CD recordings, of the Mandarin CD-ROM 'Click!' series; second the use of an ethnographic research methodology to evaluate the first volume of the CD-ROMs; and third answers to questions as to the benefits and limitations of a multimedia CD-ROM and its appropriateness in Mandarin learning.

The design of this study uses an ethnographic approach to develop and evaluate instructional materials with the Knirk and Gustafson (1986) instructional development model and its aim is to apply ethnographic techniques to the different stages of the instructional development process. Due to the special circumstances of this study, the order of this research started with an initial literature review, a pilot study, further literature review, a main study, a follow-up study, and ended with a further literature review. The pilot study, which included a user-interface focus group and a pilot interview, was conducted initially to identify problems, analyse learners' entering skills, content/curriculum, existing materials and the community's characteristics. The pilot study was used to observe learners' attitudes and learning styles to help to establish instructional objectives and strategies. The first volume of the 'Click!' CD-ROM series was developed after the analysis of the first set of data, which constituted the problem determination and design stages of the model. The pilot study then moved into the development stage. The development stage of the instructional model was an iterative process. First, a main study was conducted to evaluate and revise the

first volume of the 'Click!' CD-ROM series. The main study included conducting a teacher focus group, in-class observations and main interviews. Notes from these observations and interviews provided valuable data to revise the second volume of the 'Click!' CD-ROM series. Then a follow-up study was carried out to evaluate and revise the first volume of the CD-ROM series again to ensure reliability and validity of the data. The third volume of the 'Click!' CD-ROM series was developed at the end of this research study. The findings present implications for multimedia design and the development and deployment of a Mandarin learning package for Portuguese adult learners in Macao. The actual outcome suggested that the role of the teachers is still irreplaceable, not even with technology.

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Chapter 1: Introduction

Trinder (2002) indicated that besides the Internet, the multimedia CD-ROM, with its potential for integrating and offering different media in one storage medium, has created quite a stir among language teaching professionals in the 1990s. The benefits of multiple modalities, online support tools, and instant feedback are believed to have the potential of increasing learner control, motivation, and autonomy. This study examines the design, development and deployment of a multimedia CD-ROM for beginning Mandarin learning for adult learners in Macao. It focuses on three major issues: first the development, from existing textbooks and CD recordings, of the Mandarin CD-ROM 'Click!' series; second the use of an ethnographic research methodology to evaluate the first volume of the CD-ROMs; and third provision of some answers to questions as to the benefits and limitations of the multimedia CD-ROM and its appropriateness in Mandarin learning.

There are ten chapters in this study: introduction, background information, multimedia and language learners, multimedia and foreign language learning, multimedia and Chinese language learning, development of the CD-ROM, research methodology, analysis of data, discussion of results, and conclusions and recommendations. In the introduction chapter, two items will be discussed that will give the reader the background about this project. The rationale of the study and the special circumstances of the situation in Macao are discussed. In the background information chapter, four items will be discussed that will give the reader the basic background about multimedia and Chinese language learning. Chinese language, foreign language learning, learners, and multimedia will be briefly discussed to set the stage for this study. The literature review consists of three chapters: multimedia and language learners, multimedia and foreign

language learning, and multimedia and Chinese language learning. Components of multimedia, multi modal processing and learning style associated with language learning and multimedia will be examined in the multimedia and language learners chapter. Features of multimedia that contribute to the success of foreign language learning will be explored in the multimedia and foreign language learning chapter. Finally the relationship between Chinese language learning and multimedia will be dealt with in the multimedia and Chinese language learning chapter.

The development of the CD-ROM chapter comes after the literature review. First, the rationale of using an instructional development model and the Knirk-Gustafson (1986) instructional development model will be discussed to give the reader some background information about the steps of the CD-ROM development. Then, the development of the series of the 'Click!' CD-ROM will be discussed in terms of its background, technologies and implementation. The research methodology chapter describes the ethnographic research method with the constructive/interpretive paradigm to explore the benefits, the limitations and the appropriate use of multimedia in Mandarin learning. A formative research model will be built and research questions will be generated.

The data analysis chapter analysed the data from the initial literature review, the pilot study, the second literature review, the main study, and the follow-up study. Formative middle-range theories are formulated and they are matched with the observed results that accrue from the data collection. The discussion of the results chapter discusses the Portuguese students and their common characteristics, the research questions, and comparing data found in this study with those in the third literature review. The final chapter summarises the research carried out in this study in terms of its findings, limitations and recommendations.

course has become the Macao Polytechnic Institute's responsibility. The school has trained up more than 9000 students since then, training about 2000 students per year (Zhou, 1999). There are basically three types of students in Macao: Cantonese, Macanese and Portuguese. Cantonese are students who are of Chinese descendents and speak Cantonese and write Chinese. There are two groups of Macanese students in the school system. The first group is Portuguese descendants who were born in Macao and speak Portuguese and may or may not speak Cantonese very fluently. The second group is Chinese descendants who were brought up with the Portuguese school system and can speak Cantonese but cannot read and write Chinese very well. Portuguese are students who were born in Portugal and came to Macao and speak no Chinese language.

For the Cantonese, only oral Mandarin training is provided. The training is divided into four levels: elementary, intermediate, advanced, and improvement. Each level lasts about 70 hours. For the Macanese and the Portuguese, training in listening, reading, spoken and written Chinese is provided. There are a total of three levels: elementary, intermediate, and advanced. Each level lasts about 120 to 150 hours (Zhou 1999).

The students who are studying Mandarin in the Macao Polytechnic Institute are all adults, mature students, who are mainly working in the government. They are aged from 20s to 50s (Zhang 2000). They need to constantly upgrade their knowledge or skills in order to keep up with their jobs or compete in their working environment. Learning language to them is a good asset, especially now that Mandarin is an official language. In the past, they could go to class during office hours. Nowadays they have to attend classes after work, before work or during lunch hours, which means that they need to use their personal time to upgrade themselves.

The purpose of this study is to explore how teachers or researchers can use computer technology to help these students in their Mandarin learning and studying. First, the researcher will convert the existing textbooks and CDs into CD-ROMs[1]. Then by means of evaluating the first volume of the CD-ROMs, the researcher hopes to find the benefits and limitations of using multimedia in Mandarin learning and how appropriate it is to use multimedia in Mandarin learning with the different types of students existing in Macao.

1.2 Special Circumstances

In 1998, being inspired by Clark's (1983) contention that media do not influence learning under any condition and the fact that the Macao Polytechnic Institute had asked the researcher to produce a series of Mandarin CD-ROMs, the researcher of this study wanted to pursue a research on whether or not multimedia affects language learning. During her initial literature review, she found that some of the articles were showing no significant differences in learning, she was not sure if she wanted to continue. Further more, during her initial literature review, most of the researches she found were mainly experimental and used quantitative analyses, and she was not sure if she had the resources to perform an experimental study at that time. Given the time constraint[2], if the researcher conducted the observation study and collected data first, then she would not have time to work on the literature review at that time. At that point, she was going to call a halt to this research.

Luckily, she came across several important articles that rekindled this

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[1] Macao Polytechnic Institute asked the researcher to coordinate this project and therefore CD-ROM was already chosen as the medium of instruction.

[2] The school was going to assign a group of Portuguese students to the researcher. But knowing the special circumstances that Macao was going to be handed back to China on December 20, 1999. Whatever the researcher was going to do, she had to complete getting the data from these students by the end of 1999 otherwise they may all be gone.

research study (Brett, 1998; Antón, 1996; Charmaz, 1996). Brett (1998) claimed that no studies have attempted to investigate the language learning effects of multimedia in a non-experimental setting nor while used in self-study over an extended time period. Antón (1996) suggested that proponents of the ethnographic approach find the use of ethnographic techniques in classroom observation methods a more successful approximation to the study of classroom interaction than the use of quantitative analyses. Charmaz (1996) claimed that one of the distinguishing characteristics of grounded theory methods (ethnographic research uses grounded theory) is the delay of the literature review. Based on what the experts said, the researcher decided to use an ethnographic method to evaluate whether or not multimedia has any effect on Mandarin learning in Macao. Due to the special circumstances that Macao was going to be handed back to China at the end of 1999, she decided to start collecting data from her participants first, so the process of the research proceeded as follows: an initial literature review, a pilot study, further literature review, a main study, a follow-up study, and ended with a further literature review, and then finally analysis of data, discussion of results, and the conclusions and recommendations.

Chapter 2: Background Information

Since the purpose of this study is to explore how teachers can use computer technology to help students in Macao in their Mandarin learning, one must have a clear understanding of what Mandarin learning is all about and what computer technology is involved. This chapter gives the reader the basic background information on multimedia and Chinese language learning. Chinese language, foreign language learning, language learners, and multimedia are discussed here. Key questions are derived from foreign language learning, language learners and multimedia sections and they are important questions that need to be answered later on.

2.1 The Chinese Language

Campbell (1991) claimed that Chinese has been a written language for about 3,500 years. Chinese belongs to an independent branch of the Sino-Tibetan language family. It is by far the largest and the most important member and is spoken today by about 1,200 million people in China, Taiwan, Malaysia and other parts of the South-East Asia. The term "Chinese" covers several dialect groups, which can be broadly divided into northern and southern dialects. The northern dialect, which is Mandarin, accounts for about two-thirds of all Chinese speakers. The Southern dialects include Wu, Gan, Xiang, Hakka, Yue (Cantonese), and Min (see appendix 2).

Both Cantonese and Mandarin are different dialects of the Chinese language. A dialect is a variation of a particular language. Because of China's long history, the numerous dialects of Chinese have diverged greatly, to the point that they are mutually unintelligible, where speakers of one dialect cannot understand speakers of another dialect. Fortunately, a common history and a common writing system have had a strong unifying influence on the Chinese dialects

(Dalby, 1998, p.127). According to Arendrup (1994a), the alternate names for Mandarin are Putonghua, Guoyu, and Huayu. Mandarin, under the term "Putonghua", which means "common language" and based on the Beijing dialect, is the official language of China since 1949. It is also the official language of Taiwan, where it is called Guoyu, which means "national language", and is one of the official languages of Singapore, where it is referred to as Huayu, which means "Chinese language".

Coulmas (1996) pointed out that attempts at reforming the Chinese writing have been made periodically and since the 1980s there have been repeated calls for both romanisation and simplification. The reform agenda of the 1950s and 1960s defined three main tasks: the standardisation and simplification of Chinese characters, the creation of a romanised orthography, and the promotion of the standard language. Under the direction of the officially appointed Committee for Reforming the Chinese Written Language, 2,238 Chinese characters have been simplified since 1956. The second measure was implemented in 1958 when the People's Congress adopted the Chinese phonetic alphabet, pinyin, as the standard system of writing Chinese with Roman letters. The third measure of the Chinese writing reform is a necessary corollary to the second. Knowledge of the standard language, Putonghua, is thus a precondition for employing pinyin as an effective means of written communication in China.

In Macao, a person's mother tongue or first language (L1) is Cantonese. Mandarin, along with Portuguese are considered to be second language (L2) here. Mandarin is becoming the medium of education, government, and business more and more. English is a very popular foreign language (FL) here.

Newnham (1987) said that a frequent objection about studying Chinese is its difficulty. Language is a spoken sound. It is often implied that in order to speak Chinese, one must learn several thousand characters as the first step.

Because Chinese is not a phonetic language, Newnham (1987) suggested 'the modern approach is via sounds alone' (p. 19).

Yu and Michaels (1998) saw that the most obvious differences of Chinese and other languages are the use of tones in the spoken language and the absence of anything resembling an alphabet in the written language. The foreignness of the written language requires the beginning student to learn three written forms of each new vocabulary item: romanisation, traditional Chinese character, and simplified Chinese character. Therefore, romanisation, pronunciation, character writing, and simplification are discussed next.

2.11 Romanisation

Over the years, people have invented various ways to write Chinese words using letters. Newnham (1987) indicated that these transliteration systems include Gwoyeu Romatzyh (GR), Wade-Giles, Yale and pinyin. GR was designed in 1926 by Chinese scholars and promulgated in 1928 by the Ministry of Education. Wade-Giles was the oldest and most widely used of all current romanisations, and its chief merit lies in this wide use. Yale arrived at their system soon after America's entry into World War II, which stimulated the study of oriental languages in the United States. It was designed to get quick results with home-based students learning spoken Chinese for service in the Far East. Pinyin had a long evolution. Its origins were in Latinxua, a system devised and promulgated in the Soviet Union in 1931, which was taken up in China some four years later.

Pinyin, since 1958, is the official alphabetical system used in China (Newnham, 1987, p. 77), which includes accent marks on some vowels to indicate the four tones. According to Newnham (1987), this system, pinyin, reads and writes easily, using fewer letters per sound than any other system.

2.12 Pronunciation

Ho and Bryant (1997) stated that the basic speech unit in Chinese is the syllable. A Chinese syllable is generally composed of an initial (the beginning consonant), and a final (the rest of the syllable) and a tone, which is represented by pinyin; and when the syllable is in a different tone it represents a different meaning. All Chinese dialects have tone, but Mandarin has one of the simplest systems, consisting of four basic tones: high level (first), high rising (second), low dipping (third), high falling (fourth) tone (Brown, 1994, p. 13). So if the voice rises when it should have fallen, one can end up saying a completely different word. A classic example is "mā má mǎ mà?", literally is "mother trouble horse scold" (see table 1). Getting the tones right is tricky for foreign speakers learning Chinese, but it is very important. Chinese tone is simply part of a word's pronunciation.

Table 1: Tones of Putonghua (Brown, 1994, p. 13)

Tone	First	Second	Third	Fourth
Pitch 5 4 3 2 1				
Tone pitch	5→ 5	3→ 5	2→ 1→4	5→ 1
Example	媽	麻	馬	罵
Pinyin	mā	má	mǎ	mà
English meaning	mother	trouble	horse	scold

According to Newnham (1987), spoken Mandarin today has only about 400 basic monosyllables. Combined with four tones, that would make up fewer than 1,600 syllables because some basic sounds do not carry all four tones. Since not all the concepts of the modern word can be specified in only 1,600

syllables, there is an overcrowding of meaning into sound. Chinese is famous for its frequent homophones (same sound, different meaning).

2.13 Character Writing

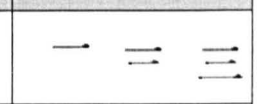
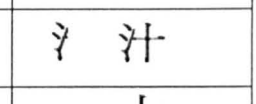
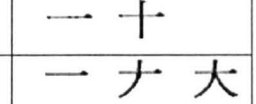
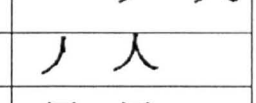
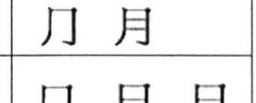
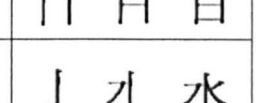
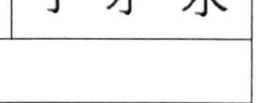
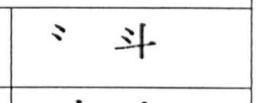
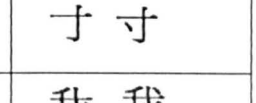
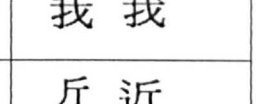
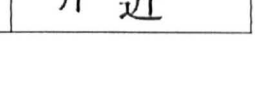
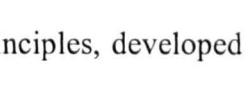
Li and Thompson (1987) said that the Chinese writing system is called the logographic or character system, because each symbol is a character/logograph. Gough, Juel, and Griffith (1992) and Ho and Bryant (1997) both identified problems of the logographic readers. The first is a memory problem. The second problem is the inability to read novel words.

Brown (1994) said that there are altogether over 60,000 different Chinese characters and about 3,000 are commonly used. In common written Chinese, there is roughly 200 commonly used character fragments or radicals. Chinese characters are often composed of many radicals, and it is frequently possible to determine the approximate meaning of a character by examining the radical. Chinese characters are also comprised of many strokes; each stroke has its own unique order in writing. This is called "pen order." One stroke is defined as the path from when the point the tip of the pen touches the paper until it is lifted off. Brown (1994) suggested eight basic strokes (see table 2) and ten basic rules in Chinese writing (see table 3).

Table 2: Eight strokes in Chinese writing (Brown, 1994, p. 4)

Name	Horizontal	Vertical	Right falling slope	Left falling slope	Hook	Elbow	Drop	Tick
Stroke								

Table 3: Basic Rules for Chinese Writing (Brown, 1994, pp. 7-8)

Rule	Chinese character	Stroke Order
1: From top to bottom	三	
2. From left to right	汁	
3. First horizontal, then vertical	十	
4. First horizontal, then right falling slope	大	
5. Right falling slope, then left falling slope	人	
6. From outside to inside	月	
7. Go inside then close the door	日	
8. First middle, then preserve the symmetry	水	
9. Three ways of writing dots		
Write the dot first when it is on the left	斗	
Write the dot last when it is inside	寸	
Write the dot last when it is on the top right	我	
10. First top right, then bottom left	近	

Brown (1994) also pointed out four out of six principles, developed by Xǔ Shèn, that can be used to explain the creation of Chinese characters. The four principles are pictograph (picture characters), ideograph (indirect symbol), phonetic compound (meaning plus pronunciation) and associative compound (combination of pictograph or ideograph to indicate a new idea) (see table 4).

Table 4: Ways of Creating Chinese characters (Brown, 1994, pp. 3-4)

Method in Chinese	Method in English	Chinese character	Meaning
象形	Pictograph 	日	Sun
		月	Moon
指事	Ideograph 	上	Above
		下	Below
形聲	Phonetic compound	河	River
會意	Associative compound	明	Sun + moon = bright

By means of picture writing, the characters describe real objects making words such as sun (日) and moon (月). Ideographs are formed by the concept of the matter, such as above (上) and below (下), by adding a dot above or below a horizontal line respectively. A phonetic compound is the combination of a radical, character fragments, suggesting the sense of the word plus a phonetic part indicating the pronunciation of the word. For example: river (河) is written with the radical of three drops of water on the left hand side, indicating river related to water, but is pronounced similar to the radical on the right hand side. Associative compound is combined by two or more pictographs or ideograph to form a new character to indicate a new idea. For example: bright (明) is made up of the sun (日) and the moon (月) to project brightness.

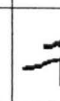
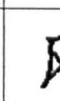
2.14 Simplification

As pointed out by Arendrup (1994b), simplification of the script was meant to make characters easier to learn and faster to write; at the same time, however, it has alienated the general reader from the classical literature. Li and Thompson (1987) said that the movement to simplify the Chinese writing system originated in 1890s. However, it did not crystallise into an official policy enforced by the government until the 1950s. The strategy of simplification involves a reduction in the number of strokes of commonly used characters.

This reduction is achieved by eliminating parts of a character, condensing several strokes into one and replacing a complex character or parts of a complex character with simpler one (see table 5). Arendrup (1994b) indicated that already in January 1956 a simplification of the script was introduced. A revision in May 1964 increased the number of simplification characters to 2,238.

Chinese now can be written in the traditional or the simplified format. In Hong Kong, Macao, and Taiwan, traditional Chinese characters are being used while in China simplified Chinese characters are being used.

Table 5: Traditional Character and Simplified Character (Newnham, 1987, pp. 165-166)

Traditional	蟲	後	寶	優	開	風
Simplified						
Meaning	insect	behind	treasure	excellent	open	wind

2.15 Summary of the Chinese Language

This section discussed romanisation, pronunciation, character writing, and simplification of the Chinese language to give the reader some background about the Chinese language. Mandarin is now one of the official languages in Macao. Learning the script writing of Chinese characters is not an easy job since there are 3,000 commonly used characters. Since pinyin became the official alphabetical system in China in 1958, it has been used widely. Chinese tone, pinyin, is simply part of a word's pronunciation. There are two types of Chinese character set: traditional and simplified. Traditional characters are being used in Hong Kong, Macao and Taiwan while simplified characters are being used in China.

Newnham (1987) suggested the modern approach of Chinese language

teaching is via sounds alone. Yu and Michaels (1998) said written Chinese language requires the beginning student to learn three written forms of each new vocabulary item: romanisation, traditional Chinese character, and simplified Chinese character. Since the initial effort of the Mandarin CD-ROM will be used for the beginning level, the researcher of this study takes Newnham's (1987) and Yu and Michael's (1998) advice and implements the CD-ROM with the concentration on vocabulary learning: pronunciation, pinyin, meaning, and character writing.

2.2 Foreign Language Learning

Rivers (1981) suggested that there are many reasons why people study foreign languages. These reasons are international understanding, intellectual training, cultural enrichment, and interpersonal communication. Twarog and Pereszlenyi-Pinter (1988) found these reasons why students studied a foreign language: 1) business interests; 2) heritage and family reasons; 3) preparation for travel; 4) meeting course and graduation requirements; 5) general interest in foreign language; 6) self-improvement and amusement; 7) overcoming fears of previously demonstrated incompetence in learning a language in a classroom setting; 8) getting a job.

Crystal (1997) indicated that foreign language learning (FLL) was at one time thought to be exclusively a matter of teaching techniques. In fact, if teaching were kept at or above a minimum level of efficiency, learning would automatically follow. Today, the active role of the learner is an established principle. Research is not only directed at the way teachers teach, but also at the way learners learn.

According to Rubin (1975), good language learning is said to depend on at least three variables: aptitude, motivation, and opportunities. An individual

with lots of natural ability and motivation with little opportunity may have difficulty in acquiring a language. If opportunity is present, but there is little motivation or poor learning skills, then language learning will proceed slowly (ibid, p. 44).

Language skills and factors affecting language learning are discussed in this section to give the reader some background about the four language skills and what makes successful language learning.

2.21 Language Skills

Zhang (1998) said that of the four skills of language learning, listening and reading are receptive skills while speaking and writing are productive skills. However, Rivers (1981) argued that listening is not a passive skill or receptive skill, listening is a creative skill. In order to comprehend the sounds falling on their ears, students take the raw material of words, arrangements of words, and the rise and fall of the voice, and from this material they create significance. One obstacle to comprehension when students listen to a message in a foreign language is the ways of life, customs, and values of speakers of a language are very different from their own. Rivers suggested that all material used for listening comprehension, even in the earliest lessons, should be authentic. He added that 'dialogues are appropriate practice in the early stage of the listening skill' (p. 168). These should be short, written in authentic speech forms with a normal amount of redundancy, and heard and repeated at a normal conversation speed.

Rivers claimed that the early introduction of the speaking of the language is important for reasons of motivation. Students come to the study of another language with the strong conviction that "language" means "something spoken". To teach the speaking skill, it is necessary to understand the processes involved

in speech. Through speech, one expresses emotions, communicates intentions, reacts to other persons and situations, and influences other human beings. Dialogue is also useful in the speaking skill. In a dialogue, the informal language is learned in an immediately useful form, where the students can practise outside of the classroom.

According to Rivers (1981), reading is sometimes referred to as a passive or receptive skill, but if one examines the abilities that come into play in fluent direct reading with comprehension of meaning it is clear that readers are far from passive during this activity. The reading skill, once developed, is the one which can be most easily maintained at a high level by the students themselves without further help from a teacher. She also noted that the ability to read another language with direct comprehension and fluency should be cultivated in progressive stages and practised at first with carefully selected material, 'which students can read with ease and enjoyment' (p. 260).

Rivers went on to state that writing is not a skill that can be learned in isolation. Writing, in its simplest form may just be notation, copying on its conventional graphic from something already written, or reproducing in written form something, which has been read or heard. In its most highly developed form, writing refers to the conveying of information or the expression of original ideas in a consecutive way in a new language. Writing practice will at first be a service activity, consolidating work in the other areas. In its more advanced form of composition, writing is dependent on progress in other skills.

Rivers recommended that decisions on the ordering of skills should depend on the aims of the course. Where communication skills are the main objective, listening and speaking seem the obvious place to begin. If reading is the primary objective, reading may be the place to start. Motivationally speaking, the aural-oral skills are a good starting point for any general course because most

students come to their first language class with the notion that language is something one hears and speaks.

2.22 Factors affecting Foreign Language Learning

Crystal (1997) indicated that exposure to native users, regular practice, learning strategies, teaching objectives, motivation, attitude, and teaching methods are some of the key factors in successful language learning (Crystal, 1997, p. 375). Oxford et al. (1993) pointed out that motivation, language learning strategies, language learning styles, gender, course level, and previous foreign language learning experience might all be relevant to achievement in learning a new language (p. 361). Therefore, exposure to native users, regular practice, language learning strategies, teaching objectives, gender, course level, previous foreign language experience, language learning style, motivation, attitude and teaching methods are briefly discussed.

Crystal noted that exposure to native users is a real benefit, through the use of authentic materials, such as audiotape, videotape, and newspaper library. Another important dimension is the use of educational visits abroad. Out-of-school activities should be encouraged, such as pen friends, private exchanges, and weekend culture simulation courses.

In terms of regular practice, Crystal also said that exposure and practice in foreign language needs to be regular. Whenever possible, the aim should be to teach little and often. Too much exposure at any one time can be as ineffective as too little, readily leading to fatigue and superficial assimilation, that which is quickly learned is quickly forgotten.

In terms of language learning strategies, Crystal also added that students can benefit from being taught to learn how to learn foreign languages. Such strategies can include silent rehearsal, techniques of memorisation, and

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In terms of language learning strategies, Crystal also added that students can benefit from being taught to learn how to learn foreign languages. Such strategies can include silent rehearsal, techniques of memorisation, and

paraphrase. Oxford et al. (1993) claimed that students' chosen language learning strategies are often determined by their style preference and gave examples of strategies such as paying attention, looking for conversation partners, and taking notes.

In terms of teaching objectives, Crystal (1997) suggested that they need to be carefully selected to allow realistic progress with any students. Different kinds of objectives should be explored. Should all four linguistic modes: speaking, listening, reading, writing, need to be introduced, and if so, in which order? Should the focus be on communicative skills or on formal techniques, such as translation? How far should L1 input be used in L2 teaching?

In terms of gender of the students, language course level, and previous foreign language experience, Oxford et al. (1993) claimed that they make a difference in learning a foreign language. Throughout the world, the language learning studies have found that females frequently use more strategies than males to learn languages (ibid, p. 363). They also indicated that language course level influences how students learn foreign languages. Higher-level students may be using more positive, student-directed, and communicative strategies. Previous language learning experience is often related to choosing a foreign language as an elective course. Students who are studying a new language as an elective use significantly more strategies and are more motivated than students who are taking the language as a requirement.

In terms of language learning styles, Oxford et al. also claimed that there are general approaches students use to learn a new language and identified sensory preferences as the key learning style difference relevant to distance learning by satellite. These preferences included visual versus auditory, which the researcher of this study feels also is applicable to CD-ROM usage. Sensory preference refers to the physical, perceptual learning channels through which the

student learns most comfortably. Visual students like to read in the new language, take notes, make outlines in writing, watch movies in the new language, and seek a great deal of visual stimulation. For them, dictations, conversations, and oral directions without any visual backup can be confusing and anxiety-producing. Auditory students, on the other hand, are comfortable without visual input and therefore seek conversation partners and oral activities. They are excited by classroom interactions in role-plays but sometimes have trouble with written work.

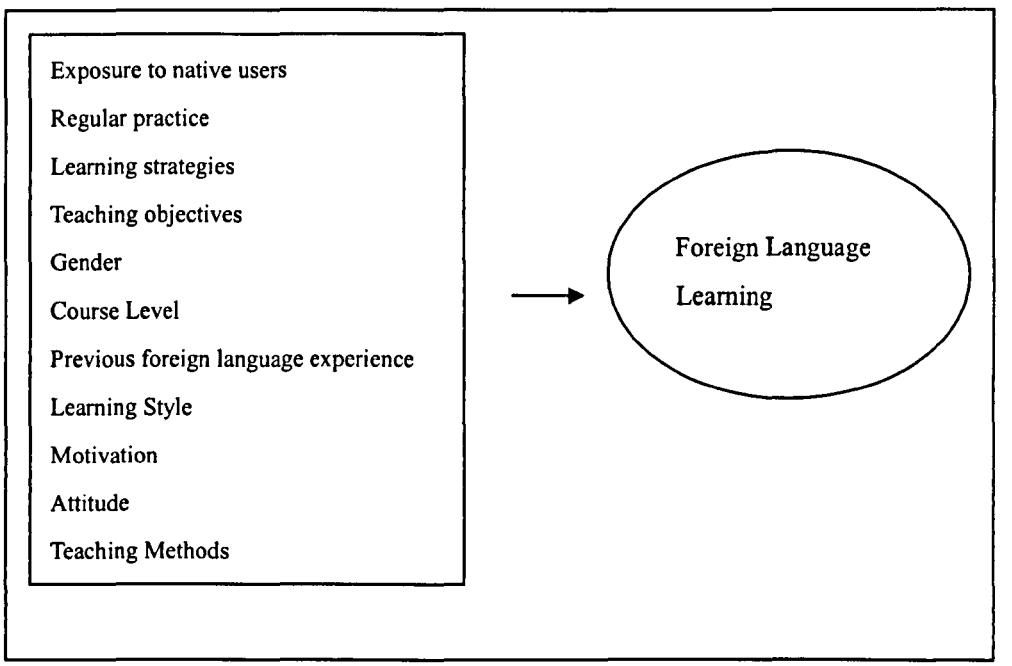
In terms of motivation, Oxford et al. (1993) added that it is one of the most important student variables in language learning. Thinking along the same line of thoughts, Crystal (1997) said that motivation should not only be applied to students, but also to teachers. It is difficult to teach enthusiastically if it is known that most of the class is going to drop their language learning at the earlier opportunities (p. 375). Crystal also added that attitude towards the foreign language is also very important. If a student perceives a country or culture to be unpleasant, the negative attitude is likely to influence language-learning achievement. Motivation and attitude are the key issues in this study.

Besides motivation and attitude, Crystal also pointed out that teaching methods need to be flexible to suit the needs of individual students, like their interests and cognitive skills and to make best use of classroom design and resources, such as the availability of audio-visual aids. Language educators have always attempted to solve the problems of language teaching by focusing attention on different language teaching methods, and these methods include grammar-translation, direct, reading, audiolingual and audiovisual methods, which will be discussed later.

Crystal (1997) and Oxford et al. (1993) both identified some key factors that

affect the learning of a foreign language. These factors are exposure to native users, regular practice, language learning strategies, teaching objectives, gender, course level, previous foreign language experience, language learning style, motivation, attitude and teaching methods, as shown in Figure 1.

Figure 1: Factors Affecting Foreign Language Learning (Crystal, 1997, p. 375 and Oxford et al., 1993, p. 361)



2.23 Summary of Foreign Language Learning

Language skills and factors affecting the foreign language learning are briefly discussed in this section. In terms of language skills, Zhang (1998) said that listening and reading are receptive language learning skills while speaking and writing are reproductive skills. Rivers (1991) claimed that the early introduction of the speaking of the language is important for reasons of motivation, listening is a creative skill and that to be literate in a language implies the ability to read and write. Dialogues are good for the development of listening and speaking skills. The order of the language skills to teach depends

on the objective of the course. In terms of factors affecting foreign language learning, Crystal (1997) and Oxford et al. (1993) claimed that exposure to native users, regular practice, language learning strategies, teaching objectives, gender, course level, previous foreign language experience, language learning style, motivation, attitude and teaching methods are some key factors affecting foreign language learning. Motivation and attitude are the central factors in foreign language learning. Teaching objectives need to be selected to allow realistic progress for any students, teaching methods need to be flexible to suit the needs of individual students, and learning materials should be authentic.

The researcher of this study took Rivers' (1981) suggestion about where communication skills are the main objective, listening and speaking seem to be the obvious place to begin. During the in-class observations in the main study, the Mandarin teacher who was assigned to teach the Portuguese group made the decision to emphasise communication skills. The teacher preferred the students to practise their speaking skills with him and their listening skills with the Mandarin CD-ROM, whether in class or at home. So listening skill is the objective of the CD-ROM development in the in-class observation study.

2.24 Key Questions

Which language skill is more appropriate to learn through the multimedia CD-ROM? The researcher will try to present some answers in the literature review.

2.3 Language Learners

Warner (2000) said that all 'learners' are not equal. They come in a variety of sizes, shapes, and from many cultural backgrounds. In addition, their past experience and existing methods of learning may be very different. Some will like to process information through text, while others will want visual support and images. Some will assimilate information individually while others will prefer to work in groups. Some will grasp information intuitively and quickly whereas others will prefer to see a strong sequential path and like time to reflect. In the end, the only thing one can say for sure is that every individual learns in his or her own particular way. This research is about adult learners in Macao learning Mandarin with a multimedia CD-ROM. Adult language learners and their learning styles in learning a foreign language are discussed in this section.

2.31 Adult Language Learners

Both Caffarella (1993) and Wlodkowski (1999) agreed that most adults choose to learn through self-directed learning. Caffarella said that self-directed learning is viewed as the essence of what adult learning is all about, which includes three principles: a self-initiated process of learning that stresses the ability of individuals to plan and manage their own learning, an attribute or characteristics with personal autonomy as its hallmark, and a way of organising instruction with formal settings for greater learner control (p. 25-26). In self-initiated learning ventures, adults seek assistance in the form of human (friends, family members and experts in the content area) and material resources (books, magazines, and videotapes). Learners choose to assume the primary responsibility for planning, carrying out, and evaluating their learning experiences. Caffarella synthesised four variables that appear to have the most influence on whether or not adult learners exhibit autonomous behaviour in

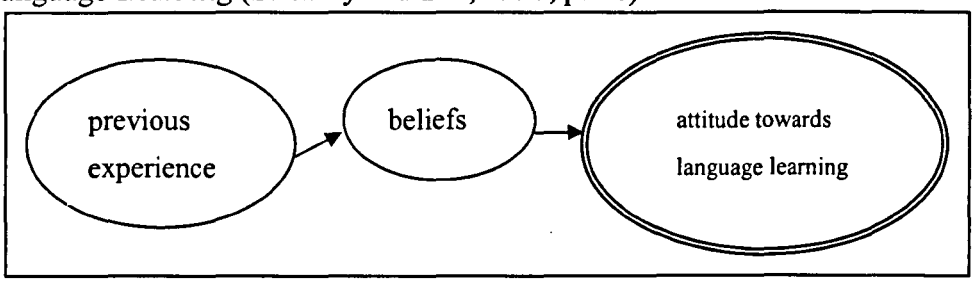
learning situations. These are their level of technical skills, their familiarity with subject matter, their sense of personal competence as learners, and the context of the learning event (p. 30). Greater learner control means that learners are given the time and opportunity to think about what they want to learn (what is meaningful or useful to them), how they want to go about learning (techniques, resources needed, location, and pacing), and which criteria will be used, and in what ways, to determine whether or not the learning experience was satisfactory and worthwhile.

Rivers (1981) pointed out that the situation of the child learning a first language and that of the adolescent or adult student learning a second language are different in many ways. Children are exploring their environment and acquiring language at the same time. They are encouraged to imitate and communicate their needs. The adult students already possess an effective means of communication. To learn another language, they must limit themselves and embarrass themselves by their incapacity to express their real meaning. Along similar thoughts, Crystal (1997) cited a list of differences between adult foreign language learners and young children acquiring their mother tongue. First, adults already have a set of formed cognitive skills and strategies that should make foreign language learning easier. Second, adults already have a language, and this inevitably reduces their motivation to learn another language. Third, adults are more self-conscious about foreign language learning and are less able to assimilate cultural differences. Fourth, adults have less time and opportunity than the child for foreign language. Fifth, adults find themselves in a less natural learning environment than children.

Samimy and Lee (1997) claimed that language learners bring with them a variety of preconceptions and beliefs about the target language, culture, instructor, learning strategies, and potential benefits for mastering the language. Their

beliefs are often influenced by their previous experiences both with education in general and with language learning in particular. Their belief systems, in turn, affect how they perceive and interpret language learning in the classroom context (see Figure 2). Similarly, their language instructors also bring with them a host of beliefs about language teaching and learning. Their beliefs are also influenced by their own experience as language learners, their experience of what works best and established practice.

Figure 2: Influence of Previous Experience and Beliefs on Attitude towards Language Learning (Samimy and Lee, 1997, p. 42)

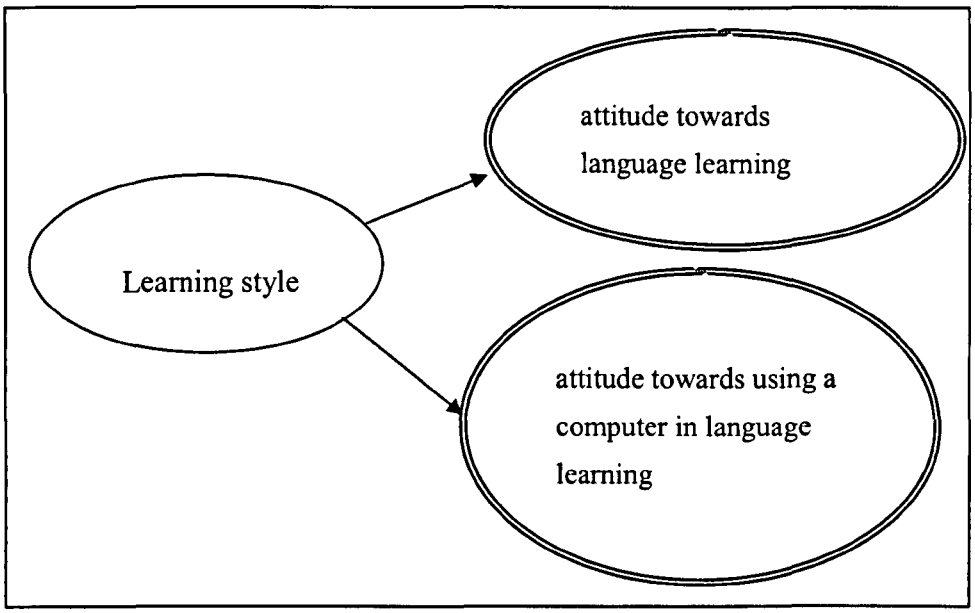


2.32 Learning Style

According to Dunn and Griggs (1995), many people prefer to learn in ways that are sometimes slightly different from other people of the same age, class, culture, grade, religion, or nationality prefer to learn. They claimed that how people prefer to learn is called their learning-style preference. Felder and Henriques (1995) claimed that mismatches often occur between the learning styles of students in a language class and the teaching style of the instructor, with unfortunate effects on the quality of the students' learning and on their attitudes towards the class and the subjects. Based on the fact that students' learning styles can affect their attitudes towards the subject, the researcher of this study will try to find out the influence of learning style on attitudes towards language learning and the use of a computer in language learning as shown in Figure 3.

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Figure 3: Influence of Learning Style on Attitudes towards Language Learning and using a Computer in Language Learning (Felder and Henriques, 1995, p. 21)



2.33 Dunn and Dunn Learning Styles Model

Dunn and Griggs (1995) argued that educators cannot identify students' learning style correctly without an instrument and pointed out that the instrument with the highest reliability and validity and the one used in most research on learning styles is the Dunn, Dunn, and Price Learning Style Inventory (LSI). The Dunn and Dunn learning styles model (see Appendix 3) described in Dunn and Griggs assesses individual preferences in the following areas: 1) immediate environment (sound, light, temperature, and seating design); 2) emotionality (motivation, persistence, responsibility/conformity; and need for internal or external structure); 3) sociological style (learning alone, in pair, as part of a small group or team, with peers, in a variety of ways); 4) physiological set (auditory, visual, tactual, and/or kinaesthetic perceptual preferences, early morning, afternoon, or evening, time-of-day energy levels, mobility needs, global (right) or analytic (left) cognitive/psychological processing inclination).

As far as immediate environment goes, Warner (2000) said that the level of

physical space and comfort can make a significant difference to an individual's capacity to learn. Good training rooms should be soundproofed and quiet. In general people need natural light to see and feel awake. Fresh or regulated air is also important, as the brain needs plenty of oxygen to perform properly. As far as emotional factors go, Warner (2000) said this involves student's motivation, persistence and need for more or less direction when learning a new task.

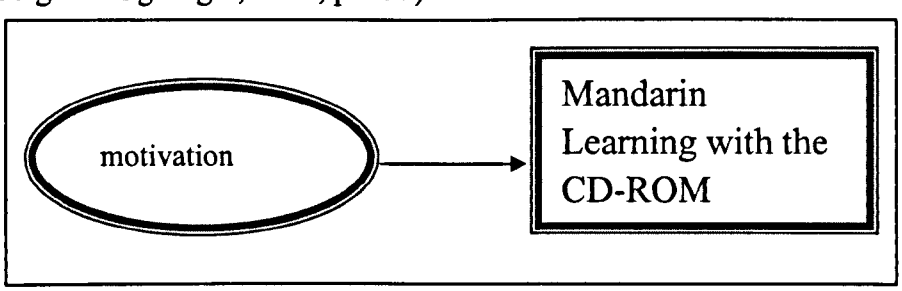
As far as sociological factors are concerned, some students prefer to work alone while others like to work with in a group, some students feel better or more confident when someone with authority is present, or some students prefer learning in several ways. Warner classified the learners into three groups: dependent learners, collaborative learners, and autonomous learners. Dependent learners, tend to like large groups, usually prefer teacher directed information, therefore lectures or tutorials are preferred. Collaborative learners tend to favour discussion orientated sessions or small group seminars and a chance for social interaction while autonomous learners prefer to exercise an influence over the content and structure of the program and see the teacher/facilitator as a resource.

As far as physiological factors are concerned, some students need to eat, drink, chew or bite objects while concentrating. Some students study best in the evening, in the morning, in the late morning, or in the afternoon. Some sit quietly when studying. Some students like to see the whole picture at once while some like to build the picture step by step. Some students are analytic and they need to learn in a logical, step-by-step way while others build facts carefully and then come to a conclusion. Some students make decisions best when they reflect. The researcher of this study likes to see whether or not these factors from the Dunn and Dunn Learning Styles Model can be seen in the students studying Mandarin using the CD-ROM in Macao.

2.34 Motivation and Attitude

Wlodkowski (1999) stated that 'people work longer and with more intensity when they are motivated than when they are not' (p. 6). When adults can see what they are learning makes sense and is important to their values, their motivation emerges. Intrinsic motivation is governed to a large extent by emotions. For adult learners to experience intrinsic motivation, 'they need to connect who they are with what they learn' (ibid, p. 12). For extrinsic motivation, the focus for learning is on the use of extrinsic rewards such as grades, eligibility, and money. When learners do not respond to these incentives, they are often seen as lacking motivation. Walberg and Uguroglu (1980) claimed that motivation is one of the several keys to effective learning. A child completely lacking in motivation to learn cannot learn (p. 121). Following Walberg and Uguroglu's thought, the researcher of this study is exploring motivation as it applies to Mandarin learning with the CD-ROM as shown in Figure 4.

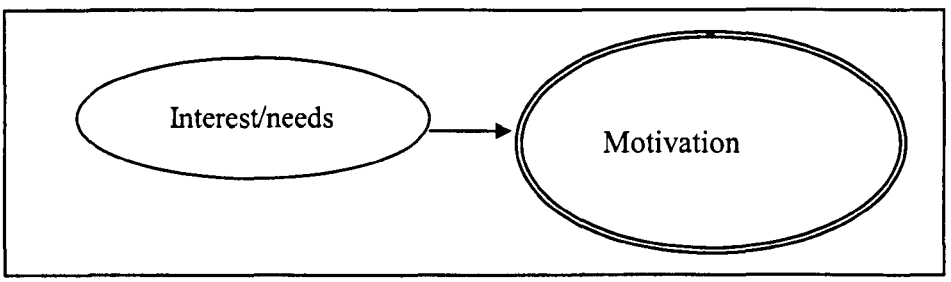
Figure 4: Influence of Motivation on Mandarin Learning with the CD-ROM (Walberg and Uguroglu, 1980, p. 133)



Uguroglu and Walberg (1979) performed a benchmark analysis of 232 correlations of motivation and academic learning found that 98 percent of the correlations between motivation and academic achievement were positive. Wlodkowski added that when motivation to learn is very low, then potential

learning achievement would be diminished; there are other factors, such as the ability and quality of instruction that are also necessary for learning to occur. If people are given learning tasks that are beyond their ability, no matter how motivated they are, they will not be able to accomplish them. Warner (2000) said that if the content of a course is of no interest to the students and that they do not believe they need the learning, it is unlikely they will have much motivation as shown in Figure 5.

Figure 5: Influence of Interest/Needs on Motivation (Warner, 2000, p.24)

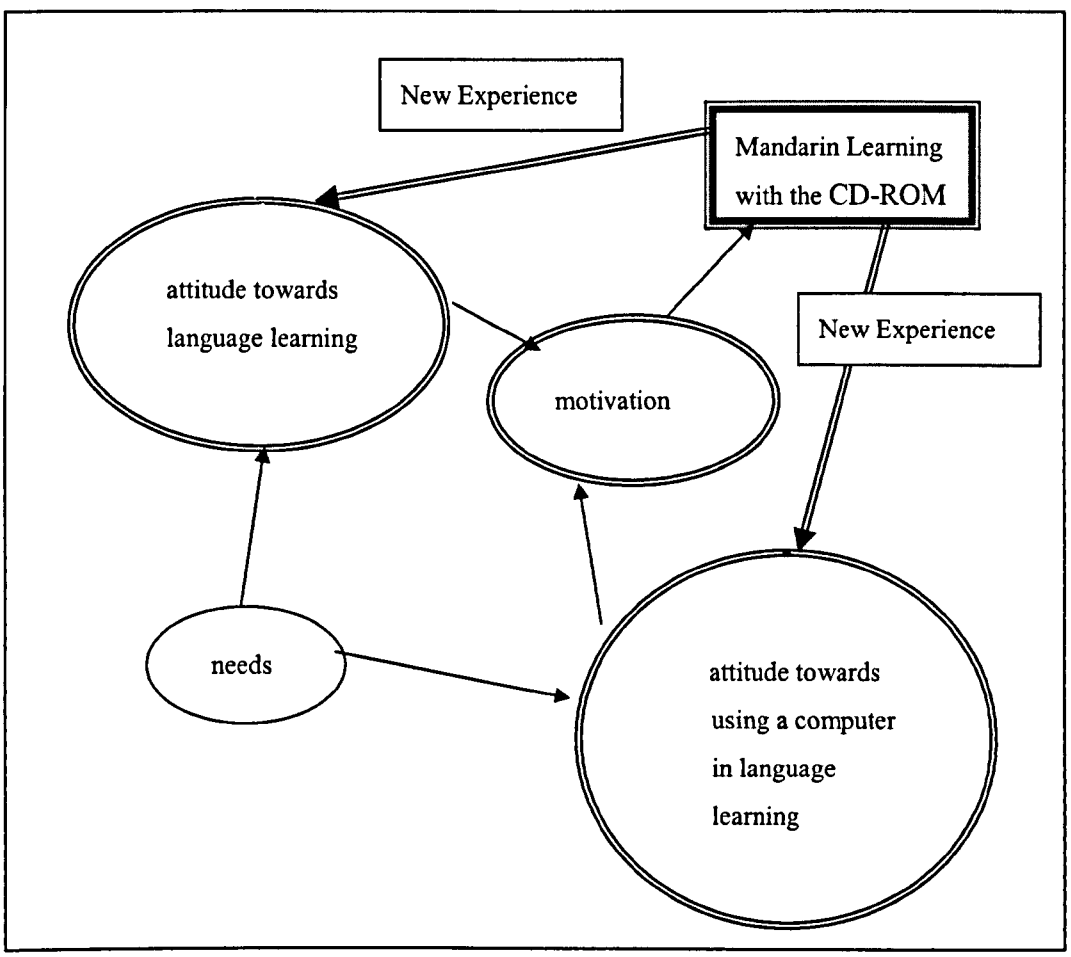


Besides motivation, Crystal (1997) said that attitude towards the foreign language is important. If a student perceives a country or culture to be unpleasant, the negative attitude is likely to influence language learning achievement. Johnson (1980) pointed out that an attitude is a combination of concepts, information, and emotions that results in a predisposition to respond favourably or unfavourably towards particular people, groups, ideas, events or objects.

Wlodkowski (1999) claimed that students' attitudes will be an active influence on their motivation to learn from the moment instruction begins and needs influence attitudes because they make certain goals more or less desirable. Because 'attitudes are learned, they can also be modified and change' (p. 73). New experiences constantly affect attitudes, by shifting, intensifying, weakening or reversing them.

According to Wlodkowski (1999), since needs influence attitudes and attitude influences motivation, which in turn motivates learning, and that new experiences can change attitude, the researcher of this study plans to investigate what attitudes the students in Macao have in using the CD-ROM in their Mandarin learning and whether or not the Mandarin CD-ROM can change their attitudes. These attitudes include both attitude towards language learning itself and attitude towards using a computer in language learning as shown in Figure 6.

Figure 6: Relationships among Needs, Attitude, Motivation and Mandarin Learning with the CD-ROM (Wlodkowski, 1999, pp. 72-73)



2.35 Summary of Language Learners

Adult language learners and their learning styles were discussed here. Caffarella (1993) said that self-directed learning is viewed as the essence of what adult learning is all about and synthesised four variables that appear to have the most influence on whether or not adult learners exhibit autonomous behaviour. They are their level of technical skills, their familiarity with subject matter, their sense of personal competence as learners, and the context of the learning event. Crystal (1997) said that adults have less time and opportunity to learn a foreign language and Samimy and Lee (1997) said that their previous experience and beliefs will affect their learning. Felder and Henriques (1995) claimed that mismatches between learning styles of students in a language class and the teaching style of the instructor affect the quality of the students' learning and on their attitudes towards the class and the subjects. Dunn and Griggs (1995) suggested using the Dunn, Dunn, and Price Learning Style Inventory to assess students' learning styles. According to Wlodkowski (1999), needs influence attitudes and attitude influences motivation, which in turn motivates learning, and that new experiences can change attitude. Motivation turns out to be the important element in the learning style that may affect foreign language learning. The researcher of this study will try to modify the Dunn and Dunn learning style model for adults learning Mandarin with the CD-ROM in the literature review.

2.36 Key Questions

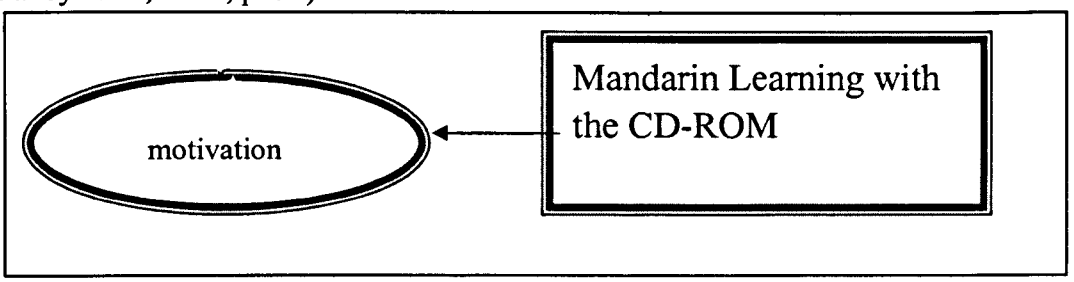
What needs to be modified in the original Dunn and Dunn Learning Styles Model to accommodate adult learners in learning Mandarin using the CD-ROM in Macao? Is motivation the focal point in the Dunn and Dunn Learning Styles Model for Mandarin learning with the CD-ROM? Which human factor affects Mandarin learning with the CD-ROM? What is the relationship between

learning style, attitude, motivation and Mandarin learning with the CD-ROM? The researcher will try to explore these questions through the literature review. Can the multimedia CD-ROM change the attitudes and motivation of the adult learners learning Mandarin with the CD-ROM in Macao? This needs to be answered later on with the analysis of the data in this study.

2.4 Multimedia

The use of multimedia technology in teaching and in courseware development is increasing. One reason for this trend may be the assumption that 'multimedia information helps people learn' (Najjar, 1996, p. 129). However, the use of multimedia may have little profit if it is not being used in a suitable learning environment. Human involvement is normally a prerequisite of successful language learning (Davey, Jones and Fox, 1995, p.32). Both the teacher as well as the student must be involved. Multimedia can be used in many areas in teaching. One popular area for multimedia approaches is foreign-language teaching (Gayeski, 1994, p. 3995). Davey, Jones and Fox argued that the introduction of sound and vision (whether still or moving) to language learning materials could transform the learning experience and enhance the motivation of the learner. Therefore, following his line of thought, the researcher of this study takes the position that since sound and vision enhance the motivation of the learner, the appropriate use of the Mandarin CD-ROM with multimedia capability should also enhance the motivation of a learner, as shown in Figure 7.

Figure 7: Influence of Mandarin Learning with the CD-ROM on Motivation (Davey et al., 1995, p. 31)



Multimedia is a term that has been under constant transformation. The name itself is subject to changes. According to Najjar (1996) and Bagui (1998), multimedia is the use of text, graphics, animation, pictures, video and sound to present information. Ghislandi (1994) has the following definition:

> "Multimedia packages" are products that use more than one medium for communication purposes, for example, text, still images, motion sequences, audio, graphics, and animation, in various combinations. They are integrated for the user by a computer that manages them transparently. Communication between the user and the computer is by means of Graphical User Interfaces (GUI) which facilitates interaction (p. 3987).

Multimedia systems can be very useful in education. Gayeski (1994) claimed that they can perform the following tasks: computer-generated lecture support, on-line communications, database research, hypertext/hypermedia, computer-based instruction (also known as computer-assisted instruction), simulators, and electronic performance support systems.

Three items are discussed in this section: instructional features; success of multimedia instruction; and motivation and engagement factors for adult learners in the multimedia environment.

2.41 Instructional Features

According to Stemler (1997), the use of multimedia technology has offered an alternative way of delivering instruction. Interactive multimedia learning is a process, rather than a technology, that places new learning potential into the hands of users. She talked about five features in the educational multimedia that are used for instructional purposes. These five features are screen design, learner control and navigation, use of feedback, student interactivity, and video and audio elements.

First of all, Stemler claimed that screen design is an issue of great importance for multimedia developers. Effective screen design causes learners to focus their attention, develop and maintain interest in lesson content, promotes the engagement of the learner with the material, facilities deep processing of important information and facilitates lesson navigation. Well-designed screens should visually stimulate, be easy to read, and exhibit no annoying or distracting features. Generally, it is suggested that no more than two or three types and sizes of fonts be used per screen. Other important aspects of screen design is the location of various components on the screen and the consistency of those locations throughout the program and displaying relevant information in chunks, limiting the quantity of information presented to a few items per screen.

Secondly, in terms of learner control and navigation, Stemler said that greater control over the learning event promotes satisfaction. Consequently, students feel more responsible for their learning process. Learners should be given more control over the content. One way multimedia can give control to the learner is providing the ability to navigate through programs at the learner's own pace and ability level. Low-ability students are especially confused when control depends on a wide range of options. Limiting the number of choices on the screen helps direct the learner to the appropriate path, yet still providing the

learner with control of the lesson. Pop-up windows in conjunction menus can provide learners with expanded clarifications, enabling the learner to make informed selection. Clearly defined navigation should be provided within the system and for accessing for on-line support. To give more complete control of the program, play, stop, and pause for video and audio should be used when possible. Buttons or hot spots to quit the program or to access the next screen, previous screen, help screen, glossary, and main screen should be provided.

Thirdly, in terms of the use of feedback and student interactivity, Stemler suggested that learners must process information actively in order to comprehend and remember. Interaction is the major difference between traditional instruction and instruction delivered by multimedia and is commonly viewed as stimulus-response-reinforcement encounters between the learner and instruction. Feedback is information about the appropriateness of the learner's response that is given to the learner by the courseware and can be defined as output, usually displayed on a screen, to tell students how successful they have been in solving problems or to provide information about the quality of their response to a test-like event. Feedback is a method to reinforce, elaborate, and clarify. Learner interactivity can be promoted by providing access to navigation icons, which include previous frame or next frame, test key, next lesson, menu, and exit key, and content icons, which include help, answer, glossary, objective, and options key. It is important to incorporate meaningful interactivity into the multimedia software, by providing opportunities for interaction at least every three or four screens, or alternatively, about one per minute, and chunk the content into small segments (ibid, p. 344). Stemler also suggested that feedback should be on the same screen with the question and student response, verify the correctness of the question and should be encouraging. If possible, allow students to print out their feedback. Interactivity can positively affect learning.

Finally, in terms of video and audio elements, Stemler (1997) said that whenever audio is used to support text, it is important to provide a way for the learner to pause or repeat the sound. Poor readers may want to go through a text passage more than once, or may want to pause the audio to study an unfamiliar word. She claimed that motion video is better used for broader, abstract materials, possibly with an emotional appeal. An abstract video segment may serve well as the medium for an advance organiser or for a lesson summarisation. Most learning occurs when audio and video are being used at the same time when the content is presented.

Stemler discussed five features in educational multimedia that are used for instructional purposes. These five features are screen design, learner control and navigation, use of feedback, student interactivity, and video and audio elements as summarised in Table 6.

Table 6: Instructional Features of Multimedia (Stemler, 1997, p. 339)

Instructional Features of Multimedia
1. Screen design
2. Learner control and navigation
3. Use of feedback
4. Student interactivity
5. Video and audio elements

2.42 Success of Multimedia Instruction

Najjar (1996) and Bagui (1998) suggested some reasons why multimedia instruction is successful. The reasons are reduced instruction time, interactivity, self-paced learning, self-directed learning, flexibility, motivational effects, information chunking, having rich content, dual coding, better-organised instructional materials and novelty.

In terms of reduced instruction time, Kulik, Kulik, and Cohen (1980) found that computer-based instruction had a 36% savings in learning time (p. 537). Kulik and Kulik (1991) identified 32 studies which compared instructional time for post secondary students in the computer-based instruction and conventional classrooms. The computer based instruction students required about two-thirds as much instructional time as did students who were taught conventionally (p. 88).

In terms of interactivity, Najjar (1996) pointed out that computer-based multimedia instruction tends to be more interactive than traditional classroom lectures. Bosco (1986) concluded that interactivity appeared to have a strong positive effect on learning and that people learn the material faster and have better attitudes towards learning the material when they learn in an interactive instructional environment. Bagui (1998) said that multimedia programs are considered interactive because they are responsive to learner's input.

In terms of self-paced learning, computer-based multimedia instruction allows the learner to personally set the pace of learning. Najjar claimed that self-paced learning is probably a more effective way to learn because the learner can move on to new material when the learner is ready.

In terms of self-directed learning, Bagui claimed that the information in computer-based multimedia is presented in a nonlinear hypermedia format. Hypermedia refers to a computer-based system that allows interactive linking of multiple format information including text, still or animated graphics, movie segments, video and audio. Any stack of information can be linked to any other stack of information through buttons. Buttons allow users to browse through a hypermedia system using any sequence they desire. The very nature of hypermedia often allows the viewers to view a given body of knowledge from many different perspectives. The users of the hypermedia system are free to choose whichever route they please to increase their knowledge bases.

In terms of flexibility, Bagui (1998) said that multimedia programs are flexible in terms of how they may be used in classrooms, by individuals, or by small groups. Flexibility can also refer to the variety of means by which wanted information can be located—menus, icons, and word-based searches.

In terms of motivational effects, Bagui suggested that many computer-based instructional programs have considered the motivational function of a computer an important factor. Although Clark (1994b) claimed that the use of all kinds of media do not motivate learning, research done by Yang and Chin (1996-97) showed that the intrinsic features of the computer such as immediate feedback, animation, sound, active interaction, and individualisation are more likely to motivate students to learn than any other media.

In terms of information chunking, Bagui argued that according to the information processing theory, an average person can hold up to seven chunks of information at a time in the short-term memory, and information is processed more easily and faster if it is appropriately chunked. Information in hypermedia can be considered chunked because learners can view cards or stacks in whatever order they wish.

In terms of having rich content, Bagui noted that since multimedia encompasses several media, there is obviously no shortage of information. If something is not written in textual format, there is probably a video made about it.

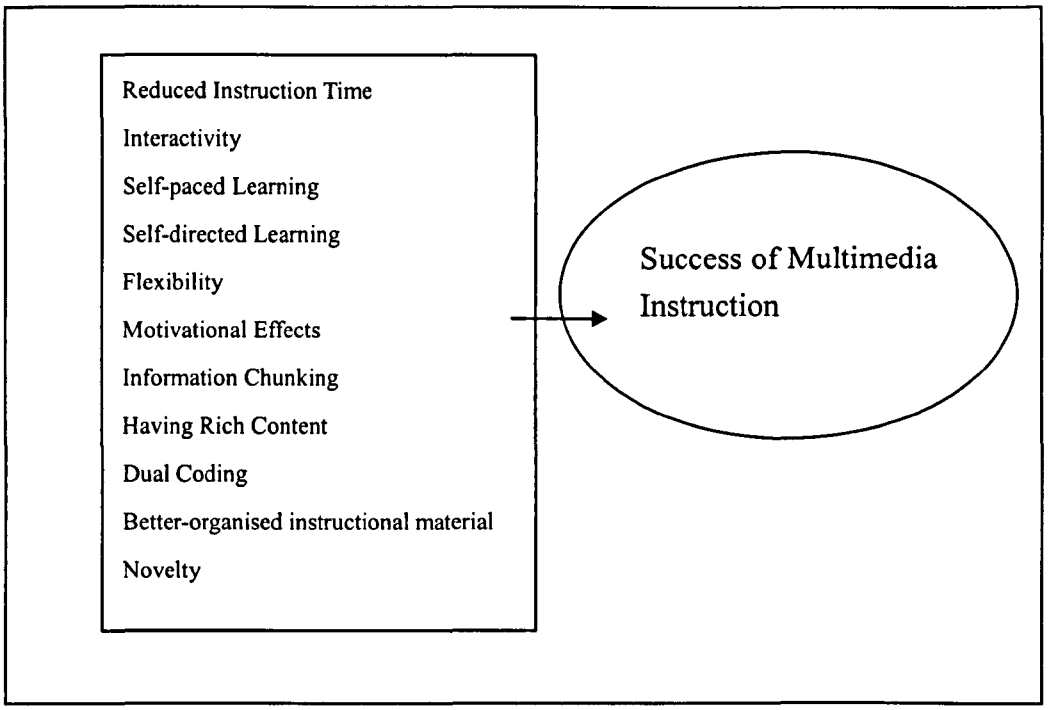
In terms of dual coding, Bagui claimed that not only does dual coding help in terms of allowing a person to absorb information from the environment using two channels, but dual coding also helps in reducing the cognitive load in a person's working memory. The ease with which one understands instructions and procedures is also influenced by prior experience and intrinsic complexity of the information.

In terms of better-organised instructional material, Najjar (1996) said that computer-based instruction might force the instructional designer to better organise and structure the learning material compared to a traditional classroom lecture. He claimed that this improved information organisation is probably the reason for the learning advantage, which agreed with Clark's (1994a) claim about it being the instructional method that influences learning. As Reiser (1994) put it 'certain media attributes make certain methods possible' (p. 45).

In terms of novelty, Najjar (1996) thought that information via multimedia might be more novel and stimulating than information presented via traditional classroom lecture. Najjar claimed that as students become more familiar with the multimedia, the novelty wears off, and the learning advantage decreases. It appears that the novelty of multimedia information has a slight, temporary, positive effect on learning.

Najjar (1996) and Bagui (1998) suggested some factors contributing to the success of multimedia instruction. The factors are reduced instruction time, interactivity, self-paced learning, self-directed learning, flexibility, motivational effects, information chunking, having rich content, dual coding, better-organised instructional materials and novelty as shown in Figure 8.

Figure 8: Factors Contributing to the Success of Multimedia Instruction (Najjar, 1996, pp. 130-132; Bagui, 1998, pp. 9-14)



2.43 Motivation and Engagement Factors

According to Stoney and Oliver (1998), interactive multimedia accommodates the principles of self-paced, resource-based learning, while at the same time appealing to the affective domain of adult learners. One of the great strengths of interactive multimedia to teach adult learners is that it can accommodate their desire for self-directed learning, as defined by Caffarella (1993), allowing the learners to initiate, plan, and manage their own learning. It allows for greater personal autonomy and it allows the learner to have control over the pace and timing of instruction. It is necessary to understand the way learners interact with interactive multimedia if the program is to be designed to motivate and engage. Stoney and Oliver suggested that the factors influencing motivation and engagement of adults are learner attributes of immersion, reflection, play and flow, collaboration, learner control, curiosity, fantasy, and challenge.

In terms of immersion, Stoney and Oliver commented that immersion is where the learner is completely absorbed both physically and psychologically in the program content and is a good indication of engagement. Immersion is often evident in situations where games are being played. Playing is described as a flow activity—where total immersion takes place and self-consciousness and time disappear.

In terms of reflection, Stoney and Oliver pointed out that reflection is often neglected in learning environments but has been shown to be essential to learning as it encompasses elements of decision-making and problem solving. Reflective skills can be broken into four parts and taught to students. First, the students do the activity themselves and gain the experience; second, they should think about the experience, what they learned, what they felt, and assimilate their thoughts into a learning perspective; third, they take these new thoughts and insights and apply them to the task to get a better theory of it; and fourth, apply this new theory and get new feedback.

In terms of play and flow, Stoney and Oliver saw that play as an inherent part of the design of an interactive multimedia program which has been found to be a powerful construct for interpreting meaningful learning. An important component of games or play is having flow activities which eliminate both boredom and anxiety. Rieber (1996) also considered that flow is possible as long as a person avoids boredom and anxiety simultaneously. He considered four themes to play: progress, power, fantasy, and self. Play as progress concerns the belief that the purpose of play is to learning something useful. Play as power refers to contests in which winners and losers are declared. Play as fantasy refers to play's role in liberating the mind to engage in creative and imaginative thinking. Finally, play as self places value on play's role as a way to achieve optimal life experiences.

In terms of collaboration, Stoney and Oliver (1998) stated that collaboration can take several forms—student/student collaboration, teacher/teacher collaboration, expert/student collaboration, or computer/student collaboration—and it is generally agreed that when using multimedia programs, motivation increases when students work collaboratively. This could be because the learners provide peer scaffolding and support, and provide a social element which increases the enjoyment of the learners.

In terms of learner control, Stoney and Oliver pointed out that programs with more learner control are more motivating and engaging because learners can construct their own path through the program, control the pace at which they work, and decide for themselves how much coaching they need. Learner control is essential for self-regulated learning (Rieber, 1996, p. 47).

In terms of curiosity, Stoney and Oliver said that all children are curious, but curiosity is not a trait fostered with adult learners. It is an important component of play and not only helps enjoyment of the learning process, but also facilitates knowledge acquisition. To build curiosity into an interactive multimedia program there should be elements of novelty, complexity, surprise, and incongruity. If the materials in the program are too complex or too easy, the learner will not find it interesting.

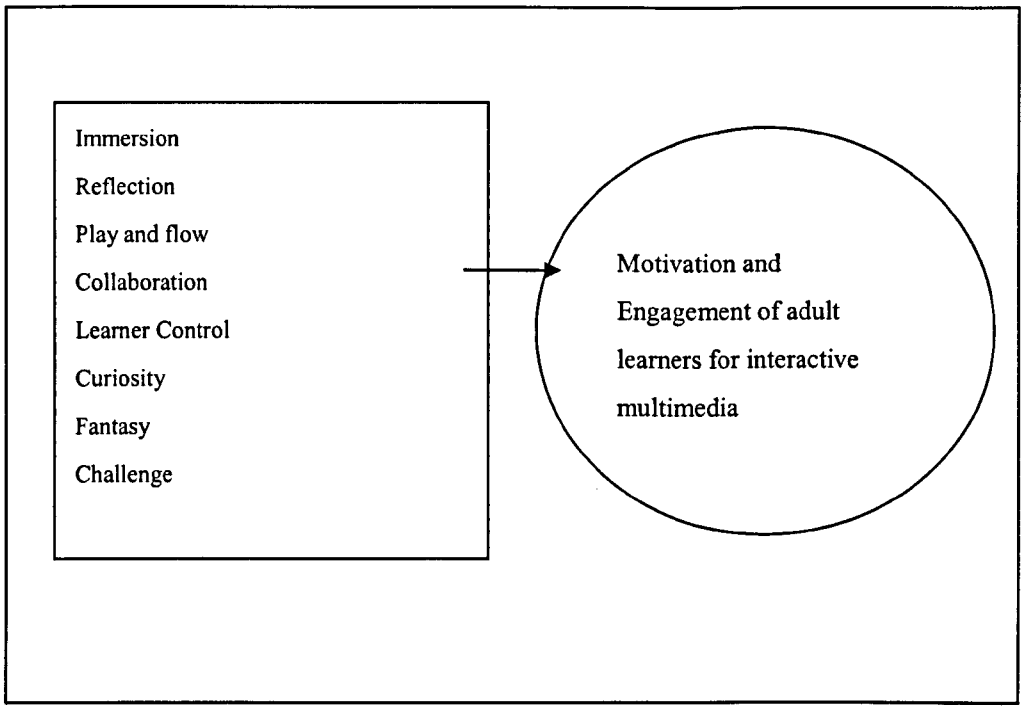
In terms of fantasy, Stoney and Oliver claimed that it is the fantasy component of a learning sofware which makes it interesting and intrinsically motivating. Fantasy, like motivation, can be intrinsic or extrinsic. An intrinsic fantasy is one which simulates a situation in which the skill would actually be applied. An extrinsic fantasy, on the other hand, is one in which learners engage in an activity in which they would not normally be able to participate. Fantasies need to be designed to accommodate the individual differences of age and gender. When designing educational materials based on a fantasy context,

care must be taken to ensure that the goals of the learning materials and the fantasy itself are congruent with one another. Rieber (1996) considered fantasy in liberating the mind to engage in creative and imaginative thinking. Fantasy is used to encourage learners to imagine that they are completing the activity in a context in which that they are really not present.

In terms of challenge, Stoney and Oliver (1998) said that in order for interactive multimedia program to be challenging, it must have built-in goals. A well-designed interactive multimedia will include learning goals, which encourage students to explore, initiate, and pursue tasks. Challenging, but attainable, learning goals will create more interest and enable students to sustain engagement with the task. Rieber (1996) pointed out that optimising challenge is particularly important in order to experience flow. People must constantly be able to match challenge with their current skill or ability; otherwise they will be bored.

Stoney and Oliver described eight factors influencing motivation and engagement of adults and they are learner attributes of immersion, reflection, play and flow, collaboration, learner control, curiosity, fantasy, and challenge, as shown in Figure 9.

Figure 9: Factors Influencing Motivation and Engagement of Adult learners for Interactive Multimedia (Stoney and Oliver, 1998, p. 55)



2.44 Summary of Multimedia

Three issues were discussed in this section and they were instructional features of multimedia, success of multimedia instruction, and motivation and engagement factors for adult learners. Stemler (1997) discussed five instructional features: screen design, learner control and navigation, use of feedback, student interactivity, and video and audio elements. Screen design is an issue of great importance for multimedia developers and that greater control over the learning event promotes satisfaction. Enabling students to interact with the computer and the use of audio and video are other instructional features of multimedia. Najjar (1996) and Bagui (1998) discussed eleven factors that contribute to the success of multimedia instruction and they are reduced instruction time, interactivity, self-paced learning, self-directed learning, flexibility, motivational effects, information chunking, having rich content,

better-organised instructional materials and novelty.

Davey, Jones and Fox (1995) argued that the introduction of sound and vision to language learning materials could transform the learning experience and enhance the motivation of the learner. The researcher of this study would like to find out how multimedia affects the motivation of adult learners learning Mandarin in Macao. Stoney and Oliver (1998) suggested that there are nine factors influencing motivation and engagement of adults using interactive multimedia and they are immersion, reflection, play and flow, collaboration, learner control, curiosity, fantasy and challenge. Which of these factors are appropriate to Mandarin learning with the CD-ROM? Learner control seems to be an appropriate influencing factor since Stemler (1997) suggested it to be an instructional feature of multimedia.

2.45 Key Questions

How could the instructional features of multimedia mentioned by Stemler (1997) be used to assist Mandarin learning with the CD-ROM? Which one of these factors contributes to the success of multimedia instruction suggested by Najjar (1996) and Bagui (1998) is more appropriate for Mandarin learning with the CD-ROM? The researcher of this study will try to answer these questions through the literature review.

Chinese language, foreign language learning, language learners, and multimedia were discussed in this chapter. Now that the reader has a better understanding of what Mandarin learning and multimedia are all about, the discussion in the next chapter will be about multimedia and language learners.

Chapter 3: Multimedia And Language Learners

Fotos (1996) pointed out that multimedia is a new composite technology that assists language teaching now. Facilitated by the development of powerful new computers and software, multimedia is generally defined as a combination of various media, including video, sound, graphics, photography, text and animation, within a single computer program. These different types of components of multimedia are converted into digital form and input into the computer. They are then manipulated and combined to make a new product integrating the separate media into a single multimedia form, often on a video or CD-ROM. Much of this multimedia software is interactive, allowing the user to control the pace and the direction of flow.

There are three sections in this chapter: multimedia components, multi modal processing and adult language learners. The multimedia components section discusses the advantages and disadvantages of the multimedia components, such as text, illustration/picture, animation, audio/voice, and video. Then the multi modal processing section discusses studies conducted between picture and text, static picture and animation, audio and text, audio and text and pictures and animation, audio and animation, video and text, and video and audio. Then situations in which it has been reported that multimedia helps people learn will be summarised. Subsequently, the human factors affecting Mandarin learning with the CD-ROM is drawn in Figure 14 (see below p. 75), from which research questions are derived. The researcher of this study plans to explore how these human factors affect Mandarin learning with the CD-ROM in Macao.

The adult language learners section analyses the learners in terms of teaching methods, beliefs, learning style, attitude and motivation. Teaching methods affect students' learning and previous experience and beliefs, learning

style, and attitude towards language learning can affect motivation. The relationships between the Dunn and Dunn learning styles model (see Appendix 3) and Mandarin learning with the CD-ROM will be drawn out in Figure 20 (see below p. 109). Finally, a cross-reference comparison table of student type/multimedia components and multimedia components/language skill is shown in Table 12 (see below p. 112) and a cross reference of teaching methods and multimedia and language skills is shown in Table 14 (see below p. 116).

3.1 Components Of Multimedia

The multimedia components of text, illustration/picture, animation, audio/voice, and video will be discussed in this section.

3.11 Text

Bagui (1998) indicated that students have been using text, or printed matter, to learn from for hundreds of years. Up until the advent of computers, text was one of the main media for gaining information. Of course, even with the advent of computers, it is still one of the main media for gaining information.

The importance of text within a computer has been widely commented upon favourably as the following writers have demonstrated. Stratfold (1994) argued that the students could control the focus of the topic by re-reading, skipping, browsing and selecting sections as they please. Shih and Alessi (1996) claimed that 'text on a page remains in front of the reader until the reader turns the page' (p. 206) and that the readers can process the text at their own speed and that advanced learners might learn more efficiently from the text. Levie and Lentz (1982) pointed out that learners have greater control over their exposure in reading. They may choose to skim or to re-read portions of the text. Kozma (1991) said that the clearest advantage to the use of stability of text to aid comprehension is when the reader must regress over segments of information

larger than a phrase. Reading processes interact with prior knowledge and skill in a way that relies heavily on the stability of text to aid comprehension and learning (Kozma, 1991, p. 183). Bagui (1998) said that textual information has the following advantages: 1) it can be processed at the learners own rate; 2) it is rehearsable; 3) it is easy to store and can be preserved for a long periods of time; 4) it is efficiently stored and processed in a computer; 5) text has some unique emphasis techniques such as character size, colour, and font.

However, some disadvantages or difficulties have also been observed. Stratfold (1994) pointed out that the weakness of print lies in the fact that it is not interactive. The presentation of text on the computer screen also has disadvantages. Students find reading large amounts of text from a screen tiring and are unable to have the same tactile experience of the text as they do when holding the paper in their hands. The other problem associated with on screen text, particularly in hypertext, is that of the fragmenting effects of the medium, the 'nuggets of knowledge' problem (Whalley, 1990, p. 62).

Text discussed here, as mentioned by Kintsch (1989), is merely media by which information is transmitted, as is the case when a student learns about geography from reading a chapter in a textbook. In this case, the text itself is secondary. What matters most is how well the student learns geography. It is one thing to have text that is easily comprehended and memorised, but another to write it in such a way that a given student is able to learn from it effectively. 'Learning from text is not equated with remembering the text', said Kintsch (1989, p. 44).

3.12 Illustration/Picture

Alesandrini (1984) discussed three types of pictures: representational, analogical, and arbitrary pictures. Representational pictures are those that share

a physical resemblance with the concept that the picture stands for. There is evidence that representational pictures can be effective in facilitating adult learning. An analogical picture conveys a concept by showing something else and implying a similarity, especially useful when the concept is abstract. For this type of picture to be successful, the learner must recognise or comprehend the object used as the analogy. Arbitrary pictures are highly schematised visuals that do not look like things they represent but are related logically or conceptually. Such pictures included graphs, flowcharts, networks, maps, tree diagrams, and other schematised charts and diagrams. Diagram, structure outline, mapping, and flowcharting have been shown to facilitate learning.

There are many advantages to using illustrations or pictures. Bagui (1998) said that visual illustration helps span linguistic barriers and overcomes individual differences to isolate and identify important material, recall prior knowledge, provide interaction with content, thus enhancing information acquisition and promoting learning. Alesandrini (1984) noted that supplemental pictures appear to help adults learn new concepts from expository text. Pictures have aided recall, although not necessarily for material that is highly abstract or complex (Alesandrini, 1984, p. 68). Levie and Lentz (1982) claimed that illustrations in the instructional text could add interest and enjoyment for the reader. Haring and Fry (1979) showed that pictures increased recall of the main ideas in a story.

However, there are also disadvantages of using illustrations or pictures. Samuels (1970) concluded that pictures interfered with learning to read by concluding that 'there was almost unanimous agreement that pictures, when used as adjuncts to printed text, do not facilitate comprehension' (p. 405). Levie and Lentz (1982) suggested that the inclusion of pictures is likely to interfere with learning to read words. When learning how to read is the objective, the

presence of pictures may hinder learning (Levie and Lentz, 1982, p. 218). Finally, Lang and Solman (1979) found that pictures inhibit the learning of words because they distract the child from the primary task of encoding the word.

Kozma (1991) suggested that for knowledgeable readers, pictures should be placed early in the text if they are used at all, and a less knowledgeable reader would benefit from interspersed pictures, juxtaposed with the corresponding text. Lang and Solman (1979) concluded that the use of spacing between the presentation of word and picture appeared to facilitate learning. Alesandrini (1984) suggested the use of representational, analogical, and arbitrary pictures in the following way: 1) begin with analogical pictures to relate new information to prior knowledge; 2) follow with arbitrary pictures to convey the essence of the new information and distinguish it from the analogous information; and 3) conclude with representational pictures that serve to further define and distinguish the new information.

3.13 Animation

According to Rieber (1990), animated visuals represented a subset of instructional visuals, and for this reason, general conclusions from research on static visuals are thought to extend to animated visuals. Examples include special effects for transitions between instructional frames or lesson parts, special screen washes, moving symbols or characters, and animated prompts. Animation is frequently used as part of practise strategies, ranging on a continuum from highly structured to discovery approaches.

There are some advantages and disadvantages of using animation. Rieber (1990) suggested that some attention-gaining applications use animation to increase a program's cosmetic appeal and to arouse students' interest. In the most structured practice activities, such as question and answer, animation is used as

feedback to students' responses. Besides providing information, the novelty of the animation provides further reinforcement, although most novelty effects are temporary (Clark, 1983). Rieber, Boyce, and Assad (1990) also suggested that animated presentations helped to decrease the time necessary to retrieve information from long-term memory and then subsequently reconstruct it in short-term memory.

However, Rieber (1990) claimed that animation could also be distracting and said that animation may not be suitable for novice learners in the content area because they may not know how to attend to relevant cues or details provided by the animation and its greatest contributions to computer-based instruction may lie in interactive graphic applications.

Rieber (1990) wisely warned instructional designers to 'resist incorporating special effects, like animation, when no rationale exists' (p. 84). Mayer and Anderson (1991) also warned that animations are meaningless to students who cannot determine to what the elements and actions in the animations refer.

3.14 Audio/Voice

Beccue, Vila and Whitley (2001) said that audio could be broken into three main elements: speech, sound effects, and music. Speech is the narration or dialogue. Narration is used when concrete information is presented. In each category, pacing, pitch and volume all play a role in setting the mood of instruction, determining tempo, and creating feeling. Technological advances have brought a new revolution in multimedia authoring; the ability to add audio is relatively more inexpensive now. Bagui (1998) claimed that voice is a realistic and natural mode of presenting information that has been as a medium for passing on information verbally for hundreds of years. Voice is used in radio, TV, and computers to pass on information nowadays. When a voice is

heard, it gives a perception of the person behind the voice whereas text appearing on the screen does not necessarily produce that perception.

There are two advantages of using audio or voice. The first advantage is that it is sometimes more easily comprehended by children or poor readers (Bagui, 1998, p. 6). Shih and Alessi (1996) also claimed that younger students or poor readers prefer and learn more from voice. The second advantage is its flexibility (Beccue, Vila, and Whitley, 2001, p. 47). Changes can easily be re-recorded and placed into existing applications.

Audio or voice has two disadvantages as pointed out by Shih and Alessi (1996). The first disadvantage of voice occurs when a speaker speaks too fast, making it difficult for listener to process and remember what was said. But this problem has now been overcome by the availability of technology, which digitally store and manipulate voice. The second disadvantage is cost efficiency. Voice is more costly to produce and store than textual information. This implies that other factors being equal, text will often be preferable and that for voice to be chosen, its advantage must be obvious.

3.15 Video

Stratfold (1994) indicated that video has two advantages. The first advantage is that it is an informationally rich medium, providing experience to motivate and entertain students. The second advantage, when it is compared to television, is that it offers the possibility of some control. Viewers are able to watch the video when they choose and have the ability to review the whole video, or specific sections, as many times as they desire.

However, Stratfold (1994) also indicated that video has three disadvantages. First, video is not an interactive medium so is unable to provide feedback. Second, it is a continuously running medium that does not easily allow for

reflection. Third, it is a linear medium, which makes it difficult to access, control and search. The limitation with tape based video is the time taken to wind the tape to the correct point, often requires stopping and playing the tape. In addition, Blake (1998) said that good video is expensive to produce and securing copyright permission for its use is difficult.

3.16 Summary of Components of Multimedia

The advantages and disadvantages of using text, illustration/picture, audio/voice, and video are summarised in Table 7. Text is more efficiently stored and processed in the computer and the stability of text aids comprehension. Both text and video are not interactive. Illustrations or pictures help recall prior knowledge and enhance information acquisition, however they may interfere with reading. Animation can be used as ways to arouse students' interest, to provide feedback to students' responses. It may not be suitable for novice learners because they may not know how to attend to the relevant cues provided by animation. Voice may be more easily comprehended or preferred to be used by children or poor readers, but it is more costly to produce and store. Video offers some control to the viewers, allowing them to view when they choose and review as many times as they desire, however it does not easily allow for reflection and it is difficult to access, control and search. Knowing the merits and shortcomings of the different components that make up multimedia, teachers can combine the usage of these components more efficiently.

Table 7: The Advantages and Disadvantages of using Text, Illustration/Picture, Animation, Audio/Voice, and Video

	Advantages	Disadvantages
Text	1) Could be processed at the learners own rate (Bagui, 1998, p. 6) 2) Rehearsable (Bagui, 1998, p. 6) 3) Easy to store and preserved for a long periods of time (Bagui, 1998, p. 6) 4) Efficiently stored and processed in a computer (Bagui, 1998, p. 6) 5) Unique emphasis techniques such as character size, colour and font (Bagui, 1998, p. 6) 6) Learners have greater control in reading (Levie and Lentz, 1982, p. 217) 7) Advanced learners learn more efficiently from text (Shih and Alessi, 1996, p. 207) 8) Stability of text aids comprehension (Kozma, 1991, p. 183)	1) Not interactive (Stratfold, 1994, Chapter 2, p. 2) 2) Reading text on screen can be tiring (Stratfold, 1994, chapter 2, p. 3)
Illustration/ Picture	1) Helps span linguistic barriers (Bagui, 1998, p. 6) 2) Recall prior knowledge (Bagui, 1998, p. 6) 3) Provide interaction with content (Bagui, 1998, p.6) 4) Enhance information acquisition and promote learning (Bagui, 1998, pp. 6-7) 5) Learn new concepts from expository text (Alesandrini, 1984, p. 68) 6) Aid recall (Alesandrini, 1984, p. 68) 7) Increased recall of main ideas (Haring and Fry, 1979, p. 185) 8) Add interest and enjoyment to reader (Levie and Lentz, 1982, p. 195)	1) Pictures used as adjuncts to printed text do not facilitate comprehension (Samuels, 1970, p. 405) 2) May interfere with learning to read (Levie and Lentz, 1982, p. 218) 3) Pictures inhibit the learning of words in children (Lang and Solman, 1979, p. 148)
Animation	1) Attention-gaining (Rieber, 1990, p. 77) 2) Increase program's cosmetic appeal (Rieber, 1990, p. 77) 3) Arouse student interest (Rieber, 1990, p. 78) 4) Provides feedback and reinforcement to students (Rieber, 1990, p. 78) 5) Helped to decrease the time necessary to retrieve information from long-term memory and then subsequently reconstruct it in short-term memory (Rieber, Boyce, and Assad, 1990, p. 50)	1) Distracting (Rieber, 1990, p. 78) 2) May not be suitable for novice learners (Rieber, 1990, p. 82)

Table 7: The Advantages and Disadvantages of using Text, Illustration/Picture, Animation, Audio/Voice, and Video (cont.)

	Advantages	Disadvantages
Audio/Voice	1) More easily comprehended by children or poor reader (Bagui, 1998, p. 6) 2) Young students or poor readers prefer and learn more from voice (Shih and Alessi, 1996, p. 207) 3) Flexible, easily re-record and place into existing applications (Beccue, Vila, and Whitley, 2001, p. 47)	1) If the speaker speaks too fast, making it difficult for listener to process and remember what was said. (Shih and Alessi, 1996, p. 206) 2) Voice is more costly to produce and store than textual information (Shih and Alessi, 1996, p. 208)
Video	1) A rich medium provides experience to motivate and entertain students (Stratfold, 1994, chapter 2, p. 10) 2) Viewers are able to watch the video when they choose and the ability to review the whole video, or specific sections, as many times as they desire (Stratfold, 1994, chapter 2, p. 5)	1) Not interactive, not able to provide feedback (Stratfold, 1994, chapter 2, p. 10) 2) Continuously running medium that does not easily allow for reflection (Stratfold, 1994, chapter 2, p. 10) 3) Linear medium, difficult to access, control and search (Stratfold, 1994, chapter 2, p. 10) 4) Good video is expensive to produce (Blake, 1998, p. 219) 5) Securing copyright permissions for its use is difficult (Blake, 1998, p. 219)

3.2 Multi Modal Processing

Meskill (1996) pointed out that multi modal processing refers to the engagement of more than one perceptual modality at a time. The opportunities for multimedia users to process combined media (text, sound, and video) simultaneously is a popular trend in software design in general, and language learning products in particular. She said that the co-occurrence of media with text, audio, graphics in the multimedia environment does raise the issue of the amount of processing these combined input modalities entail and whether or not these cognitive demands limit or lengthen task persistence. The following studies summarise multimedia features, such as text, illustration/picture, audio/sound, and video, and how these alone or in combination support or affect students' learning.

3.21 Pictures and Text

The following discussion supports the use of pictures in learning. Levie and Lentz (1982) summarised the results of experiments comparing learning from illustrated text with learning from text alone. Anglin (1987) wanted to find out if pictures were durable for adult learners over time. Peeck (1974) conducted an experiment with either an illustrated or an un-illustrated text. Rusted and Coltheart (1979) conducted an experiment with good and poor readers in the total amount recalled. Mayer and Gallini (1990) wanted to show that explanative illustrations could help low-prior knowledge students on recall of conceptual information and with their problem solving skills.

Levie and Lentz (1982) summarised the results of experiments comparing learning from illustrated text with learning from text alone. The average group score for the illustrated-text groups was 36% better than for text-alone groups. In general, they claimed that the superiority of the illustrated text was more

pronounced in two situations: in delayed recall rather than in immediate recall, and for poor readers rather than for good readers.

Anglin (1987) conducted a study to see whether or not pictures were durable over time with adult students over a 55-day period. The subjects' average recall in the prose-plus-pictures condition was 11% to 15% higher than that of subjects in the prose-only condition.

Peeck (1974) conducted an experiment with fourth graders with either an illustrated or an un-illustrated text. At retention testing (immediately, after a day, or after a week), the experimental condition produced higher scores than the control (text without illustrations) for questions concerning correctly illustrated text contents. The results clearly showed that the presence of illustrations had effects on retention.

Rusted and Coltheart (1979) conducted a study with good and poor readers and found that they did not differ significantly in the total amount recalled. The presence of pictures had no effect on pronunciation, and it did not interact with reading ability. Good readers recalled more of the features not contained in the pictures than did poor readers. The results indicated that pictures could enhance retention of text content when used in conjunction with reading. There is evidence that for good readers, the pictures facilitated retention of the passage as a whole. In contrast, the enhanced retention of poor readers seemed to be caused mainly by an increase in recall of picture features.

Mayer and Gallini (1990) investigated if explanative illustrations were effective with college students who had either low or high prior knowledge of a domain. Results indicated that the parts-and-steps illustrations consistently improved performance on recall of conceptual information and creative problem solving mainly for the low prior-knowledge students.

The discussion in this subsection suggests that illustration helps students with their memory recall. Poor readers can recall more of picture features and benefited more from illustrated text and low prior-knowledge students can improve performance on recall of conceptual information and creative problem solving with illustrative explanations. Therefore picture and text look like they can be used together to help poor readers or low prior-knowledge students.

3.22 Static Picture and Animation

The following study compared static picture with animation. Park (1998) conducted a study with undergraduate students, with little or no knowledge of the structures and functions of electronic circuits and trouble-shooting procedures. The initial results did not demonstrate the superior effect of animation over static graphics in computer-based instruction. However, the follow-up exploratory analysis indicated that animation was more effective than static graphics if static graphics did not adequately represent the dynamic nature of the animation. These results suggested that static graphics with motion cues should be considered as an alternative to graphic animations in the development of computer-based instruction if such cues can adequately represent task attributes. However, Park (1998) suggested that for most cases, animation is likely a better choice than static graphics for teaching dynamic characteristics of a task.

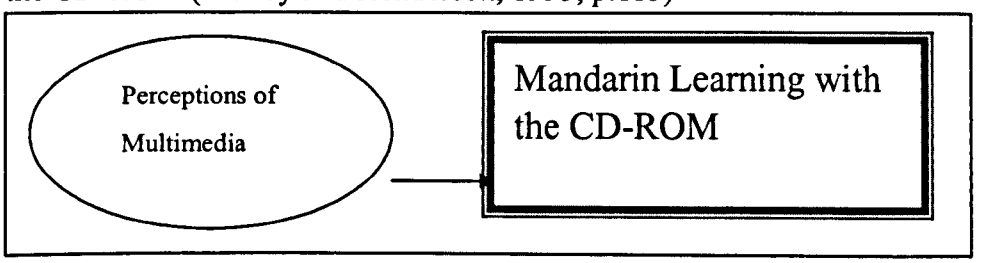
3.23 Audio and Text

The following studies demonstrated how students' perceptions and preferences affect their learning with audio and text. Bradey and Henderson (1995) conducted a study to find out students' perceptions of using digital audio and Shih and Alessi (1996) conducted an experiment with college undergraduates to investigate the effects of voice and text.

Bradey and Henderson (1995) conducted a study to find out students'

perceptions of using digital audio with college students. All of the students said that they used voice-overs to help their concentration. With or without accompanying text or graphics, 75% to 100% believed these audio sounds aided comprehension, helped them link new content to previous knowledge and generated new concepts. Redundancy voice-overs (repetition of the same information presented as text) were probably beneficial for weak readers. Two-thirds of the students felt that they expended a great deal of mental effort understanding the content of voice-overs unaccompanied by text or graphics. However there were some who commented that they either concentrated on the voice-over or the text. This indicated that voice-overs interrogating the text should occur after the user clicks to continue; the reader can then listen more constructively having already visited the text for meaning making, and the text is still present on the screen for reference. The computer's potential for representing information in more than one symbol system enables each individual to shift from one mode of representation to another. Learners can construct meaning via their preferred symbol system. The researcher of this study would like to see the influence of students' perceptions of multimedia on Mandarin learning with the CD-ROM, as shown in Figure 10.

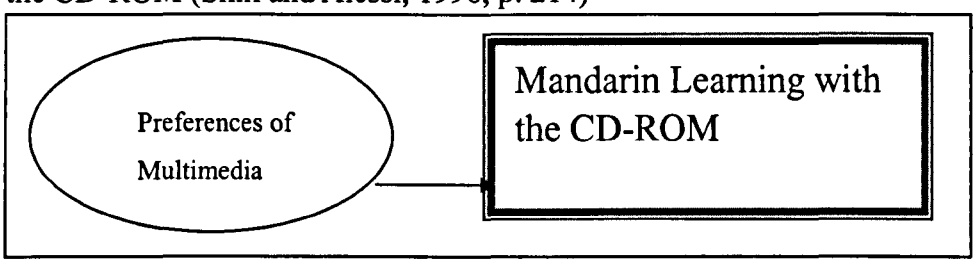
Figure 10: Influence of Perceptions of Multimedia on Mandarin Learning with the CD-ROM (Bradey and Henderson, 1995, p.113)



Shih and Alessi (1996) conducted an experiment with college undergraduates to investigate the effects of voice versus text. The results

indicated no significant difference on overall learning, whether hearing narration or reading text from screen. The redundant audio may even result in a negative effect. The results suggested that hearing explanation without reading text seemed to hinder learning, especially on learning spatial information. However, 82% of subjects preferred text and voice to the other methods. Most of the subjects, 84% of the Text group, 85% of the Voice group, and 78% of the Text&Voice group, preferred hearing narration while reading text. Shih et al. (1996) said that the results only evidenced that 'what you like is not necessarily good for you' (p. 216). The researcher of this study would like to explore the influence of students' preferences of multimedia on Mandarin learning with the CD-ROM, as shown in Figure 11.

Figure 11: Influence of Preferences of Multimedia on Mandarin Learning with the CD-ROM (Shih and Alessi, 1996, p. 214)



Shih and Alessi (1996) advised there is content for which voice appears to be advantageous and other content for which text appears advantageous. The instructional designer may select the best combination of voice and text messages.

The discussion in this subsection showed that most students believed that audio sounds aided comprehension, helped students link new content to previous knowledge and generated new concepts. Redundancy voice-overs were probably beneficial to weak readers. Although Shih et al. (1996) found that different

presentation methods, whether hearing narration, reading text from screen, or a combination of both, do not have different effects on overall learning, the majority of the students still preferred hearing narration while reading text.

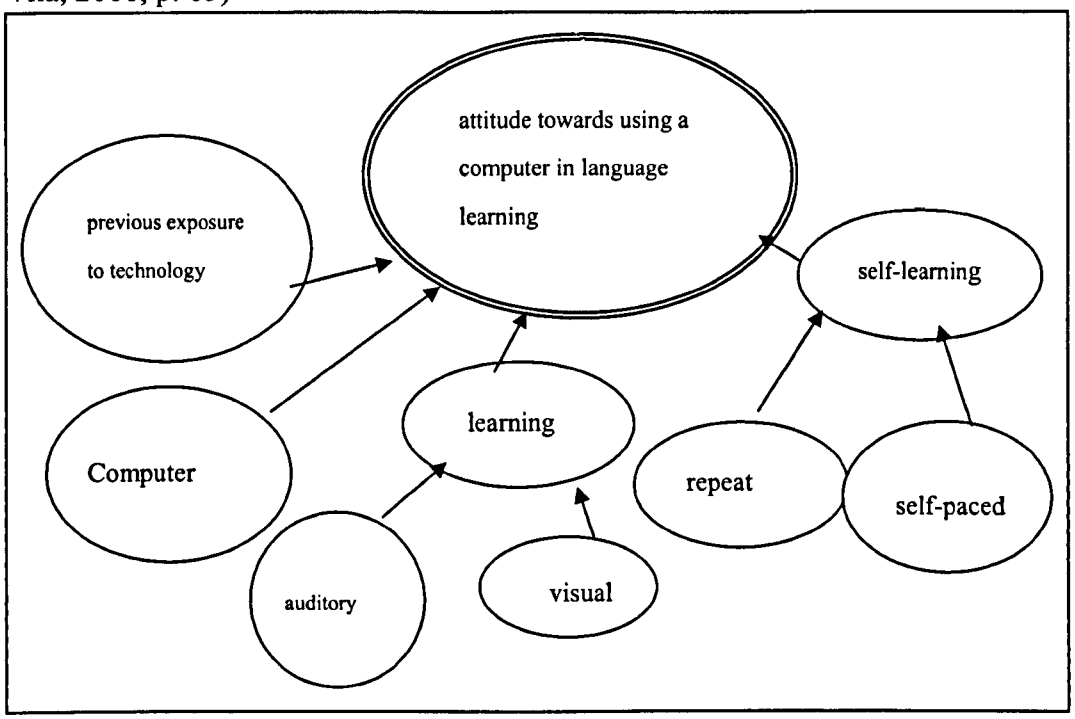
3.24 Audio, Text, Pictures, and Animation

The study in this subsection demonstrated how students' attitudes and preferences affect their learning with audio, text, pictures, and animation. Beccue, Vila, and Whitley (2001) investigated the effects on the learning and attitudes of the students by adding an audio instruction component to an existing multimedia computer lab exercise. The study revealed no significant difference on learning, attitude and perception, and performance with additional audio instructional component. The design of the study required that all students listen to the entire script of audio clips in a specific order and in its entirety. Data gathered from the observation and interviews suggested the pacing placed on the students was a factor in attitude. Variables such as previous exposure to technology, visual versus auditory learning styles, and learner control variables would affect these perceptions and attitudes. Based on observation of the subjects, the pace set by audio might be helpful for slower learners and detrimental to faster learners who wanted control of their learning environment. Beccue et al. (2001) warned that the choice of employing newest technology should not be based solely on the use of technology, but rather a combination of quantitative results, attitudes, and perceptions from students should also be studied.

Since previous exposure to technology and learning styles would affect perception and attitude, the researcher of this study plans to investigate what attitudes the students in Macao have in using computers and eventually the CD-ROM in their Mandarin learning. Previous exposure to technology can be

interpreted as computer skill as well as other technology such as tape recorders whereas learner control variables can be interpreted as self-learning, having self-paced and repeat capability. Depending on whether the learners are visual or verbal learners or self-paced learners, they will probably have different attitudes towards using a computer in their language learning, as shown in Figure 12.

Figure 12: Influence of Previous Exposure to Technology and Learning Styles on Attitude towards using a Computer in Language Learning (Beccue, Whitley, and Vila, 2001, p. 63)



3.25 Audio and Animation

The following case study discusses how audio and animation can be used together in promoting learning. Mayer and Anderson (1991) used animation to investigate the effects of simultaneous presentation of verbal narration and visual animation with a bicycle tyre pump with college students. The words-with-pictures group outperformed on the problem-solving test than students who saw the animation without words (pictures only), heard the words

without the animation (words only), or received no training (control). Despite the current enthusiasm concerning the instructional power of animation, the results showed that animation without narration can have essentially the same effect on students' scientific understanding as no instruction. Concurrent presentation of speech and animation results in better problem-solving transfer than does successive presentation, which may be limited to expository passages.

3.26 Video and Text

This subsection discusses how students process video and text. The first study of Nugent's (1982) studies aimed to assess the potential effectiveness and optimal combination of video, audio and print. Vanderplank (1988) tried to investigate the potential benefits from watching subtitled video. Salomon (1979, 1983) and Beentjes (1989) discussed learning from televised media.

Nugent's (1982) first study was designed to compare the learning of factual information from visuals, audio, and print with children. Bagui (1998) said that the individual media or codes by which people take in information are text, voice, visual, and imagery. Multimedia makes it easy to put more than one of these codes or media together to facilitate the learning process. Using more than one code in the learning process is referred to as dual coding. Results from Nugent's study generally supported the view that presentation of information through two-symbol or coding system would be superior. However, there was no difference between the three-media condition and the dual presentations involving visuals with either print or audio. The lack of significance may be due to the nature of the materials and the way print and visuals were combined, how the print appeared as captions in the video which the students were not accustomed to. Overall the data showed that when content was the same in visual, audio, and print channels, 'younger students learned equally well from all modes,

and combining pictures with print or audio generally maximised learning' (p. 172). This research confirmed the importance of considering media symbol systems and their influence on learning. From Nugent' s (1982) study, the researcher of this study suggests looking at which components of multimedia (visual, audio, or print) are more appropriate for different aspects of Mandarin learning with the CD-ROM.

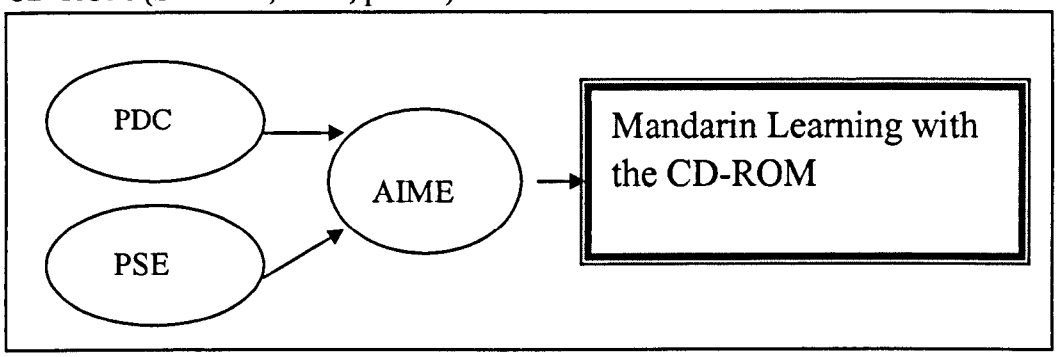
Vanderplank (1988) investigated the potential benefits in terms of language learning from watching subtitled video, with European exchange students, whose English-language level varied from high-intermediate to post-proficiency, and Arabic speaking students, whose English-language level varied from low-intermediate to advanced. All European exchange students reported that they found subtitles useful and beneficial to their language development and that they were much more positive towards subtitles than the Arabic-speaking group. The Arabic-speaking group complained that the text changed too rapidly for them to read it with understanding. For the Arabic-speaking group, who were able to express themselves well and fluently in English for the most part, subtitles proved to be distracting and disturbing. The study suggested that subtitled video may be of limited value for low-level learners, but may provide large amounts of comprehensible input for post-intermediate-level learners. If learners' listening skills are better than their reading skills, then subtitled video might help to speed up reading ability. Vanderplank observed that subtitles might help to develop language proficiency through enabling learners to be conscious of a new and unfamiliar language that might otherwise simply be lost in the stream of speech. Based on Vanderplank's method of using subtitles in his study, the researcher of this study also plans to apply English or Portuguese translations as subtitles to the development of the Mandarin CD-ROM even

though that they are beginning Mandarin learners.

Salomon (1979) found that readers of print need to put more effort into the processing of the material they read than they would if they watched the same material on video, and as a consequence they make more mental elaborations and inferences. Salomon (1983) reported four studies, three with children in the United States and in Israel and one with freshmen in college, from which he drew the following conclusions: 1) television is perceived to be a much "easier" and a more lifelike medium, demanding far less effort for comprehension than printed material of the same content; 2) children expressed more perceived self-efficacy (PSE) with television than with print; 3) failure to comprehend print was attributed by most children to its difficulty and success was attributed to "smartness", failure with television was attributed to "dumbness"; 4) the way children perceive a medium and their own efficacy is strongly related to their investment of mental effort in processing its material, which in turn is related to how much they actually learn from it; 5) poorer readers expressed a relatively high level of perceived self-efficacy (PSE) in learning from both television and print, reported the expension of the smallest amount of invested mental effort (AIME) in both, and got the poorest achievement score. It appeared that these children, for defensive reasons, played down the perceived demand characteristics of televiewing and reading by inflating their perceived self-efficacy. In doing so they could avoid the investment of effort in processing. 6) College freshmen exhibited similar patterns to children in terms of efficacy with television was higher and AIME was lower than with print. The only exception was the news: Television news was seen as "deeper" than news in print, thus demanding more AIME. 7) The more stereotyped the perception of the medium; the less effort is invested in it.; 8) when the perceived

demand characteristics (PDC) of a medium are manipulated, such as just for fun or to watch carefully to learn as much from it, the latter condition was assumed to induce greater AIME and lead to better inference-making, but the effect was more pronounced in the television group. The print group achieved relatively high achievement scores even without being told to learn the material. The researcher of this study will consider how students' perceived demand characteristics and perceived self-efficacy may influence their Mandarin learning with the CD-ROM as shown in Figure 13.

Figure 13: Influence of PDC, PSE, and AIME on Mandarin Learning with the CD-ROM (Salomon, 1983, p. 193)



In a replication of Salomon's work using Dutch subjects, Beentjes (1989) confirmed that children appeared to invest, on average, more mental effort in books than in television viewing. However, he found that the invested mental effort (AIME) and perceived self-efficacy (PSE) depended not only on the medium but also on the type of television program or book involved. Contrary to the North American children, the Dutch children perceived the effort required to watch television much differently. They did not unconditionally regard television as the easier medium, since their exposure to the medium often involved having to read the subtitles to understand what is going on. The subjects did not perceive themselves to be more able to learn from television than

from books. They saw that some topics, such as grammar and spelling, calculating the surface of a triangle, and solving math problems were thought to be more easily learned from books. Other topics, such as how plastic is made, why World War II broke out, the rules of soccer and basketball, were more easily learned from television. These topics are quite suitable for visualisation and can actually be seen on television.

From Salomon's (1983) and Beentjes' (1989) studies, in general, subjects tended to report exerting more effort when reading than when watching television. Greater perceived demand characteristics (PDC) was expected to result in greater mental effort (AIME), and greater perceived self-efficacy (PSE) was expected to result in less mental effort. For printed media, demand was expected to be high and self-efficacy was expected to be lower, resulting in higher mental effort. For television, demand was expected to be low and self-efficacy was expected to be high, resulting in lower mental effort. However, Wetzel, Radtke, and Stern (1994) suggested that although the direction of the relationship between AIME and learning performance appeared to be positive, it was not significantly so in a number of instances. Overall, the weakness with the proposed theory appeared in the predictive links between the various preconceptions and self-reports and their actual effect on learning performance. Salomon (1983) acknowledged the problems associated with a heavy reliance on self-report by subjects.

This subsection presented studies on how students process video and text. The superiority of the presentation of information through a two-symbol or coding system is generally supported and the importance of considering media symbol systems and their influence on learning is confirmed. Subtitled video may be of limited value for low-level learners, but may provide large amounts of

comprehensible input for post-intermediate-level learners. In general, subjects tended to report exerting more effort when reading than watching television, which leads to relatively higher achievement scores. However, the Dutch children invested mental effort and perceived self-efficacy depending not only on the medium but also on the type of television program or book involved. Beentjes' (1989) study could be a good example of how to apply technology or media to foreign language learning. Not only should the designers consider the ease of usage of that technology or media, they should also consider the type of lessons to be learned.

3.27 Video and Audio

The following studies discuss how students deal with both video and audio instruction. The second study of Nugent's (1982) studies was designed to assess the potential effectiveness and optimal combination of video and audio. Baltova (1994) investigated the role of video and audio with eighth graders and Coniam (2001) investigated the type of listening test that might serve as an assessment instrument of English language teachers.

Nugent's (1982) second study was designed to assess the potential effectiveness and optimal combination of video and audio. There was no significant difference between scores of students viewing the visual presentation and those seeing the visuals with audio. The presence of narration did not appear to interfere or facilitate visual learning.

Baltova (1994) investigated the role of video and audio with eighth graders, to explore the importance of visual cues in the process of listening to French as a second language. The test results recorded no significant difference between the two groups, video-and-sound and sound only. The result showed that text difficulty has influenced the outcome. More students in the sound-only

conditions in both experiments experienced difficulty with the text than those in the video-and-sound groups. It was found that students in the sound-only conditions were less successful in maintaining interest and concentration in listening. It was observed that video instruction promoted greater attention than did the audio instruction. The majority of those (70%) who watched the film on VCR expressed a positive attitude towards it, while among those who only listened to the text no one claimed to have enjoyed the story. Stronger students performed well under the video-and-sound condition, while the weaker students performed rather similarly under the two conditions. This result suggested that the stronger students were able to benefit more from the instruction with video or even with the video the text was still too difficult for the weaker students.

Following these lines of thoughts (Baltova, 1994), the researcher of this study suggests looking at two sides of this situation here. First, it would be the optimal solution to try to use video in language learning since the majority of those (70%) who watched the film on VCR expressed a positive attitude towards it. However, the cost of producing the video should also be weighted, as suggested by Blake (1998) that good video is expensive to produce. Since the result showed that text difficulty has influenced the outcome, and the test results recorded no significant difference between the two groups, using sound alone may be already sufficient in language learning, in situations where cost is the issue or weak students are involved or difficulty in text is an issue.

Coniam (2001) investigated the type of listening test that might serve as an assessment instrument of English language teachers. There was no significant difference between the two groups. Not only did the video group not see any real advantage in taking the test by video, they felt that they might have done better had they not been distracted by the visual images, and by having to look up

and down from question paper to screen. The research concluded that the listening comprehension test should be implemented via an audio, and not video mode.

From the discussion of this subsection, students can process visual and auditory information independently. It was suggested that video instruction promoted greater attention than audio instruction. Stronger students performed well under the video and sound condition and they benefited more from video instruction. However, when video was used in a listening test, students did not see any real benefits in taking the test by video because they could be distracted by the visual images. It was even recommended that a listening comprehension test should be implemented via an audio mode.

3.28 Summary of Multi Modal Processing

Multi modal processing was discussed in this section. In summary, illustrated text can help students on memory recall and explanative illustration can help low-prior knowledge students on recall of conceptual information and with their problem solving skills. Animation is more effective than static graphics if static graphics do not adequately represent the dynamic nature of the animation. For most cases, animation is a likely better choice than static graphics for teaching dynamic characteristics of a task. Audio and text may aid comprehension, help link new content to previous knowledge, and generate new concepts. Students' perceptions, attitudes and preferences affect their learning with audio and text, or audio, text, pictures, and animation. The pacing placed on students was a factor in attitude and that previous exposure to technology, visual versus auditory learning styles, and learner control variables would affect these perceptions and attitudes. Most students preferred text and voice to the other methods. Concurrent presentation of speech and animation results in

better problem solving transfer and it may be limited to expository passages. When video and text are compared, students generally exert more effort when reading than watching television, but the type of television or book involved should also be considered. Subtitled video may be of limited value for low-level learners, but may provide large amounts of comprehensible input for post-intermediate-level learners. When video and audio are compared, it seems that video instruction promotes greater attention than audio instruction. Yet when a listening test is administered, visual image may be distracting.

Kozma's (1991) recommendation about multimedia learning very much agreed with the summary here. He suggested that people who are very knowledgeable about a particular domain can process information at a much faster rate and more strategically with text. He also suggested that for novice, a more stable medium should be used, or the pace of a video production should be slow. He observed that readers use pictures initially as an organisational aid or to evoke prior domain knowledge. They then use illustrations in a periodic fashion as they read, with those with less domain knowledge being more likely to consult the illustration for clarification. He believed that 'audio may be sufficient for those knowledgeable of a domain, but visual symbol systems supply important situational information for those less knowledgeable' (p. 192).

3.29 Situations in which Multimedia helps People Learn

Based on the foregoing discussion and Najjar's (1996) suggestion about multimedia, the researcher of this study has summarised a range of situations in which it has been reported multimedia helps people learn. They are when the media supports dual coding of information, when the media support one another, and when media are presented to learners with low prior knowledge or aptitude in the domain being learned.

The success of multimedia can be attributed mainly to the dual coding theory. Bagui (1998) quoted a widely cited assertion "People generally remember 10% of what they read, 20% of what they hear, 30% of what they see, and 50% of what they hear and see". According to the dual coding theory, Bagui (1998) said that people take in information by the use of sense organs: the eyes, ears, taste buds, and pain nerves. This information then goes into the short-term memory, from where the information is processed and is stored in the long-term memory and this becomes the person's knowledge base. This knowledge base increases the person's learning. If the person can retrieve a piece of information from his or her memory, one can say that he or she has learned that information.

According to the dual coding theory (Paivio, 1971, Clark and Paivio, 1991), information is processed through one of two generally independent channels. One channel processes verbal information such as text or audio. The other channel processes nonverbal images such as illustrations and sounds in the environment. Learning is better when information is referentially processed through two channels rather than when the information is processed through only one channel (Mayer and Anderson, 1991). In Nugent's (1982) study, the highest learning levels were found when the students were presented information via combined text and pictures (verbal and nonverbal channels) or combined audio and pictures (verbal and nonverbal channels) compared to the same content presented via text along (verbal channel), audio alone (verbal channel), or pictures alone (nonverbal channel). In Mayer and Anderson's study, the students who heard a verbal description simultaneously with the animation (verbal and nonverbal channels) performed better on a problem-solving test than the students who heard the description only (verbal channel), saw the animation

only (nonverbal channel), or got no training.

Najjar (1996) concluded that multimedia information seems to improve learning when the media show closely related, supportive information. Levie and Lentz (1982) found that text that was accompanied by illustrations showing what was described in the text was learned better by children than text that was not accompanied by illustrations. Levie and Lentz (1982) also found that illustrations that did not show what was described in the text did not improve learning. The results of Peeck's (1974) study showed that retention was better when the text was accompanied by supportive illustration. Therefore, Najjar (1996) suggested that the mere presence of illustrations does not improve the learning of textual information. The illustrations must show information presented in the text and learners must be able to avoid getting distracted by nonverbal media. It appears that supportive illustrations help explain the textual material and allow learners to build connections between the verbal (text) and nonverbal (illustrations) information, which leads to improved learning (Paivio, 1971; Clark and Paivio, 1991).

Najjar (1996) also said that multimedia information appears to be more effective for learners with low prior knowledge or aptitude in the domain being learned. In Levie and Lentz's (1982) meta-analysis study, it was concluded that the superiority of the illustrated text was more pronounced for poor readers than for good readers. In Bradey and Henderson's (1995) study, it was found that redundancy voice-overs were probably more beneficial for weak readers. In Mayer and Gallini's (1990) study, for college students with low prior knowledge of automobile drum brake operation, the illustrations improved their recall of explanative information and their ability to solve problems related to the explanations. Both Bagui (1998) and Shih and Alessi (1996) concurred that

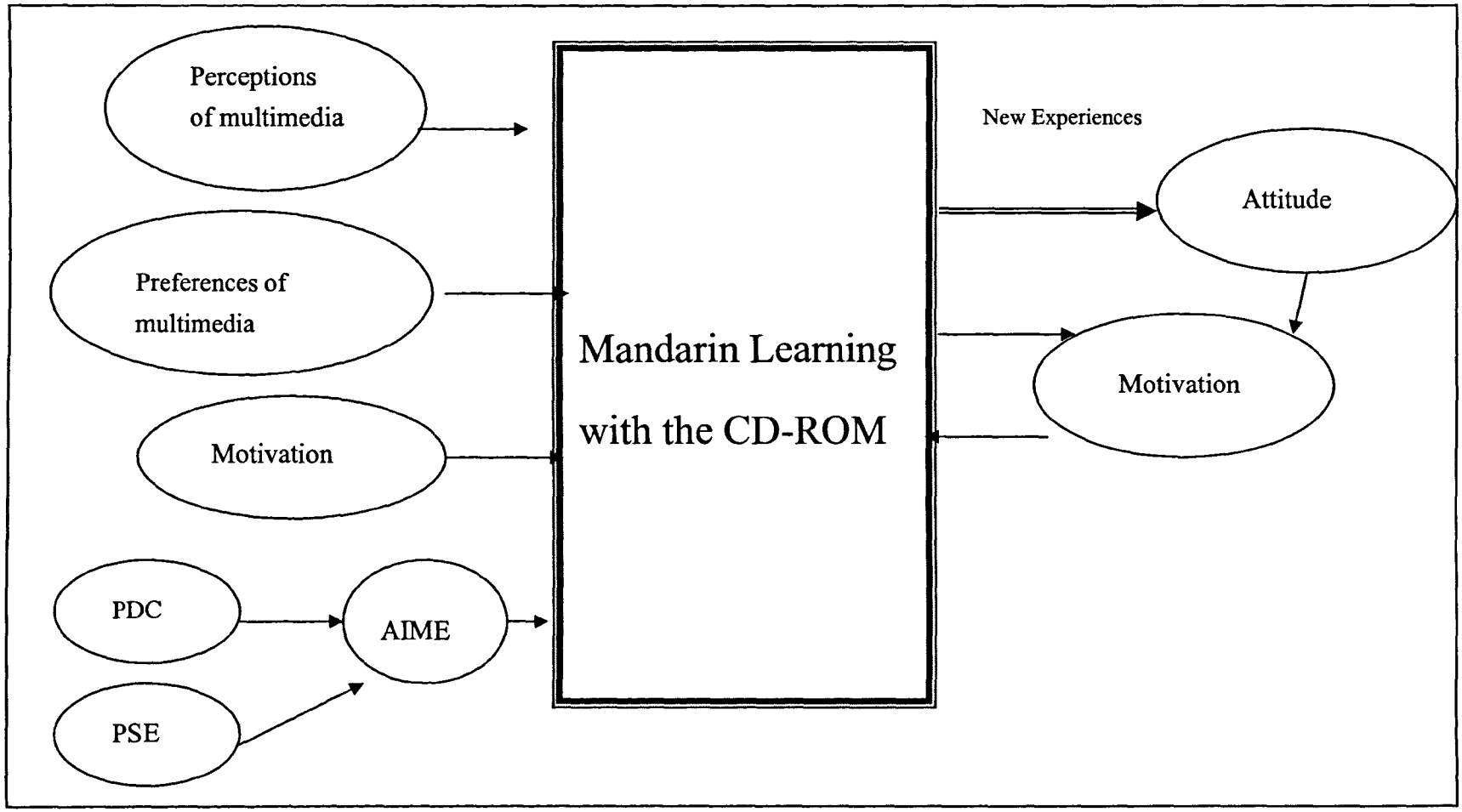
poor readers may prefer or benefit more from voice.

In this subsection, Najjar (1996) concluded that empirical studies support the idea that multimedia may help people learn. Multimedia that allows information to be processed in dual coded verbal and nonverbal modes seems to improve learning. Relevant supportive illustrations improved learning of textual stories. Multimedia also seems to be more effective for helping learners with low prior knowledge or aptitude in the domain being learned.

3.30 Conclusion of Multi Modal Processing

Based on the previous discussion, the researcher can summarise the human factors that may influence Mandarin learning with the CD-ROM as shown in Figure 14. In answering the question set forth in the Language Learner section of the second chapter about which human factor affects Mandarin learning with the CD-ROM, these factors include perceptions of multimedia (Figure 10), preferences of multimedia (Figure 11), motivation (Figure 4), and amount of invested mental effort (Figure 13). Wlodkowski (1999) claimed that motivation can be influenced by attitude and that new experiences can change attitude (Figure 6). This study plans to investigate whether or not these human factors shown in Figure 14, affect Mandarin learning with the CD-ROM and whether or not the new experiences provided by the CD-ROM can change the attitude and the motivation of the learners. Figure 14 becomes the rudimentary formative model for this research and it is used to formulate interview questions for the students.

Figure 14: Human Factors that affect Mandarin Learning with the CD-ROM



From Figure 14, the researcher will ask the following questions to the students to determine their perceptions and their preferences of multimedia components, their motivation, their perceived demand characteristics, and their perceived self-efficacy as shown in Table 8.

Table 8: Initial Research Questions for the Students

To determine how students perceive multimedia:
1. How might using the computer CD-ROM help your learning?
2. How might your learning not be improved by the CD-ROM?
To determine what preferences of multimedia students have:
3. What do you enjoy the most about the CD-ROM?
4. What do you enjoy the least about the CD-ROM?
5. If you never used a CD-ROM before, would you like to use one?
To determine if there is any motivation for Mandarin learning or Mandarin learning with the CD-ROM:
6. Why are you studying Mandarin?
7. Do you have much chance to use Mandarin outside of class?
8. What do you enjoy the most?
9. What do you enjoy the most about the CD-ROM?
10. What do you enjoy the least?
11. Have you used a CD-ROM before? If no, would you like to use one?
To determine the perceived demand characteristics
12. Why are you studying Mandarin?
13. What do you find the most difficult?
14. What do you find the most difficult about using the CD-ROM?
To determine the perceived self-efficacy:
15. What do you find the easiest?
16. What do you find the easiest about using the CD-ROM?

3.3 Adult Language Learners

From the questions drawn out in Table 8, the researcher of this study tries to explore whether or not the factors of the Dunn and Dunn learning styles model from Appendix 3 and their relationships are also applicable for adult students learning Mandarin with the CD-ROM in Macao. Therefore teaching methods, beliefs, learning styles, and motivation and attitude of adult language learners are discussed in this section.

3.31 Teaching Methods

Klippel (2000) said that the term "method" may describe both the procedures used by a teacher to instruct learners in a language lesson and the steps and techniques adopted by the learners themselves in pre-planned phases of self-teaching. The researcher is interested to learn more about how these methods can affect the language learners in their learning.

According to Pennycook (2000), language teaching prior to the twentieth century was conducted according to grammar-translation methodology, which was replaced by a revolution in language teaching that focused on the direct method. This was then followed by a series of methods, starting with audiolingualism, audiovisual method and cognitive method, and followed by a cluster of new methods that emerged in the 1970s including the silent way, suggestopedia and total physical response; and finally the modern era of communicative language teaching and task-based learning.

Pachler and Field (2001) said that the currently prevailing perspective on modern foreign language teaching is communicative language teaching, which can be seen as an eclectic assortment of traditional and novel approaches. Grammar-translation, direct, reading, audiolingual and audiovisual methods are

discussed in this subsection.

The researcher of this study aims to examine the different aspects of these methods in terms of its area of concentration, advantages/contributions, criticisms, and appropriate student group for that particular method. Teaching methods, based on whether or not the students are inductive or deductive learners, will be placed along the continuum later on.

3.311 Grammar-Translation Method

Rogers (2000) indicated that translation is used as a means of both practising and testing knowledge of the grammar-translation method. The approach is deductive, typically starting from the presentation of a rule, which is then practised by the translation of sentences into the second language (L2) on the basis of a bilingual vocabulary list. Translation into the first language (L1) is typically used as a test of reading comprehension.

Stern (1983) said that since first language serves as a very important reference system for the second language learner, translation in one form or another can play a certain part in language learning and also said that this method puts the learner into an active problem-solving situation. The major defect of grammar-translation lies in the overemphasis on the language as a mass of rules and never frees the learner from dominance of the first language (Stern, 1983, p. 455-456). Rivers (1981) also claimed that accurate pronunciation and intonated and communication skills were ignored. This method is not very successful with less intellectual students (Rivers, 1981, p. 30).

3.312 Direct Method

According to Stern (1983), the direct method is characterised by the use of

the target language as a means of instruction and communication in the language classroom. Advocates of this method wanted to make a radical change from the grammar-translation method from 1850 to 1900 (Stern, 1983, p. 456), and they shared a common belief that students learn to understand a language by listening to a great deal of it and that they learn to speak it by speaking it. Correct pronunciation became an important consideration. This method began a language course with an introductory period during which students were taught the new sound system. According to Stern, The audiolingual and audiovisuals methods have adopted many of the techniques from the direct method.

The direct method made several contributions. It was a first attempt to make the language-learning situation one of language use and to train the learner to abandon the first language as the frame of reference (ibid, p. 459). Stern saw that this method could be looked upon as a predecessor of present-day 'immersion' technique. Rivers (1981) said that it has been proven that this method is successful in releasing students from inhibitions with speaking another language. She also said that the greatest success with this method would be achieved where the student can 'hear and practise the language outside the classroom' (p.34).

Stern pointed out two major problems that have persistently troubled direct method teaching. One problem has been how to convey meaning without translation, and how to safeguard against misunderstanding without reference to the first language. Another problem has been how to apply the direct method beyond elementary stages of language learning. Unlike the infant learner, adult students already possess well-established native-language speech habits, which will inevitably influence how they express themselves. Rivers (1981) indicated that only the highly intelligent student with superior powers of induction would

benefit from this method. Since this method assumes that students learn to understand by listening and to speak by speaking it, Rivers (1981) noted that children probably benefit from this method.

3.313 Reading Method

Rivers said that in the reading method, students were to be taught to read the new language with direct apprehension of meaning, without a conscious effort to translate what they were reading. The spoken language was not neglected, but it was the reading objective that received the main emphasis. Acquiring reading ability in a foreign language is a way for the learner of increasing the range of their linguistic capabilities, and is also a way of enhancing their reading ability in their own language (Souchon, 2000, p. 506).

According to Rivers, the techniques were not radically different from those developed under previous methods. The use of the first language was not banned in language instruction. The introduction of the second language was oral as in the direct method because facility in pronunciation was regarded as an important aid in reading comprehension. Stern (1983) mentioned it has some important elements: language learning geared to specific purposes, the application of vocabulary control, and the introduction of rapid reading techniques to a foreign language classroom.

However, Rivers claimed that if the system is not controlled, extensive reading can lead to satisfaction with quantity rather than quality—number of pages perused rather than degree of comprehension. She said that while the reading method increases the ability of the better students to read in another language and frustrates students who have reading difficulties in their native language, students who were trained with this method were unable to

comprehend and speak the language beyond simple exchanges.

3.314 Audiolingual Method

Stern (1983) indicated this method has several distinctive characteristics. The separation of the skills – listening, speaking, reading, and writing, the use of dialogues as the chief means of presenting the language, the emphasis on memorisation and pattern drills, the use of linguistic and psychological theory as a basis to form this method, and the use of the language laboratory are some of the characteristics. Audiolingualism tries to develop target language skills without reference to the mother tongue. Herron and Seay (1991) said that during the heyday of audiolingualism, it was assumed that student repetition of dialogues and pattern drills would automatically benefit the development of the listening skill.

According to Rivers (1981), the materials students learned in this method are spoken in everyday situations. 'The use of take-home cassettes for individual practice enables students to spend more or less time on structure practice, depending on their individual needs', (p. 48).

Stern indicated that this method has made some major contributions to language teaching. First, it recommended the development of a language theory on declared linguistic and psychological principles. Second, it attempted to make language learning accessible to large groups of ordinary learners since this technique appeared to offer the possibility of language learning without requiring a strong academic background. Third it developed the separation of language skills.

On the other hand, Rivers pointed out some shortcomings of this method. The technique only achieves success in developing comprehension and fluency

in speaking the target language within a limited body of language material. If this is given in a mechanical way, 'students may progress like well-trained parrots—able to repeat whole utterances but uncertain of the meaning of what they are saying' (p. 47). Techniques of memorisation and drilling can become tedious and boring. Experience has shown the method to be appropriate for younger children, and less gifted students.

3.315 Audiovisual Method

Reinfried (2000) defined audio-visual language teaching as a method which is based on the coordinated use of visual and audio technical media. It is often linked to the audiolingual method because both methods use tape-recorders, work mainly with dialogues and were presented as scientifically-based methods during the 1960s. According to Stern (1983), this method is intended particularly for familiarising the learner with everyday language by providing a visually presented scenario that serves as the means of involving the learner in meaningful utterances and contexts. The grammatical as well as phonological features are practised. Writing and reading, as in the audiolingual method, are delayed, but in due course are given emphasis.

This method has made the some contributions with Stern noting that it is intended to simulate the social context in which language is used. The assumed learning process of this method proceeds from a total view of the situation to particular segments of language. The replacement of text of the direct method by a visually presented scenario has provided a fresh alternative in language pedagogy.

Stern (1983) also stated that the audiovisual method is open to two major criticisms. Like the direct method, it has difficulties in conveying meaning; the

visual filmstrip image is no guarantee that the meaning of an utterance is not misinterpreted by the learner. The other criticism that can be made is that the rigid teaching sequences imposed by this method are based on an entirely unproved assumption about learning sequences. The advantages and disadvantages of these methods are summarised in Table 9.

Table 9: Summary of Language Teaching Methods

Method	Area of concentration	Advantages/contributions	Criticisms	Best Student Group
Grammar-Translation	· grammar · translation	· first language as a reference system (Stern, 1983, p. 455) · active problem-solving (Stern, 1983, p. 455)	· overemphasis on rules (Stern, 1983, p. 455) · never free learner from dominance of the first language (Stern, 1983, p. 455-456) · accurate pronunciation and intonation and communication skills are ignored (Rivers, 1981, p. 31)	· intellectual students (Rivers, 1981, p. 30)
Direct	· correct pronunciation · speaking	· first attempt to abandon first language as a reference (Stern, 1983, p. 459) · stress on correct pronunciation (Rivers, 1981, p. 32) · successful in releasing students from inhibitions with speaking another language (Rivers, 1981, p. 33)	· how to convey meaning without translation and how to safeguard misunderstanding (Stern, 1983, p. 460) · how to apply beyond elementary stage of language learning (Stern, 1983, p. 460)	· high intelligent student with powers of induction (Rivers, 1981, p. 34) · children (Rivers, 1981, p. 31)
Reading	· reading · Correct pronunciation	· correct pronunciation (Rivers, 1981, p. 36) · Language geared to specific purpose (Stern, 1983, p. 462) · vocabulary control (Stern, 1983, p. 462) · rapid reading technique (Stern, 1983, p. 462)	· quantity rather than quality of reading (Rivers, 1981, p. 37) · students were unable to comprehend and speak the language beyond simple exchanges (Rivers, 1981, p. 38) ·	· better students (Rivers, 1981, p. 37) · students who can already read well in their native language (Rivers, 1981, p. 37)

Table 9: Summary of Language Teaching Methods (cont.)

Method	Area of concentration	Advantages/contributions	Criticisms	Best Student Group
Audio-Lingual	· listening · speaking · correct pronunciation and intonation	· mother-tongue is discouraged (Stern, 1983, p. 464) · emphasise on everyday language (Rivers, 1981, p. 42) · language theory based on linguistic and psychological principles (Stern, 1983, p. 465) · make language learning accessible to ordinary learners (Stern, 1983, p. 465)	· repeating like parrot (Rivers, 1981, p. 47) · techniques of memorisation and drilling are tedious and boring (Rivers, 1981, p. 47) · can only learn a limited body of language material (Rivers, 1981, p. 46)	· younger children (Rivers, 1981, p. 47) · less gifted students (Rivers, 1981, p. 47)
Audiovisual	· listening · speaking	· familiarise with everyday language (Stern, 1983, p. 467) · language theory based on linguistic and psychological principles (Stern, 1983, p. 468) · simulate the social context (Stern, 1983, p. 468) · a total view to particular segment of language learning (Stern, 1983, p. 468) · visually presented scenario provided an alternative in language pedagogy (Stern, 1983, p. 468)	· difficulties in conveying meaning (Stern, 1983, p. 468) · no guarantee that the meaning is not misinterpreted (Stern, 1983, p. 468) · rigid teaching sequences (Stern, 1983, p. 468)	· adult beginner (Stern, 1983, p. 466) · young children (Stern, 1983, p. 466)

3.316 Summary of Teaching Methods

Stern (1983) claimed that each of the different methods has contributed new insights and has attempted to deal with one or the other issues of language learning. Grammar-translation has based its entire teaching strategy on the use of the first language as a reference system. The direct method and the audiolingual method have recognised the value for learners to immerse themselves into the second language. The reading method and the audiolingual method have provided experience in isolating particular language skills, reading in the one case or listening and speaking in the other. All methods have emphasised the need for systematic practice. While the grammar-translation has presented the language as an intellectual learning problem, the audiolingual and audiovisual have advocated a relatively unthinking drill and training approach.

3.317 Conclusion of Teaching Methods

Stern pointed out that all of these teaching methods have in common two major weaknesses. One is that they represent a relatively fixed combination of language teaching beliefs, and another is that they are characterised by the over-emphasis on single aspects as the central issue of language teaching and learning. He also noted that during the sixties and seventies several developments indicated a shift in language pedagogy away from the single method concept. The new directions of thought are 'to overcome the narrowness, rigidities, and imbalances which have resulted from conceptualising language teaching purely or mainly through the concept of method' (p. 477). Crystal (1997) added that if only foreign language learning 'could be more natural, and the learner made more receptive to the task, more efficient learning would result' (p. 379).

In the light of the criticism made by Stern (1983) that each method has over-emphasised on single aspects of the teaching method, the cognitive method seems to be able to provide a solution. According to Stern, this cognitive method has been interpreted as an up-to-date grammar-translation theory or up-to-date direct method approach. It was developed in response to the criticisms made against the audiolingual method. The rediscovery of grammar-translation or the direct method was an attempt to give new insights to language pedagogy. This method places an emphasis on rule-learning, meaning practice, and creativity, and it moves from deductive explanations of rules to the application of the rules in contriving messages in the language.

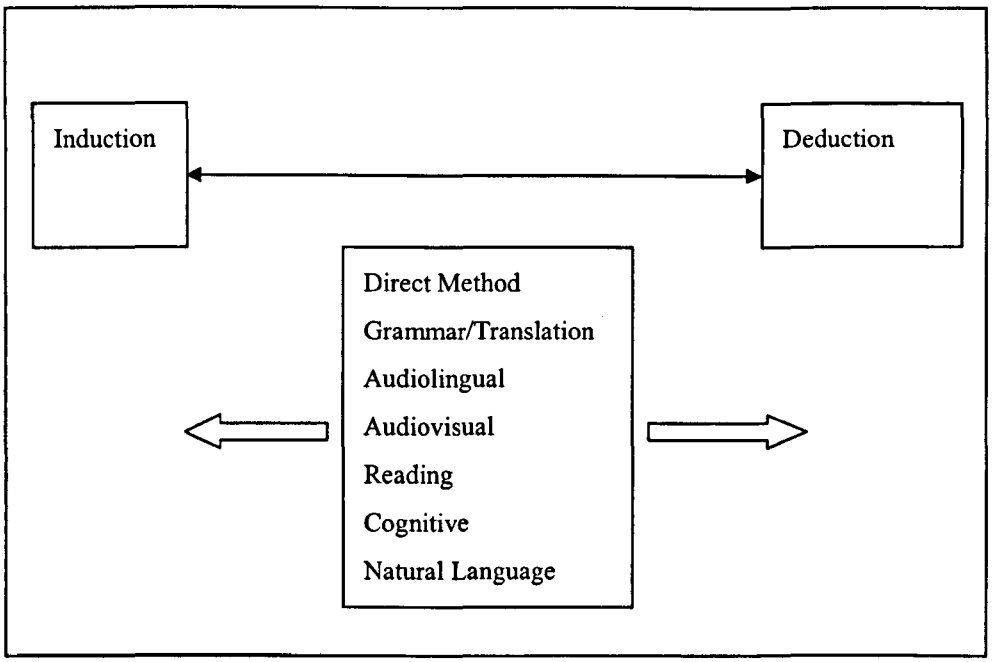
In response to Crystal's (1997) suggestion about making learning more natural, more receptive to the learner, the natural approach seems to be able to provide a solution. According to Rivers (1981), the natural language approach involves setting up informal situations where students communicate with each other and their teacher. There must exist a relationship of acceptance and equality between student and teacher and student and student if any genuine interaction is to take place. This is an active inductive approach. The present approach to language learning seeks the best of both worlds. Students study the language systematically on their own or in the language laboratory and class sessions are devoted entirely to natural interaction. Crystal (1997) pointed out that this approach emphasises the role of natural language acquisition and stresses the importance of emotional rather than cognitive factors in learning, and of mastering vocabulary rather than grammatical rules. The aim is to establish an ability to understand the basic content of a communication in informal settings. Learners use their L1 while their L2 comprehension is developing.

Rivers (1981) said that teachers are faced with the daily task of helping students to learn a new language. There are reasons why many experienced

teachers are eclectic in their teaching. The teachers 'like to retain what they know from experience to be effective, while experimenting with novel techniques and activities which hold promise for even more successful teaching' (p. 54). Eclecticists try to absorb the best techniques of all the well-known language-teaching methods into their classroom procedures, in which 'they are most appropriate' (p. 55). They seek the balanced development of all four skills at all stages and they adapt their methods to the changing objectives and to the types of students. To be a successful eclectic teacher, one needs to be 'imaginative, energetic, and willing to experiment' (p. 55). Wilkins (1990) said that it is perfectly possible to combine elements from different methods of teaching.

The researcher of this study recommends applying the eclectic approach in foreign language teaching. According to Rivers (1981), if induction-deduction is regarded as a main axis, the direct method will be at one end of the continuum, the inductive end, and the grammar-translation method at the deductive end. Reasoning which goes from particulars to generalities is inductive while reasoning that starts with rules and deduces consequences is deductive. The researcher is suggesting to teachers to look at the teaching methods along an axis, with induction and deduction on each end, as shown in Figure 15. Direct, grammar/translation, audiolingual, audiovisual, reading, cognitive methods and the natural approach can be placed somewhere in the middle of the axis where the language teachers can choose any one of these methods, or combine them to adjust to the teaching objective, student type, and their learning style.

Figure 15: Adjustment of Language Teaching Methods along the Inductive-Deductive Axis.



3.32 Beliefs in Language Learning

Horwitz (1988) said that students' beliefs about language learning would seem to have obvious relevance to the understanding of student expectations of, commitment to, success in, and satisfaction with their language classes. If certain beliefs can be an impediment to successful language learning, the question must be raised about the best way to modify them. Students' beliefs about language learning can based on limited knowledge and/or experience, which agreed with Samimy and Lee's (1997) point of view, as shown in Figure 2. Kern (1995) said that research on students' beliefs has evolved out of a more general interest in learner characteristics, such as personality, motivation, learning styles, and language aptitude, as they relate to language acquisition. Two case studies are discussed in this subsection. Horwitz administered the BALLI (Beliefs about Language Learning Inventory) to assess students opinions related to language learning. Kern compared students' beliefs about language

learning with those of their teachers and with those of their peers at another institution.

Horwitz's study (1988) identified learners' beliefs about language learning among first semester language students who were learning German, French, or Spanish. The Beliefs about Language Learning Inventory (BALLI), consists of student beliefs in five major areas (see Table 10): 1) difficulty of language learning; 2) foreign language aptitude; 3) the nature of language learning; 4) learning and communication strategies; 5) motivations and expectations on a Likert-scale indicating a response ranging from strongly agree to strongly disagree.

Table 10: Horwitz's Beliefs About Language Learning Inventory (BALLI) (Horwitz, 1988, p. 285, 287, 288, 289)

The Difficulty of Language Learning
1. Some languages are easier to learn than others.
2. The language I am trying to learn is a very difficult language, a difficult language, a language of medium difficulty, an easy language, or a very easy language.
3. I believe that I will ultimately learn to speak this language very well.
4. If someone spent one hour a day learning a language, how long would it take him/her to become fluent? (from less than 1 year to 5/10 years)
5. It is easier to speak than understand a foreign language.
6. It is easier to read and write this language than to speak and understand it.
Foreign Language Aptitude
1. It is easier for children than adults to learn a foreign language.
2. Some people are born with a special ability which helps them learn a foreign language.
3. It is easier for someone who already speaks a foreign language to speak another one.
4. I have foreign language aptitude.
5. Women are better than men at learning foreign languages.
6. People who are good at math and science are not good at learning foreign languages.
7. People who speak more than one language well are very intelligent.
8. Americans are good at learning foreign languages.
9. Everyone can learn to speak a foreign language.

The Nature of Language Learning
1. It is necessary to know the foreign culture in order to speak the foreign language.
2. It is better to learn a foreign language in the foreign country.
3. Learning a foreign language is mostly a matter of learning a lot of new vocabulary words.
4. Learning a foreign language is mostly a matter of learning a lot of grammar rules.
5. Learning a foreign language is different from learning other school subjects.
6. Learning a foreign language is mostly a matter of translating from English.
Learning Strategies
1. It is important to repeat and practise a lot.
2. It is important to practise in the language laboratory.
Communication Strategies
1. It is important to speak a foreign language with an excellent accent.
2. You shouldn't say anything in the foreign language until you can say it correctly.
3. If I heard someone speaking the language I am trying to learn, I would go up to them so that I could practise speaking the language.
4. It is okay to guess if you don't know a word in the foreign language.
5. I feel self-conscious speaking the foreign language in front of other people.
6. If you are allowed to make mistakes in the beginning it will be hard to get rid of them later on.
Motivations and Expectations
1. If I get to speak this language very well, I will have many opportunities to use it.
2. If I learn to speak this language very well, it will help me get a job
3. Americans think that It is important to speak a foreign language.
4. I would like to learn this language so that I can get to know its speakers better.

As far as the difficulty of the language learning was concerned, Horwitz (1988) discovered unrealistic goals and expectations about student language mastery, for example, that students felt that it takes two years or less in order to become fluent in a second language. As far as foreign language aptitude was concerned, most students thought that aptitude was important in foreign language

learning. As far as the nature of language learning was concerned, most students agreed that it was better to learn a foreign language in the foreign country. Some students believed that vocabulary word learning and grammar rules were the most important part of language learning. Some students believed that learning another language was merely a matter of translating from English. As far as learning and communication strategies were concerned, almost all of the students agreed that it was important to repeat and practise a lot. Most students agreed that it was important to practise in the language laboratory. As far as motivation and expectations were concerned, only a minority of students associated language skills with better job opportunities. However, a much larger number thought they would have many opportunities to use their new language.

Based on the findings of the study, Horwitz (1988) posited that mismatches between learners' beliefs about foreign language learning and the reality they experience in the classroom may not only impede successful language learning but also contribute to attrition and confirmed that students arrive at the task of language learning with definite preconceived notions of how they go about learning it. Knowledge of learner's beliefs about language learning should also increase teacher's understanding of how students approach the tasks required in language class, and ultimately, help teachers foster more effective learning strategies in their students.

Kern (1995) compared one group of students' beliefs about language learning with twelve of their teachers and also used the questionnaire called The Beliefs About Language Learning Inventory (BALLI), developed by Horwitz. At the beginning of the semester 70 percent of the students believed that they would ultimately learn to speak French very well, and of that subgroup, 43 percent believed that if one studied one hour a day it would take two years or less

to become fluent. Eighty percent of the students believed that everyone can learn to speak a foreign language and over half thought that they had foreign language aptitude. They thought that French was a language of at least medium difficulty. As might be expected, the students in French 1 tended to consider less time necessary to learn French than their more experienced peers in French 2. Only 38 percent of the students thought that knowledge of the foreign culture was important. It may be the case that students' recognition of the importance of cultural learning increases with language learning experience. Almost all agreed that practice and repetition were important and 69 percent of the students viewed the language laboratory as an important component of language learning. Over half of the students felt that if they learned French well they would have many opportunities to use it. Over half of the students also expressed the desire to learn French in order to get to know French-speaking people better, indicating some overlap of instrumental and integrative motivation.

The overall mean scores of the entire group of students with the instructors' overall mean scores had a very high correlation (.93). This finding was encouraging, as it suggested that the relationship between these particular students' and teachers' beliefs was very strong. When the analysis examined individual responses, however, more differences between students and teachers come to light. These differences between the students' and teachers' beliefs cover a wide range of issues, ranging from the nature of language learning students gave more credence to the importance of good accent, grammar rules, and translation than did teachers to pedagogy (error correction, cultural knowledge) and to length of time needed to become fluent. From the global perspective there is no indication that the teachers' beliefs influenced the beliefs of their students in any general and consistent way. Yet the individual correlation data between pre- and post- test indicated that some students greatly improved

the degree of fit between their BALLI responses and those of their instructors, suggesting the possibility that teacher's beliefs may be influential at the level of the individual. The findings suggested that teachers' beliefs are only one of many factors that affect students' beliefs about language learning It was important to recognise that students' misconceptions may not always be easily changed and that some students' attitudes may become more negative as they continue their foreign language studies, despite the best efforts of a well-intentioned teacher.

In this subsection, two case studies were discussed. Horwitz (1988) posited that mismatches between learners' beliefs about foreign language learning and the reality they experience in the classroom may not only impede successful language learning but also contribute to attrition. Kern (1995) found that teachers' beliefs are only one of many factors that affect students' beliefs about language learning.

3.33 Dunn and Dunn Learning Styles Model for Mandarin Learning with the CD-ROM in Macao

The researcher would like to see whether or not the factors from the Dunn and Dunn learning styles model from Appendix 3 could be seen or reflected in the adult students studying Mandarin using the CD-ROM in Macao. This subsection will answer the question set forth in the Language Learners section of the second chapter about what needs to be modified in the original Dunn and Dunn learning styles model to accommodate adult learners in learning Mandarin using the CD-ROM in Macao. The researcher modified this model (see Table 11) to include only inductive/deductive, or visual/auditory learners for the physiological factors, self, pair or peers for the sociological factors, motivation and attitude for the emotional factors, and the computer environment/CD-ROM for the environmental factors, as shown in Table 11.

Table 11: Dunn and Dunn Learning Styles Model for Mandarin Learning with the CD-ROM in Macao (modified from Dunn and Griggs, 1995, p. 83)

Physiological	Inductive/deductive		Visual/Auditory
Sociological	Self	Pair	Peers
Emotional	Motivation		Attitude
Environmental	Computer environment/CD-ROM		

Physiological, sociological, and emotional issues as related to Mandarin learning/Mandarin learning with the CD-ROM in the modified Dunn and Dunn Learning Styles Model are briefly discussed in this subsection and environmental factors will be discussed in the CD-ROM development chapter.

Where physiological factors are concerned, inductive or deductive learners and visual or auditory learners are discussed. First of all, according to Felder and Henriques (1995), how students reason will affect how they learn. Some students are more comfortable with inductive than deductive reasoning.

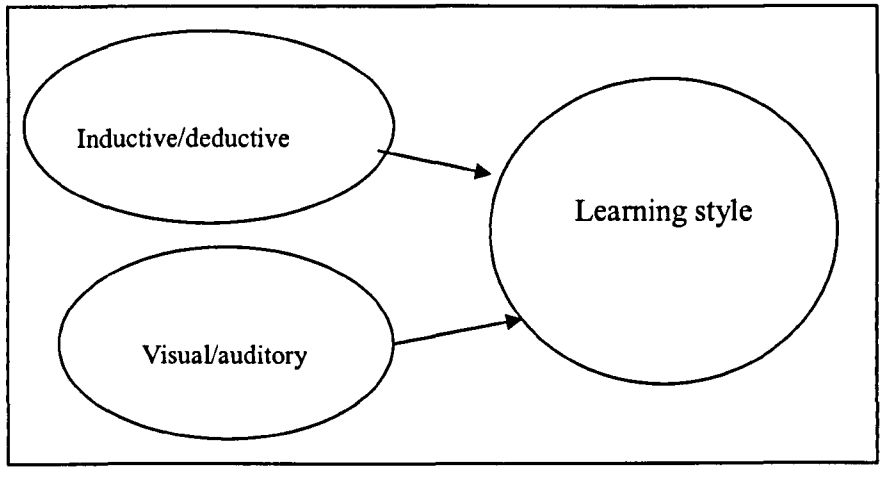
Induction is a reasoning progression that proceeds from particulars to generalities and deductive reasoning starts with axioms, principles, or rules, deduces consequences. To acquire a language means to pick it up gradually, gaining the ability to communicate with it without necessarily being able to articulate the rules. Complete command of a language thus involves both acquisition and learning. Acquisition is an inductive process, which requires learners to speak fluently, and learning is a deductive process, which requires learners to write grammatically. The two processes are not competitive, but complementary. Felder and Henriques (1995) suggested balancing the two processes when presenting course materials, which would make an ideal classroom setting for teaching a foreign language.

Secondly, as stated earlier, Oxford et al. (1993) said that visual students like to read in the new language, take notes, make outlines in writing, watch movies in the new language, and seek a great deal of visual stimulation. Auditory students, on the other hand, are comfortable without visual input and therefore seek conversation partners and oral activities. Felder and Henriques added that visual learners prefer that information be presented visually--in pictures, diagrams, flow charts, films and demonstrations and auditory learners prefer spoken or written explanations to visual presentation. Warner (2000) also added that the auditory preference student will learn best when listening to verbal instruction while the visual preference student will learn visually and will be able to recall what has been read or observed.

For Mandarin learning, inductive or deductive learners will respond differently to different teaching methods, along the inductive-deductive axis as shown in Figure 15. For Mandarin learning with the CD-ROM, visual or auditory students will respond differently to different multimedia components pointed out by Beccue, Vila and Whitley (2001), as shown in Figure 12. The

researcher feels that whether or not students are inductive or deductive learners or visual or auditory learners these are important physiological factors in assessing students learning Mandarin using the CD-ROM in Macao, as shown in Figure 16.

Figure 16: Physiological factors in Assessing Students Learning Mandarin using the CD-ROM in Macao (Felder and Henriques, 1995, pp. 23, pp. 26)

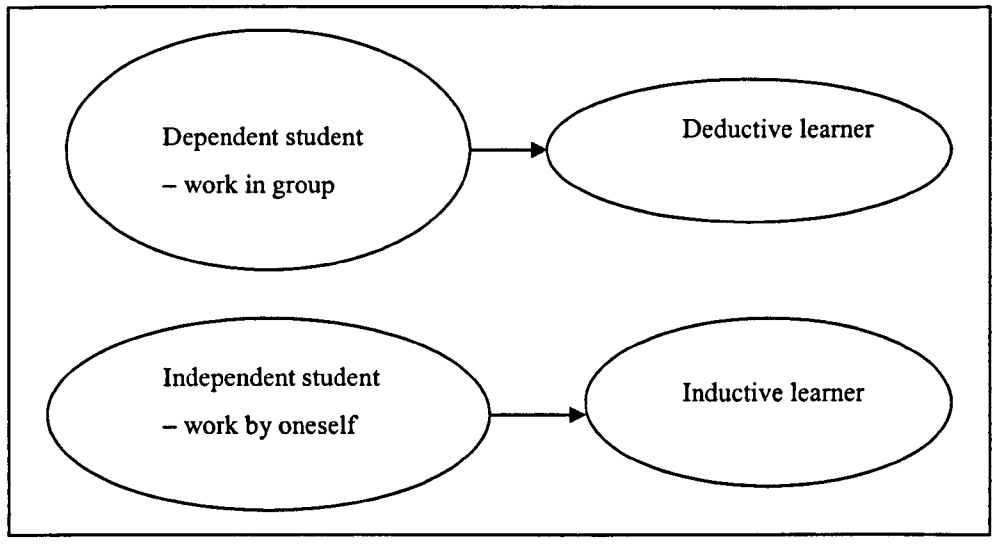


The case of Oxford et al. (1993) demonstrated learning style in terms of visual or auditory students. They performed a study with high school students to investigate factors that influence students' achievement in Japanese in the satellite setting. The authors thought that satellite technology might seem to attract most strongly students with visual preferences. They also thought that perhaps the satellite mode, in which there is abundant opportunity for conversation with native Japanese speakers, allows the auditory students to practise frequently and encourages them to develop their oral/aural skills, thus stimulating their motivation. The results showed that although auditory students were more motivated than visual students, nevertheless visual students significantly outperformed auditory students in achievement.

In terms of sociological factors, according to Dunn and Griggs (1995), certain students are incapable of learning new and difficult information directly from an adult. Some are fearful of failing, embarrassed to show inability, and/or often become too tense to concentrate. For such adolescents either learning alone or with peers may be more effective than learning directly from their teachers. When individual's preferences for learning alone, in pairs, in a small group, or with the teacher were identified, students can be taught congruently with their sociological preferences in order to maximise their learning.

Warner (2000) claimed that since learning can take place in almost any place at almost any time, the transfer methodology may vary considerably. He suggested looking at field dependent (FD) and field independent (FI) learners. According to Simonson et al. (1987), FD learners are influenced more by their surroundings than are FI learners, who are influenced more by internal factors. FD individuals seem to be more socially oriented, and are more affected by praise and criticism from their peers and tend to take a passive role in learning. FI learners, on the other hand, seem more adept at taking a message apart and at understanding its component parts, and tend to be more active learners who often have a strong self- concept. Warner (2000) said that the field dependent is likely to prefer group learning and interaction whereas the field independent is quite happy to work or listen alone. Equally, the field dependent prefers deductive learning from a rule or generalisation leading to many small examples whereas the field independent prefers inductive learning from many specific examples leading to a rule or generalisation. The researcher of this study shortens field dependent to simply dependent learner and field independent to simply independent learner for this study. Their relationships to deductive/inductive learner are shown in Figure 17.

Figure 17: Relationship Between Dependent/Independent Learners with Deductive/Inductive Learner (Warner, 2000, p.24)



As far as emotional factors are concerned, motivation and attitudes are discussed. Walberg and Uguroglu (1980) claimed that motivation is one of the several keys to effective learning and Crystal (1997) said that besides motivation, attitude towards the foreign language is also important. Walberg and Uguroglu said students who are learning more may become further motivated. Those who get off to a bad start in school or perhaps in a new subject may become less motivated, learn at a lower rate, and fall increasingly behind in both learning and motivation.

In Oxford et al.'s (1993) study, results showed motivation was the best indicator of Japanese language achievement, but the use of language learning strategies was also high influential. Motivation involved not just instrumental and integrative but also attitudes about whether or not the language was personally useful, whether or not the people in the target culture were appealing, and whether or not the students liked the school where the language was learned. The more often the students used a variety of learning strategies, the more

motivated they became.

Wlodkowski (1999) suggested that adult attitudes usually move in one or more of four directions: 1) towards the instructor, 2) towards the subject, 3) towards the adults themselves as learners, and 4) towards the adults' expectancy for success. If any one of these four attitudinal directions becomes seriously negative for the adult, his or her motivation to learn can be impaired.

Simonson et al. (1987) demonstrated how attitude affected learning. They investigated whether or not there was an attitude change among college students with different learning style. Before treatments were administered, all subjects were given the Group Embedded Figure Test (GEFT) (Witkin, et al., 1971). The GEFT was used to determine whether the students tended to be either Field Dependent (FD) or Field Independent (FI) learners. It was found that the subjects in the motion picture treatment who were identified as being Field Independent had more positive attitudes than did subjects in any of the other treatment groups.

Wlodkowski pointed out that new learning often causes mixed reaction in adults. This may be threatening to them, and their attitudes can support their resistance. Some adults may be discouraged when they realise how much extra time and effort they will need to expend to master what they are learning. Wlodkowski recommended the following three conditions to positively influence their attitudes: 1) quality instruction that will help them learn if they try to learn, 2) concrete evidence that their effort makes a difference, and 3) continual feedback regarding the progress of their learning. The researcher of this study hopes that the Mandarin CD-ROM can positively influence students' attitudes by providing quality instruction and continual feedback.

In this subsection, the modified Dunn and Dunn learning styles model included only inductive/deductive, or visual/auditory learners for the

physiological factors, self, pair or peers for the sociological factors, motivation and attitude for the emotional factors, and the computer environment/CD-ROM for the environmental factors.

3.34 Motivation and Attitude in Language Learning

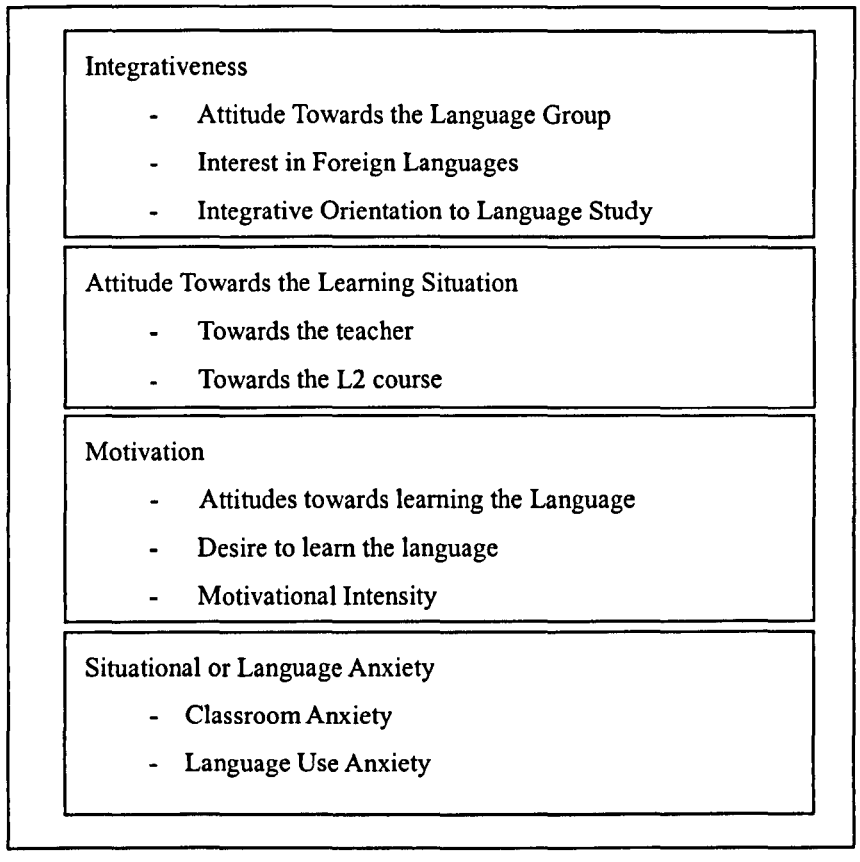
Dörnyei (1994) said that motivation is one of the main determinants of second/foreign language (L2) learning achievement and, accordingly, the last three decades have seen a considerable amount of research that investigates the nature and role of the motivation in the L2 learning process. Gardner and Lambert (1959) found that both language aptitude and motivation were important for successful acquisition of a second language. Gardner and Lambert (1972) confirmed that attitudes and motivation were associated with achievement in a second language.

Gardner and MacIntyre (1991) explained two types of motivations: instrumental and integrative. Instrumental motivation is situationally based in terms of the practical value and advantages of learning a new language. To the extent that it is tied to a specific goal, its influence would tend to be maintained until that goal is achieved, such as getting a new job. On the other hand, integrative motivation is individual-based, by having a personal interest in the people and culture represented by the other language group. Because integrative motivation has an attitudinal foundation in favourable attitudes towards the other ethnic community, other groups in general, and the language learning context, it is reasonable to expect it to have a continuing influence on language learning and use.

Gardner (1985) had proposed that two classes of affective variables, motivation on the one hand, and situational anxiety on the other, were important

in learning a second language. For the Attitude/Motivation Test Battery (AMTB), as shown in Figure 18, Gardner and MacIntyre (1993) pointed out that on the motivational side, emphasis is placed on the concept of an integrative motive. On the anxiety side, direction is focused on anxiety associated with learning and/or using the second language. The first component of the AMTB, Integrativeness, reflects the individual's willingness and interest in the social interaction with members of other groups, and it is assessed by three scales: Attitudes Towards the Language Group, Interest in Foreign Languages, and an Integrative Orientation to Language Study. The second component, Attitudes Towards the Learning Situation, refers to the students' reaction to formal instruction. The third affective construct, Motivation, refers to a combination of the learner's attitudes, aspirations and effort with respect to learning the language. It is measured by Attitudes Towards Learning the Language, Desire to Learn the Language, and Motivational Intensity. The fourth construct, Situational or Language Anxiety, refers to apprehension experienced by the individual in the language class or any situation in which the language is used.

Figure 18: Attitude/Motivation Test Battery (AMTB) (Gardner and MacIntyre, 1993, p. 159)



In this subsection, Gardner, Lalonde, and Moorcroft (1985) examined the role of language aptitude and attitudinal/motivational attributes on the rate of learning French vocabulary. Gardner and MacIntyre (1991) investigated the effects of integrative motivation and instrumental motivation on learning French/English vocabulary. Gardner, Day and MacIntyre (1992) examined the effects of both integrative motivation and anxiety on computerised vocabulary acquisition. Finally, LoCastro (2001) explored Japanese learners' self-reports on their attitudes and motivation towards learning English as a foreign language.

Gardner, Lalonde, and Moorcroft (1985) examined the role of language aptitude, attitudinal/motivational attributes and mode of presentation on the rate of learning French vocabulary in college. The results demonstrated that all three factors influenced rate of learning. Subjects high in language aptitude learned

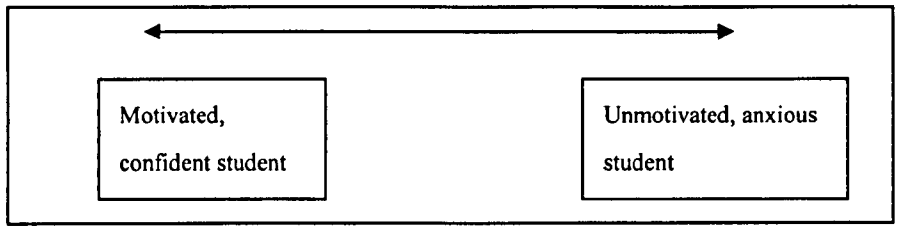
faster than those who were low, those high on integrative motivation learned faster than those who were low, and the rate of learning was more rapid under visual/written conditions as compared with aural/oral ones. Other results indicated that subjects' perceptions of their effort and interest were influenced by their level of integrative motivation but not by language aptitude.

Gardner and MacIntyre (1991) investigated the effects of integrative motivation and instrumental motivation on the learning of French/English vocabulary with college students. The results demonstrated that both integrative motivation and instrumental motivation facilitate learning. Other results indicated that instrumentally motivated students studied longer than noninstrumentally motivated students, but this distinction disappeared when the incentive was removed. Both integratively and instrumentally motivated students spent more time thinking about the correct answer than those not so motivated, suggesting that both elements have energising effect.

Gardner, Day, and MacIntyre (1992) indicated that whereas positive language attitudes and motivation facilitate second language learning, language anxiety has been shown to impair the language learning process. They examined the effects of both integrative motivation and anxiety on computerised vocabulary acquisition with college students. An attempt was made to induce anxiety in one group of subjects by videotaping them while learning. Subjects higher in integrative motivation showed superior vocabulary acquisition and tended to initiate a translation more quickly than did those lower in integrative motivation. The anxiety manipulation did not appear to influence behaviour. It seemed possible that the subjects who were more motivated to learn French attributed any added stress in the video camera condition to their own motivation rather than anxiety. The correlations revealed that vocabulary learning was positively associated with attitudes towards the learning situation and motivation.

This study raised a question regarding the relation among attitudes, motivation, anxiety, and second language learning. What is the difference between anxiety and motivation? Perhaps anxiety and motivation are opposite ends of the same dimension, there being motivated, confident students and anxious, unmotivated students, as shown in Figure 19.

Figure 19: Motivation Axis (Gardner, Day, MacIntyre, 1992, p. 212)



LoCastro (2001) explored Japanese learners' self-reports on their attitudes and motivation towards learning English as a foreign language with college students. Students thought there was a need to learn the L2 culture and the willingness to study about the target language culture was related to the level of the motivation of the learner. The students commented on the demotivating influence on learners once they realise they cannot attain native speaker level of proficiency in the L2. The various data sources suggested an overall positive, yet instrumental orientation towards the learning of English as a foreign language. All of them like to speak English frequently. They saw connections between English language ability and their future careers, graduate study, travel and living abroad.

In this subsection, Gardner, Lalonde, and Moorcroft (1985) found that language aptitude, attitude and motivation all influenced the rate of learning French vocabulary. Gardner and MacIntyre (1991) discovered that both integrative motivation and instrumental motivation facilitate learning where instrumentally motivated students studied longer when there was an opportunity

to profit from learning. Gardner, Day and MacIntyre (1992) raised a question regarding the difference between anxiety and motivation. LoCastro (2001) suggested an overall positive, yet instrumental orientation towards the learning of English as a foreign language.

3.35 Summary of Adult Language Learners

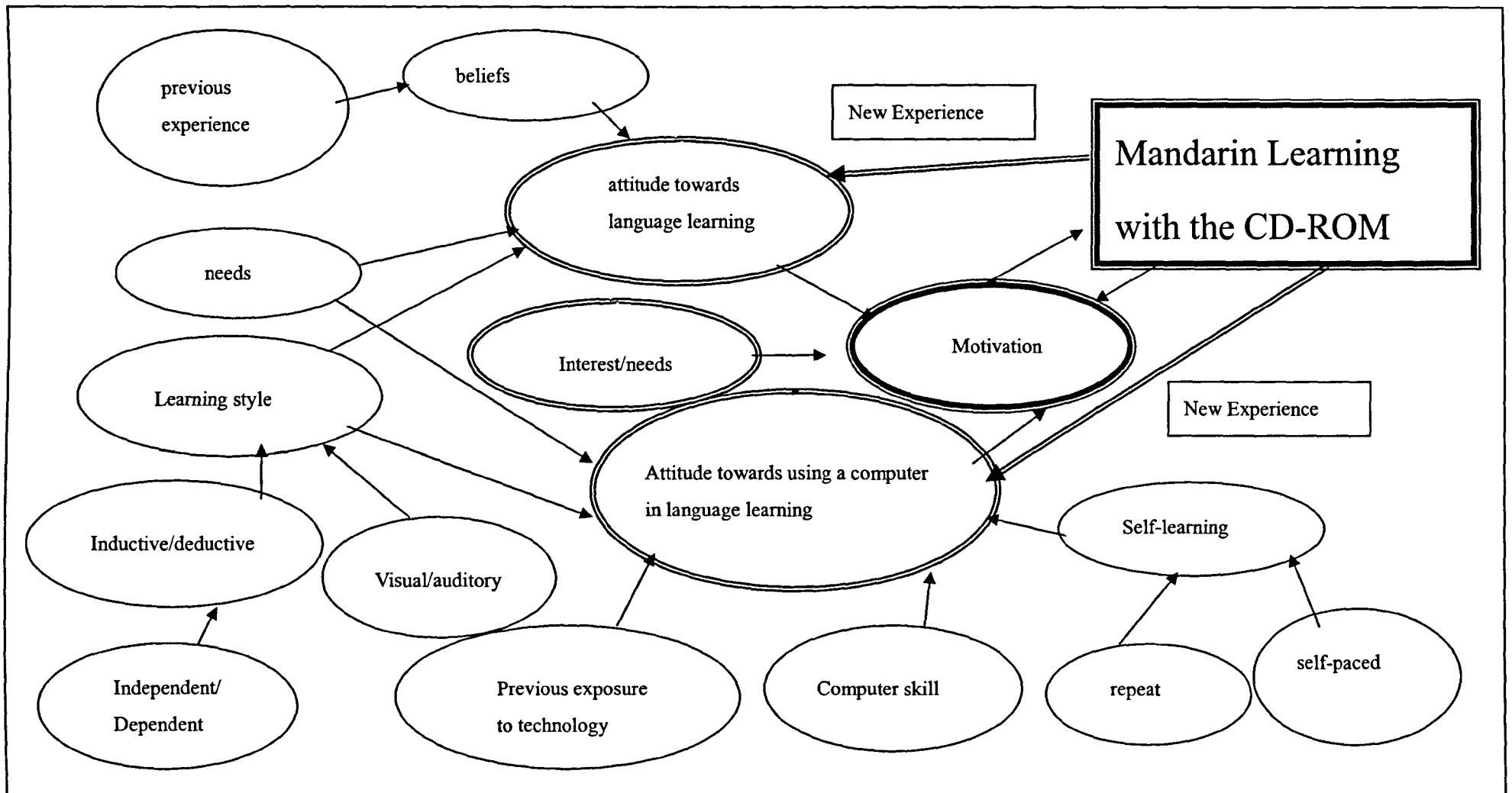
Students' beliefs about language learning would seem to have obvious relevance to the understanding of students expectations of, commitment to, success in, and satisfaction with their language classes. Both integrative motivation and instrumental motivation facilitate learning. The modified Dunn and Dunn learning styles model of adult Mandarin learners in Macao included only inductive/deductive, or visual/auditory learners for the physiological factors, self, pair or peers for the sociological factors, motivation and attitude for the emotional factors, and the computer environment/CD-ROM for the environmental factors.

3.36 Conclusion of Adult Language Learners

The researcher synthesises the diagrams in the Language Learner section of the second chapter and those diagrams in this chapter to suggest a relationship between the Dunn and Dunn learning style model and Mandarin learning with the CD-ROM, as shown in Figure 20. Figure 20 will answer the question set forth in the Language Learner section of the second chapter about the relationship between learning style, attitude, motivation and Mandarin learning with the CD-ROM. Interest or needs (Figure 5), attitude towards language learning, and attitude towards using a computer in language learning (Figure 6) are the three factors that influence motivation. Any new experiences generated by using the CD-ROM in Mandarin learning may change attitudes, which in turn may influence motivation (Figure 6). The attitude towards language learning can be affected by previous experience (Figure 2), beliefs (Figure 2), needs (Figure 6), and learning style (Figure 3) whereas the attitude towards using a computer in language learning can be affected by needs (Figure 6), learning style (Figure 3), previous exposure to technology, computer skill, and whether self-learning (Figure 12) is desirable or not. From Figure 20, the researcher can suggest that motivation is likely the key factor influencing Mandarin learning with the CD-ROM, which is in agreement with the arguments of Crystal (1997) in Figure 1, Walberg and Uguroglu (1980) in Figure 4, and Bagui (1998) in Figure 8. Crystal said that motivation is the central factor in successful language learning. Walberg and Uguroglu claimed that motivation is one of the several keys to effective learning and Bagui claimed that motivational effect is one of the contributing factors to the success of multimedia instruction. The claim that motivation is the key factor influencing Mandarin learning with the CD-ROM will answer the question set forth in the Language Learner section of

the second chapter about whether or not motivation is the focal point in the Dunn and Dunn learning style model for Mandarin learning with the CD-ROM. In summary, Figure 20 corresponds to the physiological, sociological, emotional and environmental factors of the Dunn and Dunn style model for Mandarin learning in Macao in Table 11. Physiological factors include whether or not the student is inductive/deductive or visual/auditory, sociological factors include whether or not the student likes to work by himself or herself, in pair or with peers, emotional factors include motivation and attitude which are the focal points, and environmental factors in Mandarin learning is the learning environment with the CD-ROM.

Figure 20: Relationship of the Dunn and Dunn Learning Styles Model and Mandarin Learning with the CD-ROM



The researcher analyses Figure 20 in terms of adult learning. As stated in the second chapter, Caffarella (1993) said that adults choose to learn through self-directed learning which includes three principles. First of all, in self-initiated learning, adults seek assistance in the form of human and material resources. Learners can choose to learn from a CD-ROM. Second, for personal autonomy, Caffarella synthesised four variables that appear to have the most influence on whether or not adult learners exhibit autonomous behaviour in their learning situations. These are their level of technical skills, their familiarity with the subject mater, their sense of personal competence as learners, and the context of the learning event. From Figure 20, their previous exposure to technology and computer skill will give them a sense of their level of technical skills, and their previous experience, beliefs, and interest will give them a sense of their familiarity with the subject matter. In addition, students' learning styles, their technical skills, their familiarity with the subject matter and whether or not they like self-learning will give them a sense of personal competence as Mandarin CD-ROM learners. The context of the learning event will be learning Mandarin through the CD-ROM on a computer where they will probably have to undertake self-paced learning. The last principle relating to self-directed learning is greater learner control. The learners are given the time and opportunity to think about what they want to learn, what is meaningful or useful to them, how they want to go about learning it. From Figure 20, needs or interest/need become important issues, when there is a need or interest, then the adult learner will find it useful to learn Mandarin. If the learners choose Mandarin learning with the CD-ROM, they could choose to learn it as much as they like, at home or at work.

3.4 Conclusion of Multimedia and Language Learners

Synthesising outcomes of studies reported in this chapter, a cross-reference table is drawn in Table 12 in terms of student type and multimedia components, multimedia components and language skill. The researcher classified students by the following types: strong, weak, knowledgeable, low prior-knowledge, visual, and auditory. Strong students can include good readers/listeners/writers/speakers while weak students can include poor readers/listeners/writers/speakers. Knowledgeable students are those who have some experience with Mandarin while low prior-knowledge students are those who have no experience with Mandarin. Visual students learn visually and will be able to recall what has been read or observed while auditory students learn best by listening to verbal instruction. The researcher also classified multimedia components by the following types: text, illustration/picture, animation, audio/voice, video, picture and text, audio and text, audio and animation (the order that was illustrated in this chapter).

Table 12: Cross Reference between Student Type/Multimedia Components and Multimedia Components/Language Skills

Language Skills →				Listening test(17)	Listening (18)	Reading (19)	Reading (8)	→
Multimedia Components								
Student Type	Text	Illustration/ Picture	Animation	Audio/Voice	Video	Picture And Text	Audio And Text	Audio And Animation
Strong	1		2	13*	12	5		
Weak				3, 4, 9		6*	8	
Knowledgeable	14			13				
Low prior-Knowledge		13	13		13	7, 10		11
Visual	5	15	15		15	15		15
Auditory	16			16			16	

* The researcher of this study interprets knowledgeable in the domain can also apply to strong students in the area of study.

Notes:

1. Advanced learners learn more efficiently from text (Shih and Alessi, 1996, p. 207).

2. Animation may not be suitable for novice learners (Rieber, 1990, p. 82).

3. Poor readers prefer and learn more from voice (Shih and Alessi, 1996, p. 207).

4. Voice is more easily comprehended by poor reader (Bagui, 1998, p. 6).

5. There is evidence that for good readers, the pictures facilitated retention of the passage as a whole. (Rusted and Coltheart, 1979, p. 521).

6. The superiority of the illustrated text was more pronounced for poor readers than for good readers (Levie and Lentz, 1982, p. 225). * When learning how to read is the objective, the presence of pictures may hinder learning. (Levie et al., 1982, p. 218).

7. The explanative illustrations were effective in improving problem-solving for low prior knowledge students (Mayer and Gallini, 1990, p. 724).

8. Redundancy voice-overs were probably beneficial for weak readers (Bradey and Henderson, 1995, p. 113).

9. The pace set by audio might be helpful for slower learners. (Beccue, Vila and Whitley, 2001, p. 64).

10. Students (low levels of prior experience with mechanical devices) learn best when the words and pictures of an explanation are presented contiguously in time or space. (Mayer and Anderson, 1992, p. 450).

11. When animation was presented concurrently with narration, students (low levels of prior experience) demonstrated large improvements in problem-solving transfer (Mayer and Anderson, 1992, p.450).

12. Stronger students were able to benefit more from instruction with video (Baltova, 1994, p. 519).

13. Audio may be sufficient for those knowledgeable of a domain, but visual systems supply important situational information for those less knowledgeable (Kozma, 1991, p. 192).

14. People who are very knowledgeable about a particular domain can process information at a much faster rate and more strategically with text (Kozma, 1991, p. 194).

15. Visual learners prefer that information be presented visually--in pictures, diagrams, flow charts, films and demonstrations (Felder and Henriques, 1995, p. 23).

16. Verbal (auditory) learners prefer spoken or written explanations to visual presentation (Felder and Henriques, 1995, p. 23).

17. The mode of assessment (listening comprehension) to be recommended will involve the test being delivered by audio mode (Coniam, 2001, p. 12).

18. The majority of those (70%) who watched the film on VCR expressed a positive attitude towards it (Baltova, 1994, p. 518).

19. Pictures could enhance retention of text content when used in conjunction with reading (Rusted and Coltheart, 1979, p. 521).

As shown in Table 12, strong students should be able to use text, animation, audio/voice, video, picture and text in their learning while weak students should use audio/voice, picture and text, and audio and text to guide their learning. Knowledgeable students can process just text or audio while low prior-knowledge students will need illustration/picture, animation, video, picture and text, and audio and animation to guide their learning. Finally, visual students should be able to process text, illustration/picture, animation, video, picture and text, and audio and animation while auditory students can use text, audio/voice and audio and text in their learning.

The only language skills that were mentioned in this chapter are a listening test, listening, and reading skills, which are the receptive language skills. On the top row of Table 12, in terms of matching multimedia components with language skills, listening test matches with audio/voice, listening skill matches with video, reading skill matches with picture and text or audio and text. Coniam (2001) concluded that a listening comprehension test should be implemented via an audio mode. Baltova (1994) claimed that it would be the optimal solution to try to use video in language learning since the majority of those (70%) who watched the film on VCR expressed a positive attitude towards it. Rusted and Coltheart (1979) found that pictures could enhance retention of text content when used in conjunction with reading. Bradey and Henderson (1995) claimed that redundancy voice-overs (voice with text) were probably beneficial for weak readers.

Based on the outcomes of these studies, the researcher of this study draws the conclusion that picture and text is good for reading for both strong and weak students and audio and text is only good for reading for weak students, video is good for listening for strong students, and audio is good for providing listening

tests for both strong and weak students. Therefore the researcher decided to implement audio and text and not to use video in the production of the CD-ROMs in this study.[3]

The researcher suggested looking at which components of multimedia (visual, audio, or print) are more appropriate for different aspects of Mandarin learning with the CD-ROM. From Table 12, text seems more appropriate for advanced learners (Note 1, 14), audio or audio with text is more appropriate for weak readers (Note 3, 4, 8, 9), and pictures or video are more appropriate for stronger students (Note 5, 12).

In answering the question set forth in the Foreign Language Learning section of the second chapter to find out which language skill is more appropriate to learn through the multimedia CD-ROM, the multimedia CD-ROM is probably suitable for the listening and reading skills.

Finally, the researcher explores the relationship on strong and weak students with the teaching methods described in Table 9. Table 13 displays only those multimedia components that are related to strong and weak students.

Table 13: Cross Reference between Strong/Weak Students and their Multimedia Components and their Associated Receptive Language Skills

Listening Skill →			Listening Test	Listening	Reading	Reading
Multimedia Components						
Student Type	Text	Animation	Audio/Voice	Video	Picture And Text	Audio And Text
Strong	X	X	X	X	X	
Weak			X		X	X

[3] Macao Polytechnic Institute assigned a group of Portuguese students learning the elementary level of Mandarin for the main study of this research.

From Table 13, the researcher is able to combine with Table 9 to see how each teaching method is related to strong and weak students (see Table 14). Since grammar/translation, direct, and reading methods are more appropriate for strong students, text, animation, audio/voice, video, picture and text can be used in their learning materials. Furthermore, since audiolingual and audiovisual methods are more appropriate for weak students, audio/voice, picture and text, audio and text can be used in their learning materials.

Table 14: Cross Reference of Teaching Methods and Multimedia and Language Skills

	Language Skills				Listening Test	Listening	Reading	Reading
	Student Type		**Multimedia Components**					
Teaching Methods	Strong Students	Weak Students	Text	Animation	Audio/Voice	Video	Picture and Text*	Audio and Text
Grammar/ Translation	1		X	X	X	X	X	
Direct	2		X	X	X	X	X	
Reading	3		X	X	X	X	X	
Audiolingual		4			X		X	X
Audiovisual		5			X		X	X

Notes:

1. intellectual students (Rivers, p. 30)
2. high intelligent student with powers of induction (Rivers, p. 34)
3. better students (Rivers, p. 37)

   students who can already read well in their native language (Rivers, p. 37)
4. less gifted students (Rivers, p. 47)
5. adult beginner (Stern, p. 466)

* When learning how to read is the objective, the presence of pictures may hinder learning. (Levie and Lentz, 1982, p. 218).

From Table 14, it seems that both audio/voice and picture with text are appropriate for all teaching methods and for both strong and weak students. Pictures with text should be used with care. Since strong students favour video and weak students favour audio with text, this will also justify the fact that the researcher of this study used audio and text in her CD-ROM development with elementary Portuguese students in her study.

This chapter discussed three issues: components of multimedia, multi-modal processing and adult language learners. The multimedia components section discussed the advantages and disadvantages of the multimedia components. The multi modal processing section discussed studies conducted between different multimedia components. The adult language learners section analysed the learners in terms of teaching methods, beliefs, learning style, attitude and motivation. The main issues learned that contributed to use of audio and text in the development of the CD-ROM are as follows. The stability of text aids comprehension and voice may be more easily comprehended by children or poor readers. Audio and text may aid comprehension, help link new content to previous knowledge, and generate new concepts. Even though video instruction promotes greater attention than audio instruction, only stronger students seem able to benefit more from it. After studying about adult language learners, the researcher is going to use the modified Dunn and Dunn learning styles model to evaluate adult Mandarin learners in Macao. Now that the reader has a better understanding of multimedia and adult language learners, the researcher will discuss multimedia and foreign language learning in the next chapter.

Chapter 4: Multimedia and Foreign Language Learning

Armstrong and Yetter-Vassot (1994) said that technology and foreign language teaching are no strangers to each other. Salaberry (2001) pointed out that several tools/media have lent themselves well to incorporation in the L2 classroom, from the early uses of the phonograph to reproduce the human voice to films, videotapes, computers, teleconferencing, and the use of Internet chat rooms to increase communicative interaction with other learners. There are two major sections in this chapter and they are technology as related to foreign language learning and computer assisted language learning (CALL). In the technology section, the technology from radio to microcomputer is discussed. In the CALL section, first, the background and technology of CALL are discussed. Then finally foreign language learning case studies of multimedia/CD-ROM technology are analysed to try to determine how the instructional features of multimedia mentioned by Stemler (1997) are to be used to assist Mandarin learning with the CD-ROM and which one of the successful factors mentioned by Najjar (1996) and Bagui (1998) are more appropriate for Mandarin learning with the CD-ROM.

4.1 Technology Relating to Language Learning

First, materials and media relating to language learning are defined. Then radio, television, telephone are briefly discussed to learn from its history while language laboratory and computers are discussed more in detail as they contain information relating to the present technology—multimedia/CD-ROM discussed in this paper.

4.11 Materials and Media

According to Sercu (2000), materials and media are everything that can be

used to support the foreign language learning process. Clark (1986) said that media are part of instructional technology and they are the means, forms or vehicles by which instruction is formatted, stored, and delivered to the learner. Schramm (1977) pointed out that the first instructional medium of modern times was print and defined media big media and little media. By big media, he meant those expensive media like television, sound films, and computer-assisted instruction. By little media, he meant the simper ones like slides, slide films, and projected transparencies to radio and programmed texts. According to Kozma (1991), media can be defined by its technology, symbol systems, and processing capabilities. The most obvious characteristic of a medium is its technology and characteristics such as size, shape, and weight make it more likely that a student will use one over another. Roche (1997) said that students and teachers often consider the use of media in teaching as a welcome change in daily teaching routines. The equipment itself usually produces a novelty effect, which attracts their attention. Whether or not the technology is actually needed to transmit the subject matter and whether or not it in fact improves language learning and teaching often appears to be overpowered by the technology factor. Najjar (1996) also claimed that novelty is one of the successful factors of multimedia instruction.

4.11 Radio and Audio Cassette

In terms of using radio in a foreign language classroom, Garfinkel (1972) argued that radio had 'the technological resources to supply any language classroom, no matter how remote, with a wealth of stimuli from all over the world' (p. 162). In this subsection, Wipf (1984) described ways of using radio broadcast, Hwu (1997) and Meredith (1983) described audiocassettes and portable cassette player respectively. Garfinkel (1969) and Mohr and Lally

(1973) discussed courses conducted with radio broadcast.

What Wifp (1984) described about the use of radio broadcast can also be applied to the use of CD-ROM as well. He described the classroom techniques of radio broadcasts in the second language classroom. First, a number of teachers seeking course materials to improve speaking and listening skills had utilised broadcasts as the basis for all or a major portion of their classes. On the other hand, some teachers preferred to supplement existing curriculum. Others suggested that recordings of broadcasts should be available to interested individuals beyond the school.

In terms of selection of materials, he suggested that if the listener could identify with the content, then motivation would be enhanced. The use of materials on topics familiar to students will be most successful. In terms of practice, he noted that extra listening practice is especially important during the initial stages of a course when students were not accustomed to hearing native speakers talking at a rapid rate on topics that might be unfamiliar. The recordings could then be listened to repeatedly in the classroom, the language laboratory, a listening lounge, or at home.

He pointed out that appropriate reference materials should be provided for students' use in the listening area. A good bilingual dictionary, an atlas, and world maps, ideally in the languages being learned, would greatly enhance the learning process as listeners were confronted with new terms, expressions and unfamiliar geographic locations.

As Wipf (1984) noted that extra listening practice was especially important and recordings could be made, cassette recorder and cassette players should play an important role in language learning. Hwu (1997) said that audiocassettes have long been the primary device used by most instructors to demonstrate sounds and have also been made available for students' use outside the classroom.

However, due to the limited technical capacity of audiocassette players, it was often difficult to locate a specific item without rewinding the audiocassette back and forth many times. Students who use audiocassettes in conventional language laboratories also have to deal with the frustrating problem of winding and rewinding audiocassettes. Meredith (1983) talked about how the portable cassette player has considerable potential for benefiting the foreign language student. With a clip-on-the-belt cassette player with its headphones, dedicated students can take advantage of the portability of these units to practise listening comprehension in the foreign language almost anywhere.

Garfinkel (1969) completed a preliminary investigation into the effects of a series of enrichment-oriented radio programs on measures of listening comprehension and attitude on Spanish language. The programs contained such elements as jokes, riddles, entertaining commercials, popular music, sound effects, and student interview. Students were divided into three groups: a) not listening to the programs; b) listening to the programs via tape recording; c) listening to the programs via radio at broadcast time. Pre-tests were used to establish the similarity of the classes before the programs began. The results in listening comprehension also favoured the experimental groups, but the difference was not statistically significant. Results from the attitude scale were slightly more significant.

Mohr and Lally (1973) tested the effectiveness of short-wave broadcast in German language learning, based on the premise that students have greater motivation and interest when confronted with materials about which they were already familiar and interested in. This is in agreement with Caffarella's (1993) self-directed learning concept of personal autonomy in which adult students like to learn with what is familiar to them. Interest was considered which is in agreement with Warner (2000) who said that if the content of a course is of no

interest to the students, it is unlikely they will have much motivation. There was significant improvement in pronunciation, phrasing, intonation, vocabulary and above all in a feeling of confidence. The value of this study was assessed from the instructors' and students' viewpoints. All the students showed enthusiasm for the course. The most common criticism was the daily length of the use of the broadcast. From the instructor's point of view, this broadcast was a challenge in terms of new vocabulary, more interaction between students and instructors, and intensive participation on the part of everyone involved. Mohr and Lally (1973) concluded that 'no matter what type of language lab facilities are used, students must have easy access to the recorded materials' (p. 121).

In this subsection, Wipf (1984) described radio broadcast in terms of classroom techniques, selection of materials, practice, appropriate reference materials and explanation of the limitation of a short-wave receiver. Meredith (1983) said that students could take advantage of the portability of the portable cassette player to practise their listening skill; however, Hwu (1997) indicated that students who used audiocassettes have to deal with winding and rewinding audiocassettes. Garfinkel (1969) found that students' attitude scale were slightly more significant when listening to radio and Mohr and Lally (1973) noticed improvements in confidence and that the students were very enthusiastic about the course when radio broadcast was used.

4.13 Television and Video

Salaberry (2001) said that television broadcast for pedagogical purposes was perceived as a natural extension of the use of radio broadcasts. Kozma (1991) pointed out that television could employ pictures, diagrams, and depict motion. In this subsection, Schramm (1977) described television use in school, Krendl and Watkins (1983) explored the amount of invested mental effort, and

Swaffar and Vlatten (1997) and Herron, Cole, Corrie and Dubreil (1999) discussed the use of video in language learning.

Schramm (1977) described television use in Hagerstown, Maryland in the United States. Hagerstown began to broadcast in September 1956 and the teachers controlled the television. The number of students who were involved in the television viewing went from 6,000 to 20,853 in two years. After one or two years of television, each grade exceeded the national norms. Some results were less than expected. The same rural pupils made only a small gain in actual problem-solving. Teachers thought that television probably did not contribute in the area of problem-solving. The students identified the chief advantage of nontelevision classrooms as freedom for students to ask questions, get personal help from the teacher, and participate actively in discussion. The chief advantages of television teaching were that without it they would not have the visuals and other materials presented by the television teacher; furthermore, the television classes were better prepared and the teleteachers, in general, more expert in their subjects. Najjar (1996) also claimed that computer-based multimedia instruction might force the instructional designer to better organise the learning material.

Krendl and Watkins (1983) exposed children to a 15-minute educational television video to explore the nature of comprehension. There was no significant main effect for viewing set (educational or entertaining) and view mode (stopping or no-stopping) in terms of simple recall. Overall, both entertainment viewing set groups scored at consistently lower levels than did the educational groups. Thus Krendl and Watkins (1983) concluded that viewing mode, whether for educational or entertaining purposes affected student learning with television, which confirms what Salomon's (1983) description of the amount of invested mental effort, or AIME, which is influenced by the attitudes

people have about the amount of effort required to process a medium's message and also by the purpose that people bring to the task.

Swaffar and Vlatten (1997) said that videos might become a useful medium because videos expose students to authentic materials and to voices and dialects other than what the teachers could otherwise provide and provide the cultural context. Herron, Cole, Corrie, and Dubreil (1999) investigated whether beginning-level students learn culture embedded in a video. The findings of the study suggested that introductory level college French students could improve their knowledge of cultural information with the videos presented in class over the course of one semester.

In this subsection, Schramm (1977) said that television might not be good in problem solving and Krendl and Watkins (1983) concluded that viewing mode, whether for educational or entertaining purposes affects student learning with television. Swaffar and Vlatten (1997) agreed that video is a useful medium because it exposes students to authentic materials. Finally, Herron, Cole, Corrie and Dubreil (1999) pointed out that the use of video improved knowledge of cultural information in language learning.

4.14 Telephone and Telephone-related Tools

Buscaglia and Holman (1980) said that the nature of the telephone as a device for communication compelled a student to want to be able to communicate a message successfully. Furthermore, the psychological impact of the apparatus—a dial tone, dialling the number, the ringing of the unit, with an occasional busy signal—helped students forget that they were in a classroom and eliminated some of the artificiality of learning a foreign language in school. Audio-active voice reflector, telephone, photophones and video conferencing were used for pedagogical purposes and they are discussed in this subsection.

Firstly, Brown, Dietz, and Fritz (1972) used the audio-active voice reflector to teach Spanish in a L2 classroom. This device reflected the student's voice towards his or her ears while enabling him or her to hear the instructor's voice and other students' voices. The results showed a statistically significant difference between a treatment group and a control group in a pronunciation-mimicry test.

Secondly, Buscaglia and Holman (1980) reported teleprompter's usage teaching English in a L2 classroom, which consisted of two telephone units and a loudspeaker that had buttons for operating an authentic dial tone, busy signal, and ring for both telephones. Buscaglia et al. (1980) suggested that a teleprompter should be used sparingly in order to preserve its novelty and should be used late in the semester when students are more experienced verbally and well acquainted with each other. The teleprompter gave the students another alternative for motivating conversation.

Thirdly, Twarog and Pereszlenyi-Pinter (1988) described the implementation of the telephone-assisted language study. The only important difference was that students received assistance and feedback on their progress by telephone. The results showed that it was a very effective and time-saving method to learn and to review foreign languages. Busy, time-conscious professional people found it to be especially rewarding.

Fourthly, Gallego (1992) conducted a language exchange with a group of students in Spain and the U. S. using a photophone—a telephone-like device which consists of a camera, a telephone, a built-in loudspeaker and microphone, and a small screen. The benefits of the Tele-class could be characterised as linguistic, cultural, and motivational in nature. Language gain was perceived most noticeably in the areas of listening comprehension, vocabulary and fluency.

Finally, Kinginger (1998) analysed a classroom interaction taking place

between French language learners in the U.S. and English learners in France via international videoconferencing. Both sites were equipped with video cameras, microphones, and televisions. The videoconferencing event added new forms of language classroom anxiety induced by the stress of public speaking in a networked or linked environment. On the other hand, exposure to the spoken French used by peers was clearly motivating to learners.

In this subsection, Brown et al.'s (1972) study showed a statistically significant difference between a treatment group and a control group in a pronunciation-mimicry test. Buscaglia and Holman (1980) thought that the telephone gave the student another alternative for motivating conversation. Twarog and Pereszlenyi-Pinter (1988) said that telephone-assisted language study could be a very effective and time-saving method for review. Gallego (1992) concluded that photophone provided language gain in the areas of listening comprehension, vocabulary and fluency while Kinginger (1998) spoke of videoconferencing which provided exposure to spoken language used by peers was clearly motivating to learners.

4.15 Language Laboratory

Crystal (1997) claimed that the best-known technological aid in foreign language teaching is undoubtedly the language laboratory, a room, usually divided into booths, where students can listen individually to tape recording of foreign language material, and where they may record and play back their own responses, while being monitored by a teacher. These laboratories were heralded as a technique that would vastly improve the rate and quality of foreign language learners and take the burden of repetitive drills away from the teacher by providing more opportunities for learners to practise listening and speaking, and enable them to develop at their own rates and monitor their own

progress. Salaberry (2001) said that the instant spread of the language laboratory was attributed to the audiolingualism language learning theory of the time.

In this subsection, Hayes (1964) described the advantages of the language laboratories. Then Angelis (1973) and Church (1986) reported the usage of the language laboratories while Holmes (1980) and Schwartz (1995) pointed out problems with earlier generations of the language laboratories. Gray (1996) mentioned many advances in language laboratories and Rivers (1981) gave a few suggestions about the design and usage of the language laboratory. Advantages and disadvantages of the language laboratory and the design of the future language laboratory should also be applied to CD-ROM usage as well.

Hayes (1964) pointed out that the advantages of the language laboratory in Table 15. As far as students were concerned, it provided authentic, consistent, untiring models of speech for imitation and drill, differences in learning rates, technical facilities for self-instruction, and recordings with many native voices, without relying the voice of one teacher. The language laboratory also facilitated the testing of each student for listening comprehension, testing of speaking ability of each student in a class, and the division of a class into teacher-directed and machine-directed groups. Finally, it could enhance the student's potential for evaluating his or her own performance, and with the use of the headphones, it provided a sense of isolation, clarity of sound, and facilitated complete concentration, all students could practise aloud simultaneously. In terms of advantages to teachers, the teachers were free to focus their attention on the individual student's performance and some teachers could even improve their own proficiency with the aid of the language laboratory.

Table 15: Advantages of a Language Laboratory (Hayes, 1964, pp. 16-17)

Advantages for Students	Advantages for Teachers
1) Provided authentic, consistent, untiring models of speech for imitation and drill.	1) Was free to focus his attention on the individual student's performance.
2) Provided for differences in learning rates	2) Could even improve their own proficiency.
3) Provided technical facilities for self-instruction.	
4) Provided recordings with many native voices, without relying the voice of one teacher.	
5) Facilitated testing of each student for listening comprehension.	
6) Facilitated testing of speaking ability of each student in a class.	
7) Made it possible to divide a class into teacher-directed and machine-directed groups	
8) Could enhance the student's potential for evaluating his own performance.	
9) With the use of the headphones, it provided a sense of isolation, clarity of sound, and facilitated complete concentration; all students could practise aloud simultaneously.	

Armstrong and Yetter-Vassot (1994) indicated that campuses across the United States were busy installing language laboratories in the sixties and early seventies. Many educators and researchers were extremely thrilled about the advent of the language laboratory. Many felt that students would finally reach higher levels of proficiency in the foreign language, in a shorter amount of time, through the use of technology. Salaberry (2001) said that the purported advantages of language laboratories continued to be upheld throughout 1960s

and 1970s. For instance, Angelis (1973) stated that laboratories 'can be used to advantage in learning to hear what are usually difficult sounds or sound sequences' (p. 104). Along the same lines, Church (1986) argued that 'language laboratories, if well used, can drill the students on the oral aspects and provide stimuli or cues for some written work'. (p. 251).

Holmes (1980), however, pointed out that many L2 teachers were disenchanted with the use of language laboratories and summarised a number of factors that contributed to such negative attitudes: poorly produced commercial tapes, insufficient effort to make structural drills meaningful, selection of materials without learner appeal, lack of programs for advanced students, and little faculty involvement. It was not surprising that the demise of the language laboratory appeared to have accompanied the emergence of technology-assisted learning: computer-assisted instruction. Gray (1996) said that the technological constraints of earlier generations of language laboratory technology meant that there was only a one-way communication, from the teacher to the students. Schwartz (1995) indicated the problem, in retrospect, was obvious. 'Materials were developed, published, and distributed without research into how best to use the technology' (p. 528).

According to Gray (1996), many instructors and students 'now consider the language laboratory to be merely a leftover relic of the earlier and now discredited audiolingual method' (149). He suggested that if the language laboratory is to continue to have any place in the language agenda, it must be shown that it can be purposefully and usefully integrated into communicative, multiskills approaches to teaching and learning.

Gray (1996) also said that the latest generation of language laboratory technology eliminated many of these constraints that were found before. More advanced language laboratory technology, such as the random-access cassette

player and direct-access audio disk, and finally the writable compact disks, were made available. Minidisks enable tracks to be recorded or deleted. Access to any track is immediate. A digital disk will no doubt provide an ease of use which enhances the interactivity of communicative activities in the language laboratories. Language laboratory facilities can now be incorporated with such equipment as VCRs, computers, satellite television, and camcorders.

Armstrong and Yetter-Vassot (1994) pointed out that 'it is how we use these tools that will ultimately affect our students' (p. 476). Rivers (1981) suggested that the design of the laboratory should evolve from an analysis of pedagogical needs and students' study patterns. Quality of equipment, preparation of students psychologically, instructions given to students, how much time spent in laboratory and preparation of materials are the key factors that have to be considered when designing and preparing for the use of a language laboratory.

First, audio quality of the equipment must be considered. Second, it is important to prepare students from the beginning that they must not be led to believe that the laboratory is a short and effortless road to language mastery, but must see it as one part of an integrated learning process. Third, the students must then be given explicit instructions for the operation of the equipment from their booth positions, and practise in performing different kinds of exercises. Fourth, an important question to consider is the length of time students can be expected to concentrate on practice in a laboratory situation. Twenty minutes of such concentrated attention without a break is ample at college level. Classes are scheduled in the laboratory for twenty-minute periods as part of the lesson several times a week, to ensure regular practice. Finally, for the full value of any set of tapes to be realised, the teacher must be very familiar with the contents, which requires careful lesson preparation. In

designing lessons, the teacher should strive for a balance of activities, with variety to avoid monotony.

Quality of equipment, preparation of students psychologically, instructions given to students, time spent in the laboratory and preparation of materials are not only the key factors with a language laboratory, but they also apply to CD-ROM learning as well.

In this subsection, Hayes (1964) discussed the advantages of the language laboratories for both the students and the teacher. Angelis (1973) and Church (1986) both agreed that the language laboratories could be used to drill students on the oral aspects. Holmes (1980) said that L2 teachers were disappointed with the language laboratories because of poorly produced commercial tapes, insufficient effort to make drills meaningful, selection of materials without learner appeal, lack of programs for advanced students, and little faculty involvement. Schwartz (1995) pointed out that materials were developed, published, and distributed without knowing how best to use the technology. Gray (1996) mentioned many advances in language laboratories. Rivers (1981) gave a few suggestions about the design and usage of the language laboratory. The researcher of this study feels that problems pointed to by Holmes (1980) and suggestions given by Rivers (1981) about the design and usage of the language laboratory can affect the CD-ROM usage in Macao if one were to learn from history.

4.16 Computers

Salaberry (2001) indicated that the early uses of computers in L2 learning constituted a natural extension of the work done in the audiovisual language laboratories. Meredith (1983) said that the computer is especially well suited for some of the most repetitive language teaching tasks: grammar drills, teaching

reading and practising vocabulary, and certain aspects of teaching writing skills all can be done quite effectively with the microcomputer. Furthermore, when used in combination with other equipment such as the videodisc or the videotape players, the computer holds exciting potential for use in teaching and practising speaking and listening skills. The advantages and disadvantages of computer usage are summarised in Table 16.

Table 16: Advantages and Disadvantages of using a Computer in Language Learning (Ahmad, Corbett, Rogers and Susex, 1989, pp. 4-8)

	Advantages	Disadvantages
Using a computer in language learning	1. Interactive learning 2. Flexible 3. Handle different kinds of material: text, graphics, audio, video 4. Handle different exercises: question-and-answer, simulated dialogues, hypothesis testing 5. Choose questions in sequence or random 6. Branch to different parts of the package 7. Record results and errors 8. Easily modify exercise 9. A powerful motivational force	1. Quality of CALL needs to be evaluated 2. Not a complete substitute for a teacher

In Table 16, Ahmad, Corbett, Rogers and Susex (1989) pointed out many advantages of using a computer in language learning. First, the computer offers interactive learning. It can assess the student's response and it can also display messages, doing it very quickly, with practically instantaneous response. It can repeat an activity without any errors and handle large volume of interaction. Second, the computer is flexible in a number of ways. When the students cannot attend a class because of illness, timetable clashes, and other problems,

the computer is available for the students. The student can come at any time, and spend as long as is needed to gain full benefit from the material. Third, the computer can handle different kinds of material, in the form of text, graphics, audio and video. Fourth, it can also handle question-and-answer routines, simulated dialogues, hypothesis testing, and many other types of exercises. Fifth, it can choose questions in sequence or at random from the list of questions. Sixth, it can branch to different parts of the package, depending on many different factors. Seventh, when the student has completed the session, the computer can record results, errors, success rates, the time spent, and much more information. Eighth, the computer exercise can be easily modified. Finally, the computer can be a powerful motivating force for productive study. Ahmad et al. (1989) observed that there is evidence to suggest that drop-out rates are lower with classes using computer assisted language learning (CALL) software; that achievement rates are at least as good as those of the control group not using CALL; that attention spans are longer; and that the material is usually better learned, and learned more quickly.

In Table 16, Ahmad, Corbett, Rogers and Susex (1989) also pointed out several disadvantages of using a computer in language learning. First, the quality of a lot of CALL material still leaves much to be desired. Like any other educational materials, CALL programs need to be evaluated. Second, while the computer is able to accommodate a substantial range of learning styles, it is certainly not a complete substitute for a teacher. What computers can do is to present text and to provide graphics, video and audio to the student. The computer cannot effectively conduct an open-ended dialogue with the student. It has neither the vocabulary, nor the ability, to understand the enormous range of utterances possible in human language. It cannot handle ambiguity with any confidence.

Blake (1998) referred to three important paradigmatic shifts of computer-centred technology for language learning in the last thirty years. These shifts took place in the area of hardware, in the role of the learner, and in the interface. In the area of hardware, the best-known mainframe project was PLATO, which began by offering drill and practice exercises in Russian; later, in the 1970s, it added lessons for other languages. Stanford University had a similar program for Russian. In the early 1980s, low costs and the increased mobility offered by microcomputers finally put an end to the use of mainframes as a delivery tool for language software.

In terms of the role of learners, Blake (1998) also pointed out that throughout 1960s, 1970s, and early 1980s computer-assisted instructions (CAI) were developed with the focus more on the program than on the learner. Driven by the teacher, CAI programs typically guided learners through a series of tutorials with exercises with linear design. In the 1980s, a greater emphasis on the role of the language learner caused software developers to cede some control to the learner. As a consequence, linear programming architecture ceased to dominate courseware design. This change, signalled by a new generation of software program now bearing the acronym CALL (computer assisted language learning), reflected a more learner-driven and communicative approach.

Blake (1998) also pointed out that the third shift, which is still under way, involves the overall flexibility of the user interface. Most mainframe and CAI software has had a tendency to be textually oriented. The current trend is to produce software with a multimedia interface that combines text, digitised sound, digitised video, and graphics in nonlinear ways.

4.17 Microcomputers and CAI in the 1980s

Thrush and Thrush (1984) pointed out that microcomputers use five types of educational programs. The first type, drill and practice, is the most simple and usually consists of rote drill. The second type is tutorial when the students can be drilled on a particular area. Simulation is the third type. It recreates a situation such as a physical event, lab experiment or natural process. The fourth type is computer games. These are extremely popular and can also be used for educational programming. Use of computers as problem solvers is the fifth type of educational program.

Thrush and Thrush (1984) said that microcomputers and related hardware will be updated constantly and memory capacity and mass storage will be increased dramatically. Although hardware improves rapidly, software will advance more slowly. Three lessons from the past are important, according to Thrush et al. (1984). First, exercise caution when attempting to link education with technology. Second, recognise the importance of software. Third, understand the full educational value of computers.

According to Ahmad, Corbett, Rogers and Susex (1989), CAI (Computer Assisted Instruction) is a term used widely in North America, and whereas Computer-Assisted Learning (CAL), is the usual term in Britain. CAI involves the use of computers to present instruction to students and it has been available since the early 1960s. The interaction between the computer and students is designed to help students learn new materials or improve their knowledge of materials previously studied.

Salaberry (2001) said that the early CAI programs were mostly delivered through central computer systems such as the PLATO System. There were some negative feedback about early CALL. Out of the 602 responses from 1810

foreign language departments in the U.S., Olsen (1980) found limited enthusiasm for CAI because of cost, negative attitudes, lack of experienced personnel, unsuccessful teaching programs elsewhere, lack of ready-made computer programs, and lack of facilities to handle alternative font (mainly for Russian or Chinese). Dunkel (1987) presented arguments similar to Olsen's (1980) to explain the limited use of CAI in L2 classroom: 1) start-up costs of computer hardware; 2) dearth of quality courseware; 3) wide-spread scepticisms about the teaching effectiveness of CAI. Dunkel claimed that many teachers expected that computers will be just another in a series of highly touted technological tools that have neither revolutionised learning nor lived up to initial promise. The teachers pointed out that the radio promised to revolutionise education in the 1920s, as did television in the 1950s. In the 1960s language laboratories were hailed as technological breakthroughs for education; however, students have not been seen to have wondrous learning gains.

However, Decker (1976) argued that CAI most significantly provides 'instant feedback correcting drill exercises and tests, and immediate explanations of errors' (p. 263). Keller (1987) highlighted the speed of the electronic dictionaries because they were 'noticeably faster than paging manually through a conventional one' (p. 12). He said that the three attractions of this basic machine dictionary are: 1) speed; 2) completeness of the dictionary entry; and 3) size of the dictionary, in terms of the number of entries in it. Lindenau (1984) maintained that computer-enhanced technology could provide specialised learning environments: 1) electronic dictionaries for foreign language student; 2) business and professional speaking modules for occupations requiring foreign language skills; 3) architecture and art modules for teaching of culture; 4) arrays of simulations such as trips to a foreign country; 5) electronic data banks.

Meredith (1983) pointed out that when CAI in foreign language instruction

has been compared to classroom teaching, the computer often failed to show superiority; when CAI has been matched against textbooks, one could question in many cases whether any differences shown were attributable to the inherent quality of the materials written. So students working with a high quality workbook will almost always outperform those working with a poor quality, computerised practice program. Najjar (1996) also claimed that multimedia instructions are better-organised instructional material.

Lindenau (1984) argued that 'we are all in the midst of a microelectonic revolution', and pointed out that ignoring such revolutions might carry negative effects: 'A blackboard and textbook system of education in the age of microelectronics will inevitably promote detrimental and far-reaching consequences' (p. 119). Armstrong and Yetter-Vassot (1994) suggested that researchers and teachers should 'take advantage of the powerful and fascinating tools the new technology that are available to improve foreign language teaching in the twenty-first century' (p.481). Technology cannot transform teaching by itself. Computers and language laboratories are of no value unless someone actually plugs them in and plugs into them. It is how these tools are being used that will eventually affect how students learn. It is about empowering the learner (Armstrong and Yetter-Vassot, 1994, p.483).

In this subsection, microcomputers and CAI in the 1980s were discussed. Ahmad, Corbett, Rogers and Sussex (1989) talked about the advantages and disadvantages of using a computer in language learning. Blake (1998) referred to three important paradigmatic shifts of computer-centred technology for language learning and they are in the area of hardware, in the role of the learner, and in the interface. Thrush and Thrush (1984) warned of three lessons one should learn from the past about microcomputers. There were both positive and negative comments about early CALL.

4.18 Summary of Technology Relating to Language Learning

Materials and media, radio, television, telephone, language laboratory and computers were discussed in this section to give the reader a sense of the technology used in language learning. In general, radio technology improved students' attitudes, confidence and enthusiasm. Television might not be good in problem solving and viewing mode, whether for educational or entertaining purpose and affect student learning, particularly with high level processing. The use of video improved knowledge of cultural information in language learning. Telephone technology gave students another alternative for motivating conversation and provided language gain in the areas of listening comprehension, vocabulary and fluency.

In terms of the language laboratory, teachers both agreed that the language laboratories could be used to drill students on the oral aspects. However, some teachers were disappointed with the language laboratories because of poorly produced commercial tapes, insufficient effort to make drills meaningful, selection of materials without learner appeal, lack of programs for advanced students, and little faculty involvement. Finally, Rivers (1981) gave a few suggestions about the design and usage of the language laboratory, which included the quality of the equipment, psychological preparation of students, instructions given to students, time spent in laboratory and preparation of materials, which can also be used in the CD-ROM usage in this study.

In terms of computers or microcomputers, it is especially well suited for some of the most repetitive language teaching tasks: grammar drills, teaching reading and practicing vocabulary, and certain aspects of teaching writing skills all can be done quite effectively with the microcomputer. Furthermore, when used in combination with other equipment such as the videodisc or the videotape players, the computer holds exciting potential for use in teaching and practising

speaking and listening skills. Early CAI had its problems: cost, negative attitudes, lack of experienced personnel, unsuccessfully teaching programs elsewhere, lack of ready-made computer programs, and lack of facilities to handle alternative font (mainly for Russian or Chinese).

4.19 Conclusion of Technology Relating to Language Learning

The researcher of this study feels that though many problems still exist today in regard to CALL, one shall not be totally discouraged to continue to use technology to enhance learning. The only problem that has probably been resolved is the ability to display Chinese characters on the screen. Beyond that, cost, negative attitudes, lack of experienced personnel and the quality of CALL still pose problems to teachers and researchers. With the development of the CD-ROM in the present study, the researcher hopes to improve at least two shortcomings: to produce better quality CALL and to change any negative attitudes that students may have in learning Mandarin with the CD-ROM.

Although technology is not to be expected to provide a panacea for all the concerns of foreign language learning, as pointed out by Blake (1998), the researcher takes the viewpoint of Armstrong and Yetter-Vassot (1994) such that the use of technology is about empowering the student to learn. The scope of this research is to develop Mandarin CD-ROMs so that students can choose to learn as little or as much as they want. The researcher feels that language laboratory problems pointed to by Holmes (1980) and CAI problems pointed to by Olsen (1980) and Dunkel (1987) and suggestions given by Wipf (1984) about selection of materials, practice and appropriate reference materials in radio broadcast and Rivers (1981) about the design and usage of the language laboratory can also be applied to the CD-ROM usage in this study.

4.2 Computer Assisted Language Learning (CALL)

van der Linden (1993) said that computer-assisted language learning (CALL) is becoming more complex. On one hand, courseware designers develop courseware of a more open-end character with hypermedia technology. On the other hand, courseware in the traditional drill and practice is more and more elaborate and offers extensive feedback. In this section, the background/phases of CALL are discussed. Then the technology relating to the third phase of CALL—Integrative CALL is discussed with the Internet and the multimedia technology. Finally, case studies of multimedia/CD technology and foreign language learning are analysed.

4.21 Background of CALL

Ahmad, Corbett, Rogers and Susex (1989) indicated that computer assisted language learning (CALL) arose from the combination of two separate factors: educational needs and technological means. The aim of developing CALL is not to provide language learners with novelty, but is to improve the quality of language teaching. The late 1960s and early 1970s are of particular historical importance for CALL. The rapid computer technology development and the linguists' willingness of using the computers had paved the way for the introduction of computers in language teaching and learning. Development of CALL can be traced back to the 1960s: the PLATO project, a large system developed at the University of Illinois, and the computer-based foreign-language-teaching project at Stanford University. Both systems were developed on the mainframe computers.

Ahmad, Corbett, Rogers and Susex (1989) said that developments in computer technology meant that some of the mainframe capabilities became available on microcomputer. The relative cheapness of the microcomputer meant that computer facilities were much more available in the late 1970s.

While interesting work was being done on microcomputers, there was nevertheless a profusion of trivial and boring packages. Partly to blame was the limitations of microcomputers in terms of the available programming languages and other programming aids, as well as the hardware, particularly the limited storage capacity then. In addition, many designers were unaware of previous work done in CALL, which meant that mistakes made on mainframes were being repeated, and accumulated wisdom was being ignored. It was, perhaps, not surprising that the microcomputer boom had yet done little to advance the standards of CALL in the 1980s, according to Ahmad, Corbett, Rogers and Susex (1989, p. 36).

Taking the advice from Ahmad et al. (1989), the researcher of this study plans to take a look of some of the obstacles to the implementation of CALL and benefits of CALL, to try to learn more about CALL for the development of the Mandarin CALL in this study. Kidd (1997) pointed out that there are many obstacles to the implementation of CALL in the curriculum, as summarised in Table 17.

Table 17: Obstacles to Implementation of CALL (Kidd, 1997, pp. 187-194)

Obstacles to Implementation of CALL
1. Attitudes of all those concerned in the educational process
2. Effectiveness of CALL
3. Lack of equipment in the schools
4. Lack of software
5. Poor quality of many of the programs
6. Difficult to integrate into the curriculum

In Table 17, Kidd said that one of the first obstacles is the attitudes of all those concerned in the educational process and the general attitude towards computer assisted language learning is often one of scepticism. Many instructors still refuse to regard a computer as a possible helpmate in the instructional process. Their resistance is perhaps the greatest obstacle facing the

implementation of CALL. One common attitude is that of fear. Some fear that the teacher's role will be weakened and others fear that working with computers will give a new independence and freedom to the learner, which threatens the authority of the teacher. The attitude of the administrators is also important. If administrators do not support the introduction of CALL, teachers may not be properly trained to use CALL in their classes. The second obstacle is the effectiveness of CALL. Numerous tests have been run (ibid, p. 190). Obviously these results are inconclusive and sometimes have been felt to be too dependent on particular variables such as program design, mode of implementation, role in the curriculum, and teacher support. Some feel it is useless to test the medium by testing individual applications. Perhaps the question that should be asked is what can CALL do that traditional teaching cannot do.

Kidd also noted that one of the greatest deterrents to the implementation of CALL was the lack of equipment in schools (ibid, p. 191). Some teachers feel they should wait to become involved until their school can afford the latest models of computers with all the latest features. Another obstacle could be the lack of software and the feeling that what was available was not adaptable enough. Other obstacles have been the poor quality of many of the programs. Furthermore, many of the programs were difficult to integrate in a meaningful way into the curriculum. These criticisms do reflect certain realities about the state of computer software past and present. However, there are still other useful general programs such as spell checkers, dictionaries, general reference, and cultural programs that everyone can use. There are also all the resources available on the Internet.

Kidd (1997) said that most language teachers are continually frustrated by the lack of time to cover many of the important aspects of learning a language as

well as providing ample opportunities for practice to students. CALL offers a means of enhancing learning not by eliminating the instructor but by helping him to teach more and do more effectively. Kidd (1997) highlighted several benefits of implementing CALL in Table 18.

Table 18: Benefits of Implementing CALL (Kidd, 1997, pp. 194-195)

Benefits
1) Provides exercise
2) Marking of composition with spell checker and/or grammar program
3) Vocabulary acquisition
4) Guided reading
5) Listening Comprehension
6) Dictation

In Table 18, CALL can provide exercises that help embed various grammatical structures. Another area which requires a great deal of teacher time is the marking of compositions. The computer can assist in this matter if the students use the spell checker and/or grammar program. Vocabulary acquisition and guided reading are necessary aspects of language learning and require a lot of reinforcement. Listening comprehension and dictation are two more activities that can be assumed by the computer.

Kidd (1997) said that it should be obvious that what can be relegated to the computer are some of the basic classroom practice activities that are best done on an individual basis. The teacher's role is not diminished but in fact becomes more vital. The teacher can devote his or her energy to what humans do better. No machine can rival the human instructor in the areas of spontaneous interaction or subtlety of comprehension. With the help of the computer, the teacher is able to provide an enhanced learning experience and the student's

chances for achieving proficiency are improved.

This subsection described some background of CALL. According to Kidd (1997), the obstacles to the implementation of CALL included attitudes of people, effectiveness of CALL, lack of equipment in the schools, lack of software and poor quality of many of the programs. Kidd (1997) also discussed benefits of implementation of CALL which included that CALL can provide exercises for the students. It can help teachers with marking of composition, students with vocabulary acquisition, guided reading, listening comprehension, and dictation. Phases of CALL is discussed next to have a better understanding of what CALL can do today, to help the researcher with the development of the CD-ROMs in this study.

4.22 Phases of CALL

According to Warschauer (1996), there are three phases of CALL, which he refers to as behaviouristic CALL, communicative CALL, and integrative CALL. He indicated that 'the introduction of a new phase does not necessarily entail rejecting the programs and methods of a previous phase; rather, the old is subsumed within the new.' (p. 2)

The first phase of CALL, conceived in the 1950s and implemented in the 1960s and 1970s, was based on the behaviourist theories of learning. Programs of this phase entailed repetitive language drills. Warschauer (1996, p. 4) commented CALL drills are still used today because it can be rationalised as follows:

- Repeated exposure to the same material is beneficial or even essential to learning
- A computer is ideal for carrying out repeated drills, since the machine does not get bored with presenting the same material and since it can provide immediate non-judgmental feedback.

- A computer can present such material on an individualised basis, allowing students to proceed at their own pace and freeing up class for other activities.

Based on these notions, one of the most sophisticated of these tutoring systems developed on the mainframe was the PLATO System. In the late 1970s and early 1980s, behaviourist CALL was undermined by rejection of the behaviourist approaches to language teaching and the introduction of microcomputers.

The second phase of CALL was based on the communicative approach to teaching which was prominent in the 1970s and 1980s. Warschauer (1996) said that proponents of this approach felt that the drill and practice programs of the previous decade did not provide enough valuable authentic communication. These CALL models not only included computers as tutors, but also computers as a stimulus, and computers as tools. Computers as tutors included programs that taught grammar, listening, pronunciation, reading, text reconstruction, vocabulary, writing, and comprehensive skills. Computers as tools included programs such as the word processor, grammar checkers, collaborative writing, reference, Internet and authoring tools. In other words, Warschauer (1996) said the dividing line between behaviouristic and communicative CALL involves not only which software is used, but also how the software is put to use by the teacher and students. On the face value, communicative CALL seems like a significant advance over its predecessor. But by the end of the 1980s, many educators felt that CALL was failing to live up to its potential.

Integrative approaches, the third phase of CALL, the present state of CALL, are based on two important technological developments of the last decade-multimedia computer and the Internet. Multimedia technology, exemplified today by the CD-ROM, allows a variety of media: text, graphics,

sound, animation, and video, to be accessed on a single machine. What makes multimedia even more powerful is that it also entails hypermedia. That means that the multimedia resources are all linked together and that language learners can navigate their own path simply by pointing and clicking a mouse. For the first time, language learners can communicate directly, inexpensively, and conveniently with other learners or speakers of the target language twenty-four hours a day, from school, work, or home, through the Internet. With the World Wide Web (WWW), students can search through millions of files around the world within minutes to locate and access authentic materials tailored to their own personal interests.

Warschauer (1996) claimed that the history of CALL suggests that the computer can serve a variety of uses of language teaching. It can be a tutor, which offers language drills or skills of practice; a stimulus for discussion and interaction, or a tool for writing and research. With the Internet, it can also be a medium of global communication and a source of limitless authentic materials.

Garrett (1991) pointed out that the use of the computer does not constitute a method. Rather, it is a 'medium in which a variety of methods, approaches, and pedagogical philosophies may be implemented' (p. 75). Warschauer (1996) indicated that the effectiveness of CALL cannot reside in the medium itself but only in how it is put to use. The third phase of CALL, which is based on two important technological developments: Internet and multimedia are discussed next.

4.23 Technology Relating to Integrative CALL

Internet, multimedia, hypermedia, and speech recognition software are important elements in the integrative formula. First, in terms of the Internet, Tillyer (1996) pointed out that the electronic mail (email) and electronic communications in general are not new. The U.S. military had already created an electronic network (ARPANET) to handle the computer-to-computer transfer of large amount of data back in the late 1960s and 1970s. One of the most exciting trends is that the Internet itself offers more astonishing opportunities for learning, pleasure, and communication, while the access and exploitation of it are getting easier and easier. Moreover, since electronic communications are global and the Internet has no borders, this technology will have a special impact on language education. Below are cases of how some teachers took advantage of the Internet.

Gölz (1997) used emails and "hot words" which link users to another page in web course development. Since the quality of sound transmission on the Web depends on many factors, he also offered a CD-ROM with sound files in .au format, which can guarantee that all learners have the same version of certain programs and also have the opportunity to access some course materials without necessarily being connected to the Web.

Suzuki, Keaten-Reed et al. (1997) evaluated the use of Internet functions for language learning and found that more students used e-mail and WWW. From the analysis of students' observation, email was good for writing, mailing-list was good for discussion, WWW was good for reading and listening, and newsgroup was good for debating.

Cabot (2000) found that effective use of the Web can improve language skills in the following areas: an increase of vocabulary, more use of references,

more student-initiated interactions and greater interactivity in the classroom among students observed. The data confirmed that Web based courses can increase the motivation of students, improve the scope of their reading, and enhance their perception of the target culture, all with a great effect on range of language explored, learned and re-processed, but a much lesser effect on the accuracy of written language produced.

Multimedia is discussed next. Yang (1998) said that the term "multimedia" refers primarily to computer applications that include not only text but also other media in digital format. Digital multimedia, differs from the traditional multi-media in the precise control users have over digital media, with interactive and user-friendly features, gives language professionals powerful teaching tools. Users may control, combine, and manipulate different types of media, such as text, sound, video, graphics, and animations stored on CD-ROMs or DVDs.

Merlet (2000) stated that foreign language learning is a major area of application for multimedia technologies and knows that a popular assumption that multimedia learning will allow more authentic communication to take place, which in turn will promote students' self-evaluation and regulation for their learning processes. This is supposedly a major step towards individualised, autonomous learning programs. Yang (1998) indicated that the computer-student relationship in a multimedia application can provide a one-to-one relationship, with much less cost. In addition, the teacher is invisible in a computer-student relationship, giving language learners the impression that they are independent and in complete control of their learning.

According to Yang (1998), since multimedia applications include multiple components, language educators could incorporate their own teaching strategies in their language learning applications. For instance, they can tailor a reading comprehension application for learners at different levels in order to guide them

to apply reading strategies appropriate to their degree of proficiency in the language. Developers can easily extend the learning environment by converting language learning exercises into games or linking them to other authentic language materials.

Yang (1998) indicated that multimedia activities can accommodate individual levels of language learning. For the elementary level, preferred activities will help students learn pronunciation, basic vocabulary, grammar, and simple sentence structure. Other learning activities should include phonetic training using speech recognition technology, vocabulary building by means of picture based exercises, listening comprehension development at the word and sentence level based on video and sound clips, and grammar training in the form of multiple-choice and fill-in-the-blank exercises. Multimedia activities for the intermediate level can help language learners expand their vocabulary and develop listening, reading, and writing skills at the level of the entire text by viewing longer video clips, listening to long audio clips, reading annotated texts, and writing essays with the help of writing tools. Multimedia based activities that can help students develop speaking skills at this level are still waiting for substantial enhancement from the use of speech recognition technology. Advanced-level students can use multimedia program to further develop their language skills by completing more complex multimedia projects, such as Web page projects.

Hypermedia is discussed next. According to Warschauer (1996), what makes multimedia even more powerful is that it also entails hypermedia. That means that multimedia resources are all linked together and that language learners can navigate their own path simply by pointing and clicking a mouse. Hypertext and hyperlinking makes hypermedia possible. Leffa (1992) said that hypertext is basically a programming technique that allows for any text to be

linked to any other text and the most frequent hypertext application consists of moving the cursor to a word on the screen, pressing a key and getting the available information. Herron and Moos (1993) also said that hypertext designates a more designed reading environment capable of responding to user input interactively. Hypermedia just simply expands the notion of hypertext to include graphics, sound, animation, video, and other forms of data with which texts can be combined to form classroom programs.

van de Bosch and Bolluyt (2001) stated that hyperlinking can offer a useful contribution to the process of academic writing. Hyperlinks are electronic references, which link one piece of text to another. The value attributed to hypertext is based on the acceptance of constructivist principles to teaching and learning. Students acquire knowledge when they become involved in an active construction process. The ease of hyperlinking will stimulate students to make explicit links between pieces of information. Hyperlinking supports and encourages browsing, exploration and learning behaviours that are frequently associated with higher-order learning.

Warschauer (1996) said that hypermedia provides a number of advantages for language learning. First of all, a more authentic learning environment is created, since listening is combined with seeing, just as in the real world. Secondly, skills are easily integrated, since the variety of media makes it natural to combine reading, writing, speaking, and listening in a single activity. Third, students have great control over their learning, since they can go not only at their own pace but even on their own individual path, going forward and backward to different parts of the program, and skipping other aspects altogether. Finally, a major advantage of hypermedia is that it facilitates a principal focus on the content, without sacrificing a secondary focus on language form or learning strategies. For example, while the main lessons is in the foreground, students

can have access to a variety of a background links which will allow them rapid access to grammatical explanations or exercises, vocabulary glosses, or pronunciation information.

Chun (2001) said that in a hypermedia environment like the Web, it is possible to gloss individual vocabulary items by linking them to their definitions or translations. Tillyer (1996) pointed out that hypertext is essential to the success of the World Wide Web area of the Internet. However, hypertext is not exclusive to the Internet: text-based CD-ROMs also have hypertext.

Finally, speech recognition software is discussed. Yang (1998) stated that speech holds great promise as a language learning technology. Speech recognition software cannot only help elementary-level language learners improve their pronunciation but also provides a faster computer input system for non-roman based language like Chinese. The inclusion of speech recognition in multimedia applications allows language learners to enjoy a more realistic environment for oral communication and interaction. Further development of speech recognition technology will eventually enhance the intelligent processing of oral interactions in multimedia applications.

Bernstein, Najmi and Ehsani (1999) said that the key to the success of the future multimedia CALL will be the ability to understand and judge continuous spoken language with programmable levels of acceptance. Many multimedia computer programs that are available that promote spoken foreign language acquisition are mostly English speaking programs. The recent commercial CALL products based on speaker-dependent recognition have typically been trained on a small sample of native speakers. Such products have no internal representation of the difference between, for example, a faulty microphone and a faulty pronunciation. The difference between native and nonnative speech is a primary obstacle in the employment of speech recognition technology for CALL.

In this subsection, integrative CALL technologies were discussed. Technologies such as Internet and multimedia play a very important role in the integrative CALL, according to Warschauer (1996). Hypermedia and speech technologies made Internet and multimedia more powerful. According to Warschauer (1996), what makes multimedia more powerful is hypermedia and hypertext and hyperlinking makes hypermedia possible. Yang (1998) stated that speech holds great promise as a language learning technology and Bernstein, Najmi and Ehsani (1999) said that the key to the success of the future multimedia CALL will be the ability to understand and judge continuous spoken language with programmable levels of acceptance.

From the discussion of the Internet, the Web may sound like a perfect environment to development a Mandarin CALL; however, the researcher would like to remind the reader that her school has asked her to coordinate this project with the CD-ROM chosen as the medium of instruction. Besides it is probably a good idea to develop the Mandarin CALL on the CD-ROM as well. Gölz (1997) commented that since the quality of sound transmission on the Web depends on many factors, offering a course with a CD-ROM with sound files and supplying the software on the CD-ROM to guarantee that all learners have the same version of certain programs and also have the opportunity to access some course materials without necessarily being connected to the Web is important. Therefore, the project described in this paper is about multimedia courseware development on the CD-ROM. Cases of multimedia/CD-ROM and foreign language learning are discussed next.

4.24 Multimedia/CD-ROM and Foreign Language Learning

Pawling (1999) pointed out that CD-ROM is potentially a liberating instrument for teachers and learners alike in that it has the special facility of incorporating practice in all four language skills in a multimedia packing using video, text, photograph and sound. Wiget (1988) indicated that it is an era heralded by the introduction of the CD-ROM technology. The CD-ROM technology places at the fingertips of the individual up-to-date information on almost any topic. The key to successful utilisation of this new technology will rest in the teachers' ability to turn the information it houses into useful knowledge for the learner. CD-ROM places before the individual a variety of resources never before assembled in one place in a compact format and in a manner easily accessible. It is enabling and empowering technology to those that have access to it. It allows the individual to turn information into knowledge. Below are cases that describe how multimedia can help with the four language skills: listening, speaking, reading, and writing. Language skills and technology used are summarised in Table 19 (see p. 169) and factors that contributed to the success of multimedia instruction as suggested by Najjar (1996) and Bagui (1998) that are related to these cases described in this section are also summarised in Table 20 (see p. 171). These factors are reduced instruction time, interactivity, self-paced learning, self-directed learning, flexibility, motivational effects, information chunking, having rich content, dual coding, better-organised instructional materials and novelty as shown in Figure 8 (p. 40) and they will be put into [ ] with the page number of the specific article in this section for referral. A cross-reference between successful factors and instructional features of multimedia for Mandarin learning is listed in Table 21 (see p. 176).

4.241 Listening Comprehension

Brett (1997) said that listening is a key language skill, that it has a vital role in the language acquisition process. Computer software applications to further language learning are becoming commonplace and with advances in technology are now able to include multimedia that delivers video and audio in combination with text. In this subsection, Brett (1997) investigated listening performance in a computer-based multimedia environment, Klassen and Milton (1999) evaluated the effectiveness of a multimedia-based learning program, and Merlet (2000) tested the effects of preliminary aids on the oral comprehension of an illustrated dialogue by learners of English as a foreign language.

In Brett's (1997) study, he compared learners' success rates on comprehension and language recall tasks while using the three different media of audio, video and multimedia. Learners were allowed to explore the CD-ROM [self-paced, self-directed, p. 44] and were let loose [self-directed, p. 44] on its full range of features [rich content, p.44]. There were three areas that were found which explained the efficiency of the multimedia. They were multimedia and efficiency of focus, feedback and its impact on comprehension, and comprehension, language recall and language acquisition. While completing the on-line comprehension tasks, only slight eye adjustments between video image and true/false statements were needed. Using a mouse click to respond was a briefer action [interactivity, p. 48] than writing paper and may free up attention capacity that can then be used for listening. A further reason for the greater success rate on the multimedia comprehension tasks may be the feedback. Learners received instant ticks or crosses for their responses to all the parts of the tasks [interactivity, p. 49]. Higher levels of comprehension and language recall were achieved while listening in this multimedia environment.

Klassen and Milton (1999) evaluated the effectiveness of a multimedia-based English language learning program. The students needed to assume responsibility for completing the units and that they were free to navigate the CD-ROM in their own way or could choose to follow a semi-guided path as outlined within the program units [self-directed, p. 290]. The students who completed the syllabus in a multimedia-enhanced mode demonstrated slight improvement in writing skills, but significant improvement in listening skills. The results also demonstrated positive attitudinal changes for the multimedia-enhanced mode of learning [motivational effect, p. 281].

Klassen and Milton also addressed three teaching-learning experiences from the student and facilitator perspective: teacher as the facilitator, time management, and feedback. As far as teacher as the facilitator was concerned, students realised that if interaction was to take place between the student and the facilitator, then it needed to be initiated by the students themselves [self-directed, p. 290]. As far as time management was concerned, students were exhibiting control over their learning agenda, choosing when and how often to break [self-paced, p. 291]. As students adjusted to the freedom of choosing their own learning path [self-directed, p. 291], they also realised that their choices need not influence their peers' learning agenda, thus taking ownership of their own learning [self-directed, p. 291]. As far as feedback went, the major of comments and feedback received were positive towards this mode of learning, and they are (p. 294):

> 'It raises our interest [novelty, motivational effects, p. 294] in learning since usually lectures and tutorials are quite boring'.
> 'It helps the nervous students avoid embarrassment when they make errors during exercises.'

'We can check the results from exercises quickly with the immediate feedback.'[interactivity, p. 294]
'If a student is absent from the classroom usually he misses out, but not here.'

Merlet (2000) tested the effects of preliminary aids on the oral comprehension of an illustrated dialogue by intermediate-level English learners. The students were asked to listen once to the dialogue and they then received the type of preview assigned to them. The lexical preview showed a screen presenting unfamiliar vocabulary and phrases and the semantic preview consisted 15 pictures accompanying the dialogue. They then listened to the dialogue a second time and had the chance to perform a number of control actions: pause, replay some dialogue cues on the current page [self-paced, p. 152] by selecting an active zone on the screen, and go back to previous dialogue pages [interactivity, p. 152]. The lexical preview seemed to play a facilitative role. The two types of previews led to a significant increase in the amount of correct information recalled. However, the effect of the semantic preview was stronger.

In this subsection, Brett (1997) concluded that higher levels of comprehension and language recall were achieved while listening in his multimedia environment. Klassen and Milton (1999) discovered that the multimedia-enhanced mode demonstrated only slight improvement in writing skills, but significant improvement in listening skills and positive attitudinal changes for the multimedia-enhanced mode of learning. Finally, Merlet (2000) pointed out that both the lexical and semantic previews led to significant increase in the amount of correct information recalled.

4.242 Speaking Ability

Johnston and Milne (1995) indicated that communicative activities are a common goal of most school-based foreign language programs. Orchestrating

sufficient target language listening and speech production opportunities for 25 students in a 50-minute class period is difficult. In the absence of a feasible alternative, language teachers tend to dominate the verbal exchange in the classroom. To compensate, teachers routinely bring to the classroom target language movies and audiotapes. Johnston and Milne (1995) said that this is where multimedia can offer more promise. Videotape can be digitised and transferred to videodisc, and the visuals and audio controlled precisely by a computer that has been appropriately programmed. Additionally, the computer technology permits supplementing the video with materials such as an electronic dictionary that can be used by a teacher to scaffold (support) student comprehension and production of the target language.

In this subsection, Johnston and Milne offered a multimedia instructional environment to test the increase of the amount of target language communicative discourse in the classroom. Borrás and Lafayette (1994) tested the effects of multimedia courseware subtitling on the speaking performance of college students. Coniam (1998) explored the potential use of continuous speech recognition technology to test the oral proficiency of learners.

Johnston and Milne (1995) conducted a study that offered a multimedia instructional environment for foreign language learning in French. The multimedia tool took existing videodisc material and using computer software, chunked the video into segments short enough for the comprehension span of the novice language student [information chunking, p.317]. It supplemented the video with on-demand resources including a transcript [dual coding, p. 317], visual dictionary, contextualised grammatical explanations, and suggestions for student exercises that utilise the vocabulary and structures of the lesson [rich content, p. 317]. The support material appeared on-screen at the discretion of the teacher and is readily replayed as needed [flexibility, p. 318]. The teacher

was given total flexibility as to when and how to use the multimedia tool during the 50-minute class periods [flexibility, p. 320]. Although the multimedia tool had no effect on the proportion of time the teacher controlled the discourse (still two-thirds of the time in these classes), year-long research analysing classroom interaction patterns showed increased use of communicative discourse by students in those class periods, 39 percent in French 1 and 55 percent in French 2.

The teacher who was involved in Johnston and Milne's (1995) study gave some comments. The visuals in the video were key to motivating students [motivational effects, p. 327] and giving them authentic models of the behaviour. The segmentation with computer control permitted students to review short segments of conversation [information chunking, p. 327]. The availability of the multimedia tool made it easier for the teacher to select a communicative exercise as the learning task for students. While the point-and-click interface was easy to use by most standards [interactivity, p. 328], it was not without its challenges for a teacher who was trying to manage technology and interact with students at the same time.

Borrás and Lafayette (1994) tested the effects of multimedia courseware subtitling on the speaking performance of college French students. From the researchers' observation, the reactions of subjects were quite positive [motivational effect, p. 67]. The majority of the students preferred the computer laboratory where the experiment took place, which gave them a feeling of independence [self-directed p. 68] and creativity. The results seemed to indicate that subtitles have potential value in helping the learner to not only better comprehend authentic linguistic input but also to produce comprehensible communicative output (Borrás and Lafayette, 1994, p. 69). The statistically significant difference found in favour of the subtitles condition strongly suggests

that when learning from authentic video in a multimedia environment, having the opportunity to see and control subtitles, results in both better comprehension and subsequently better productive use of the foreign language. Self-controlled subtitles may empower learners to adjust the redundancy of the aural and visual channels of video programs [self-directed, p. 71] according to the learning requirements or language mastery, thus extending the potential effectiveness of the subtitles to the early stages of language learning and to either visually- or aurally-oriented learners. Subtitles could also be an effective way to promote reading literacy, which is similar to what Vanderplank (1988) said. However, attitude in Borrás and Lafayette's (1994) study correlated poorly with subjects' oral performance, which confirms what Shih et al. (1996) said about 'what you like is not necessarily good for you' (p. 216).

Coniam (1998) explored the potential use of continuous speech recognition technology and found that the technology in computer based testing has considerable potential, for example, in situations where oral assessment cannot be conducted in face-to-face interviews. The results showed that the implementation of speech recognition technology is still far from being readily usable primarily because the technology is speaker-dependent and has to be trained to recognise each person's voice and that though it has the potential for language assessment but may not yet be a completely viable means of assessment.

In this subsection, Johnston and Milne (1995) claimed that the visuals in the video were key to motivating students and giving them authentic models of the behaviour. Borrás and Lafayette (1994) said that subtitles appeared to have a significant effect upon oral communicative performance. Coniam (1998) concluded that implementation of speech recognition technology is still far from being readily usable because the technology is speaker-dependent.

4.243 Vocabulary Learning

Chanier and Selva (1998) pointed out vocabulary knowledge is a key factor in reading comprehension and written production. Goodfellow (1994) suggested that good first language readers need to know about 3000 words in L2 to be able to transfer their reading competence to the second language. In this subsection, Pawling (1999) evaluated the feasibility and effectiveness of a CD-ROM as a tool for resource-based, student-centred foreign learning while Leffa (1992) demonstrated the use of electronic glossary to Portuguese students.

Pawling's (1999) study involved vocabulary acquisition with a multimedia dictionary. There were three parts to the application; a dictionary section, a browser section which covers the vocabulary areas, and a game section. The photographs enabled the students to infer meaning. The assimilation of the vocabulary was facilitated by the fact that the learners could play the model sentence as many times as required [self-paced, p. 165] at the click of the mouse [interactivity, p. 165], a technically enhancing feature of the CD-ROM. Multimedia allowed for differentiation in that the pairs could work at their own pace [self-paced, p. 165]. The following were statements made by some students. "The voices sound more human than those on tapes and there's a picture to help you understand what the word's about." (Mary) "The picture helps you remember the word [dual coding, p. 165]." (Mark) "You can play it over and over [self-paced, p.165]. If you get it wrong you can listen again. You can hear it as much as you want and then you can record yourself." (Simon) "You can do it at your own pace [self-paced, p. 165] and do it steadily so you get it right." (Sarah) It was concluded that the CD-ROM can promote effective, student-centred vocabulary acquisition, pronunciation and independent learning [self-directed, p. 163] and has a major contribution to the development of language teaching and learning.

Leffa (1992) demonstrated the use of electronic glossary to Portuguese students and found that it was more efficient than the traditional dictionary, allowing the students to understand 38% more of the passage, using 50% less time [reduced instruction time, p. 63]. By enabling the learners to get more meaning in less time, the electronic glossary may also facilitate acquisition of the foreign language. The glossary used in the study capitalised on the great number of cognates that occur between English and Latin languages. Between languages that share few cognates, Leffa (1992) suggested that the glossary would probably be less helpful.

In this subsection, Pawling (1999) concluded that CD-ROM can promote vocabulary acquisition, pronunciation and independent learning. Leffa (1992) found that the electronic glossary was more efficient than the traditional dictionary, allowing the students to understand 38% more of the passage, using 50% less time.

4.244 Reading Comprehension

Chun (2001) said the process of reading in either a first or a second language is a complex one and is not fully understood, though considerable research has been done in the past 30 years. Of interest for research on L2 reading in hypermedia environments are questions regarding when and how often learners access different built-in learning tools and whether these tools aid in the lower-level process of understanding individual words and ultimately in the higher-level process of text comprehension.

In this subsection, Chun and Plass (1996) conducted studies on how reading comprehension can be facilitated with a multimedia application. Davis (1997) suggested the use of marginal glosses to text to enhance L2 reading comprehension and Chun (2001) explored how L2 learners access information

while reading L2 texts in a Web-based learning environment.

Chun and Plass (1996) conducted studies on how reading comprehension can be facilitated with a multimedia application. In order to look up a word, students clicked on the annotated word. Icons appeared above the text indicating the types of annotation available. Students then dragged the word to the icons and dropped it on the icon representing the desired annotation [interactivity, p. 510]. Annotating words with both visual and verbal information resulted in the most successful recall or comprehension [dual coding, p. 513], which also provided support for the dual coding theory of Paivio (1986). The result showed no significant correlation between look-up behaviour of vocabulary words and overall comprehension. Maybe poor readers needed to look up more words and yet not score well on vocabulary tests.

Davis (1997) performed a study with intermediate-level French students reading French text mediated by a computerised gloss. The results indicated two areas of interests. First, the most frequently consulted informational categories were the English definition. The heavy reliance upon the English definitions category suggested that the students felt that the key factor in understanding the passage was accessing word meanings in their native language. Second, attitudes of the students towards the computerised glosses were unanimously favourable [motivational effects, p. 67]. Many of the descriptions of reading with the computer contained the adjectives "helpful" [information chunking, p. 67] "time-saving" [reduced instruction time, p. 67], "easy" [information chunking, p. 67], and "enjoyable" (Davis, 1997, p. 6). One student felt that she had gained a more coherent understanding of the text while reading aided by the computer glosses. Her reading was not interrupted by clicking on unknown words and expressions [interactivity, p. 67], unlike using a regular dictionary she would forget what she was reading [information chunking, p. 67].

Another student suggested that using the computer made him a more independent learner [self-directed, p. 67], where he didn't have to call on anyone else for help. Another student expressed the wish that more materials would be available in computer-glossed format.

Chun (2001) explored how L2 learners access information while reading L2 texts in a Web-based learning environment, which included an internal glossary, an online bilingual dictionary, and an audio narration of the text [rich content, p. 367]. Students could choose to listen to the written text narrated by a native speaker of German [dual coding, p. 378] and they could read at their own pace [self-paced, p. 378]. Students used the internal vocabulary glosses in the hypermedia environment more extensively than the external online dictionary. They looked up significantly more words that were hyperlinked to brief definitions and translations than words that they had to copy and paste into an online dictionary [interactivity, p. 391]. They commented that the internal glossary was very helpful to read [information chunking, p. 391] and understood because it was seamless and did not disrupt the reading process and that they would sometimes rather guess at the meaning of the unknown words rather than take the trouble to look the words up. This study suggested that instantaneous vocabulary help from an internal glossary can be beneficial to L2 reading online. In addition, Chun (2001) said that one of the emerging principles in learning with hypermedia is the importance of individual differences in learning styles and learning strategies. The audio narration of the text [dual coding, p. 392] provided information in a different mode, and was seen by some learners as a positive reinforcement [motivational effect, p. 392] of the textual presentation they were reading. However, although some students listened to the narration multiple times and commented that it was helpful for them, as they might have been auditory learners, others did not find it particularly useful, as they might

have been visual learners. Students also commented that being able to see both the text on the screen and the word being looked up was helpful and desirable [information chunking, p. 392].

In this subsection, Chun and Plass (1996) found that annotating words with both visual and verbal information resulted in the most successful recall or comprehension. Davis (1997) found that attitudes of the students towards the computerised glosses were favourable. The results from Chun's (2001) study provided insights into how L2 learners use online textual and audio information to aid comprehension while reading.

4.245 Writing Skill

New (1999) said that writing is a recursive, dynamic process involving a multitude of strategies, skills, and higher order processes. ESL writers, however, are often found to be constrained by an incomplete language system, language transfer, and affective considerations. The increased importance of computer-assisted language learning (CALL) has influenced both writing instruction and research.

In this subsection, Greenia (1992) said that word processing provided incentives for change the way writing is understood and taught in the foreign language classroom. van de Bosch and Bolluyt (2001) used the Internet to facilitate the process of writing group papers. Finally, New (1999) tried to have a better understanding of the foreign language writing process by observing the work of five students.

Greenia (1992) used WordPerfect (WP) as the text editor and the use of a Spanish dictionary and thesaurus in his writing class. Very little or no paper ever changed hands. The fuss and time actually collecting and returning diskettes could be saved by carrying out all communication on a networking

system, or through the electronic mail systems. The key point was that both the teacher and the students had free exchanges within the group. No other teacher or student should have access to anyone's writing without that person's explicit permission; the class formed a writing and communicative community, but also an editing community, and each person had the right to limit distribution of his or her written materials. Greenia (1992) concluded that taking advantage of the computer arrangement of text editing tasks will perhaps change the way the teacher thinks about students' need for grammar and writing practice and save everyone a good deal of time and energy in the process. Best of all, both the teachers and students may come to share the excitement of writing [motivational effect, p. 36].

van de Bosch and Bolluyt (2001) used the Virtual Constructing Tool (VCT), based on the Internet, to facilitate the process of writing group papers. About 125 students participated in this three-year study, used the VCT to produce collective papers. Students were allowed to divide tasks, but they were held responsible for the quality of the arguments in the paper as a whole. The use of hyperlinking offers a contribution in each of these processes that varies from associative linking of pieces of information to strengthening linear structuring [interactivity, p. 355]. The division of labour was detrimental in the beginning. Students only felt that they were responsible for their own part and did not find the VCT too helpful. However, after making use of the teacher's feedback, and having critical discussions, their attitude has changed and they were then responsible for the whole paper [self-directed, p. 361]. Students valued the four working processes, exploring the subject, exchanging information, arguing and discussing, and editing, equally. They felt that collaborative group writing improves efficiency and academic content as well.

New (1999) thought that a better understanding of the FL writing process is

needed, especially as it relates to technology. She observed the revision strategies of 5 students of French enrolled in a 1-semester intensive intermediate college French course. The participants were Brooke, Shannon, Amanda, David and Meredith. Although they all had previous experience with the software and computers and liked to read, three of them liked to write but two of them (David and Meredith) did not, four of them considered themselves to be good-writers and one (Meredith) did not. The students could use the following tools in their writing: a word processor, a bilingual dictionary, a verb conjugator, a reference grammar, a vocabulary index, and a phrase index.

The students did not use the reference resources to their full potential, relying primarily on the English dictionary. Amanda, who wrote the longest composition, made the most effective use of the program. David was the least dictionary dependent. Unlike the other writers, he looked up a considerable amount of information in the indexes [interactivity, p. 89].

The writing sessions for all students lasted from 1 to 2 hours, with Amanda's first session the longest at 2 hours and 31 minutes. Total pausing and rereading time for the students lasted from 30 minutes to 1 hour [self-paced, p. 90].

With regard to the effect of the computer, Brooke stated that it was faster and easier for her to use than writing by hand. Moreover, the software program made it much easier [information chunking, p. 90] and faster [reduced instruction time, p. 90] to look up words, translations, grammar, accents, etc. Similarly, Shannon reported that the software was very easy to use and that it made the actual writing easier by providing all the information in French [rich content, p. 90].

New's (1999) study suggested that allowances must also be made for the ways in which composing strategies vary according to different contexts,

including the computer-mediated environment, as well as for differences among individual writers.

In this subsection, Greenia (1992) concluded the use of word processing software can help the teachers and the students. van de Bosch and Bolluyt (2001) used the Virtual Constructing Tool (VCT) to facilitate the process of writing group papers. Finally, New's (1999) study suggested that allowances must also be made for the ways in which composing strategies vary among individual writers.

4.25 Summary of CALL

In this section, the background and phases of CALL were discussed. Technologies relating to integrative CALL were discussed with case studies of multimedia/CD-ROM with foreign language learning. There are many obstacles to the implementation of CALL in the curriculum and they are attitudes of people, effectiveness of CALL, lack of equipment in the schools, lack of software and poor quality of many of the programs. There are also many benefits of implementation of CALL which included that CALL can provide exercises for the students. It can help teachers with marking of composition, students with vocabulary acquisition, guided reading, listening comprehension, and dictation.

Warschauer (1996) indicated that the integrative CALL is based on two technologies: multimedia and the Internet. Hypermedia and speech technologies made Internet and multimedia more powerful. The WWW can provide language training for the students for their reading, listening, and writing skills. Video, picture, and sound are combined within a single multimedia program to help students with the appropriate skill they are acquiring in the target language. Case studies of multimedia/CD-ROM in foreign language learning

were divided into the four language skills: listening, speaking, reading, and writing. For listening skill, Brett (1997) suggested the use of video-based listening text on CD-ROM for listening comprehension. Klassen and Milton (1999) used interactive multimedia CD-ROM while Merlet (2000) used static pictures along with computer-presented dialogue for their students. For the speaking skill, Johnston and Milne (1995) used multimedia instructional software with video included interviews and dialogue on the computer with on-demand resources such as transcript and dictionary. Borrás and Lafayette (1994) used subtitles in their multimedia video courseware and Coniam (1998) used continuous speech recognition to test oral proficiency. For vocabulary learning, Pawling (1999) used multimedia dictionary on a CD-ROM for vocabulary acquisition and Leffa (1992) used electronic glossary/dictionary to support the readers with their understanding of vocabulary. For reading comprehension, Chun and Plass (1996) used multimedia with colour pictures, short videos, and dictionary to help students with their reading. Davis (1997) used computerised marginal glosses for L2 reading and Chun (2001) used online multimedia support resources with internal glossary, external dictionary and audio narration for L2 learners. For writing skill, Greenia (1992) suggested the use of a word processor, with a regular Spanish dictionary and thesaurus, and submitting the work through either the network system or electronic mail system. van de Bosch and Bolluyt (2001) used the Internet to promote group writing among students. Finally New (1999) used computerised reference resources to help students with writing and revision of papers. Table 19 summarised the language skills and multimedia/CD-ROM technology used as suggested by different authors.

Table 19: Language Skills and Multimedia/CD-ROM Technology Used

Language Skills	Multimedia/CD-ROM Technology		
Listening	1. Brett (1997) – CD-ROM with video	2. Klassen and Milton (1999) – interactive multimedia CD-ROM	3. Merlet (2000) – computer-presented dialogue with static pictures
Speaking	1. Johnston and Milne (1995) – multimedia with video consisting interviews and dialogues, dictionary resources, transcript	2. Borrás and Lafayette (1994) – multimedia with video and subtitles	3. Coniam (1998) – speech recognition software
Vocabulary	1. Pawling (1999) – electronic dictionary on CD-ROM	2. Leffa (1992) – electronic glossary/dictionary	
Reading	1. Chun and Plass (1996) – multimedia with colour pictures, video and dictionary lookup	2. Davis (1997) - computerised marginal glosses	3. Chun (2001) - online multimedia support resources with internal glossary and external dictionary, audio narration
Writing	1. Greenia (1992)- word processor, with a regular Spanish dictionary and thesaurus, with output saved on diskette, network system or through electronic mail system	2. van de Bosch and Bolluyt (2001) – Internet	3. New (1999) - computerised reference resources, such as dictionary

Supporting findings made by specific authors in this section are cross-referenced with the nine factors contributing to the success of multimedia instruction suggested by Najjar (1996) and Bagui (1998) from Figure 8 are summarised in Table 20. These nine factors are reduced instruction time, interactivity, self-paced learning, self-directed learning, flexibility, motivational effects, information chunking, having rich content and dual coding.

Table 20: Supporting Findings Contributed to the Success of Multimedia Instruction

Factors Contributed to the Success of Multimedia Instruction	Supporting findings made by specific authors
Reduced Instruction Time	1. The electronic glossary allowed the students to understand 38% more of the passage, using 50% less time, Leffa, 1992, p. 63 2. The use of marginal glosses to text for some students is time-saving, Davis, 1997, p. 67 3. The software program with the help of a reference tool made it faster to look up words, New, 1999, p. 90
Interactivity	1. a) Using a mouse click to respond is a briefer action than writing on paper, Brett, 1997, p. 48 1. b) Learners received instant ticks or crosses for their responses, Brett, 1997, p. 49 2. One student said that he can check the results from exercises quickly with the immediate feedback, Klassen and Milton, 1999, p. 294 3. The students perform a number of control actions, Merlet, 2000, p. 152. 4. The point-and-click interface was easy to use, Johnston and Milne, 1995, p 328. 5. Play the model sentence as many times as required at the click of the mouse, Pawling, 1999, p.165. 6. Students dragged the word to the icons and dropped it on the icon representing the desired annotation, Chun and Plass, 1996, p. 510 7. Her reading was not interrupted by clicking on unknown words, Davis, 1997, p. 67 8. The students looked up significantly more words than were hyperlinked to brief definitions and translations, Chun, 2001, p. 391 9. Hyperlinking offers a contribution in each of these processes which varies from associative linking of

	pieces of information to strengthening linear structuring, van de Bosch and Bolluyt, 2001, p. 355 10. One student looked up a considerable amount of information in the indexes, New, 1999, p. 89
Self-paced	1. Learners were allowed to explore the CD-ROM, Brett, 1997, p. 44 2. Students were exhibiting control over their learning program, choosing when and how often to break, Klassen and Milton, 1999, p. 291 3. Students perform a number of control actions, Merlet, 2000, p. 152 4. Play the model sentence as many times as required at the click of the mouse, the pairs could work at their own pace, You can play it over and over, Pawling, 1999, p. 165 5. Students could read at their own pace, Chun, 2001, p. 378 6. Total pausing and rereading time for the students lasted from 30 minutes to 1 hour, New, 1999, p. 90
Self-directed	1. a) Learners were allowed to explore the CD-ROM, Brett, 1997, p. 44 1. b) Learners were let loose on its full range of features, Brett, 1997, p.44 2. a) Students needed to assume the responsibility and were free to navigate the CD-ROM in their own way, Klassen and Milton, 1999, p. 290 2. b) Students realised that the interaction needed to be initiated by themselves, Klassen and Milton, 1999, p. 290 2. c) Students adjusted to the freedom, choosing their own learning path, taking ownership of their own learning, Klassen and Milton, 1999, p. 291 3. a) Being in the computer laboratory gave them a feeling of independent, Borrás and Lafayette, 1994, p. 68 3. b) Self-controlled subtitles may empower learners, Borrás and Lafayette, 1994, p. 71 4. CD-ROM can promote independent learning, Pawling, 1999, p. 163 5. One student said that the computer made him more independent, Davis, 1997, p. 67

	6. After making use of the teacher's feedback, and having critical discussions, their attitude has changed and they were then responsible for the whole paper, van de Bosch and Bolluyt, 2001, p. 361
Flexibility	1. a) The teacher was given total flexibility as to when and how to use multimedia tool, Johnston and Milne, 1995, p. 320 1. b) The support material appeared on-screen at the discretion of the teacher, Johnston and Milne, 1995, p. 318. 2. Internet facilitates the process of writing group papers, van de Bosch and Bolluyt, 2001, p. 355
Motivational Effects	1. a) The results demonstrated positive attitudinal changes for the multimedia-enhanced mode of learning, Klassen and Milton, 1999, p. 281 1. b) One student said that it raises his interest in learning, Klassen and Milton, 1999, p. 294 2. The visuals in the video were key to motivating students, Johnston and Milne, 1995, p. 327 3. a) The reactions of subjects were quite positive, Borrás and Lafayette, 1994, p. 67 3. b) Data revealed a highly positive attitude towards speaking practice with multimedia courseware, Borrás and Lafayette, 1994, p. 68 4. Attitudes towards the computerised glosses were unanimously favourable, Davis, 1997, p. 67 5. Audio narration of the text was seen by some learners as a positive reinforcement, Chun, 2001, p. 392 6. Both the teachers and students may come to share the excitement of writing, Greenia, 1992, p. 36
Information Chunking	1. a) Using computer software to chunk video into segments short enough for comprehension span of novice language student, Johnston and Milne, 1995, p. 317 1. b) The segmentation with computer control permitted students to review short segments of conversation, Johnston and Milne, 1995, p. 327 2. a) Her reading was not interrupted by clicking on unknown words, Davis, 1997, p. 67 2. b) The use of marginal glosses to text for some students is helpful and easy, Davis, 1997, p. 67

	3. a) The internal glossary was very helpful to read, Chun, 2001, p. 391 3. b) Students commented that being able to see both the text on the screen and the word being looked up was helpful and desirable, Chun, 2001, p. 392 4. The software program with the help of a reference tool made it easier to look up translation, grammar, New, 1999, p. 90
Rich Content	1. Learners were let loose on its full range of features, Brett, 1997, p.44 2. The tool supplemented video with on-demand resources including a transcript, visual dictionary, Johnston and Milne, 1995, p. 317 3. Multimedia resources included an internal glossary, an online bilingual dictionary, and audio narration of text, Chun, 2001, p. 367 4. The student reported that the software made the actual writing easier by providing all the information in French, New, 1999, p. 90
Dual Coding	1. It supplemented the video with on-demand resources including a transcript, Johnston and Milne, 1995, p. 317 2. One student said that the picture helps him remember the word, Pawling, 1999, p. 165 3. Annotating words with both visual and verbal information resulted in the most recall or comprehension, Chun and Plass, 1996, p. 513 4. a) The learners could choose to listen to the written text narrated by a native speaker of German, Chun, 2001, p. 378 4. b) The audio narration of the text provided information in a different mode, Chun, 2001, p. 392
Novelty	1. One student said that it raises his interest in learning, Klassen and Milton, 1999, p. 294

4.3 Conclusion of Multimedia and Foreign Language Learning

From Table 20, the researcher of this study likes to count the number of authors who made supporting findings for each one of the successful factors with multimedia instruction. Each author with more than one comment about one factor will only be counted as having just one comment. There are 3 supporting authors for reduced instruction time, 10 for interactivity, 6 for self-paced learning, 6 for self-directed learning, 2 for flexibility, 6 for motivational effects, 4 for information chunking, 4 for having rich content, 4 for dual coding and 1 for novelty. In terms of top three ranking factors, interactivity has 10 supporting authors, self-paced learning, self-directed learning, and motivational effects all have 6 supporting authors, information chunking, having rich content, and dual coding all have 4 supporting authors, these findings are relating to these factors suggested by Najjar (1996) and Bagui (1998) in Figure 8. The researcher draws the conclusion that these factors are more appropriate for language learning/Mandarin learning. This will answer the question set forth in the Multimedia section of the second chapter about which one of these factors is more appropriate to Mandarin learning with the CD-ROM. In the order of appropriateness, interactivity ranks the top, followed by self-paced learning/self-directed learning/motivational effects, and information chunking/rich content/dual coding. The researcher plans to investigate if these factors are also appropriate to the adult learners learning Mandarin with the CD-ROM in Macao.

Stemler (1997) discussed the instructional features of multimedia that include screen design, learner control and navigation, use of feedback, student interactivity, and video and audio elements in Table 6. These features can be used to help language learning. The researcher synthesised these features with top three ranking factors from Table 20 and created Table 21.

Table 21: Cross Reference Between Successful Factors and Instructional Features of Multimedia for Mandarin Learning

Factors Contributing to Success of Multimedia Instruction for Mandarin Learning	Instructional Features of Multimedia				
	Screen Design	Learner Control and Navigation	Feedback	Student Interactivity	Video and Audio
1. Interactivity	X	X	X	X	X
2. Self-paced learning	X	X	X	X	X
Self-directed learning	X	X	X	X	X
Motivational effect	X	X	X	X	X
3.Information Chunking	X	X	X	X	X
Having rich content		X			X
Dual Coding	X				X

Table 21 is a cross reference between the successful factors and instructional features of multimedia for language learning. To answer the question set forth in the Multimedia section of the second chapter about how could these features be used to assist Mandarin learning with the CD-ROM. Interactivity is an important factor to the success of multimedia is instruction. Effective screen design, learner control and navigation, feedback, the proper use of video and audio create an interactive, stimulating environment for the learners. Well-designed screen should be visually stimulating and are expected to develop and maintain interest of the learners. Self-directed learning and self-paced learning requires the implementation of effective screen design, learner control and navigation, feedback and interactivity, and proper use of video and audio within the multimedia software. Since video and audio provide motivational effect to the learners, in screen design, video and audio should be chunked into segments short enough for the comprehension of the learners. Audio should be designed so that the learners can interrupt the audio at any time and continue

with the program. Whenever audio is used to support text, it is important to provide a way for the learners to pause or repeat the sound. The researcher plans to utilise the instructional features of multimedia as much as she can in the development of the Mandarin CD-ROMs in the present study.

For listening comprehension, Brett (1997) suggested the use of video-based listening text on CD-ROM. For vocabulary learning, Pawling (1999) used multimedia dictionary on a CD-ROM for vocabulary acquisition. For reading comprehension, Chun and Plass (1996) used multimedia with colour pictures, short videos, and dictionary to help students with their reading. The researcher likes the advice of these authors about the listening and reading skills and vocabulary learning; however, because of what Blake (1998) indicated that good video is expensive to produce and the fact that the researcher is converting existing textbooks and CDs to CD-ROMs and pictures and video were not included, she will not be using video in this CD-ROM development. She will be using audio narration for listening, dictionary/glossary/audio narration for reading, and dictionary/glossary for vocabulary learning, as shown in Table 22.

Table 22: Language Skills/Multimedia Technology in the Mandarin CD-ROMs

Language skills placed in Mandarin CD-ROM	Multimedia Technology
Listening	1. Audio
Reading	1. Dictionary
	2. Glossary
	3. Audio narration
Vocabulary	1. Dictionary
	2. Glossary

There were two major sections in this chapter and they were technology as related to foreign language learning and computer assisted language learning (CALL). In the technology section, the technology from radio to microcomputer was discussed. In the CALL section, the background and technology of CALL were discussed. Then finally foreign language learning case studies of multimedia/CD-ROM technology were analysed. The researcher of this study felt that the problems and lessons learned with language laboratory and CALL can also be applied to the CD-ROM usage if one were to learn from history. There were many problems and they were cost, attitudes of people, effectiveness of CALL, lack of equipment in the schools, lack of quality software or software for advanced students and little faculty involvement. Selection and preparation of materials, instruction given to students and time spent with the software were major lessons learned. As stated before, with the development of the CD-ROMs in the present study, the researcher hopes to improve at least two shortcomings: to produce better quality CALL and to change any negative attitudes that students may have in learning Mandarin with the CD-ROM. From the discussion in this chapter, it seems that interactivity, self-paced learning, self-directed learning, and motivational effects are the successful factors mentioned by Najjar (1996) and Bagui (1998) that are more appropriate for Mandarin learning with multimedia. Now that the reader has a better understanding of multimedia and foreign language learning, the researcher will discuss multimedia and Chinese language learning in the next chapter.

Chapter 5: Multimedia and Chinese Language Learning

According to Mowry (1997), the earliest attempts at designing animated Chinese-language tutors took place in the 1970s. The project, Champaign, a Chinese component of the PLATO System inspired later investigation into using computer animation in the teaching of the Chinese written script. Mowry (1997) said that since Apple Computer's introduction of microcomputers in 1983, a number of Chinese-language instructors began seriously in the exploration of and experimentation with the computer's potential as a teaching and research tool. In this chapter, CALL for learning the Chinese language is discussed in terms of its strengths and weaknesses and types of Chinese CALL. Chinese PLATO system and the CyberChinese software are discussed, to give the reader a sense of what Chinese CALL was like in the 1970s with emphasis on character writing and in the 1990s with emphasis on pronunciation, tone, vocabulary, and grammar to improve listening and reading skills. Their contents will be used to set the stage for the CD-ROM development in this study. CALL software relating to vocabulary, character writing and reading are also discussed. Finally, criteria for evaluating CALL for learning Mandarin are discussed in terms of domain-dependent demands, instructional demands, user-interface demands, and pragmatic demands.

5.1 CALL for Learning Chinese

Mowry (1997) suggested what the computer and multimedia could actually do for Chinese language teachers and their students in Table 23. First of all, pronouncing dictionaries are made available. Secondly, as an electronic dictionary or a reference tool can be networked to simultaneously accommodate multiple users; the computer will search, retrieve, sort, link, and classify increasingly greater amounts of information or data quickly and efficiently.

Thirdly, a multimedia textbook designed for self-study can offer the student several activity options within a single package, switching from one task to another, from reading to testing, to do exercises based on what has just been read, with access to instant glossary help at any point. Fourthly, multimedia tools can provide immediate feedback and record students' performances. Fifthly, multimedia learning materials can be interactive, which means that individual users will have extensive control over, and choice of, the mode and pace of learning and the type of activity. Sixthly, a multimedia tool can be updated easily, and also be customised to suit the needs of individual teachers and students. Lastly, a multimedia tool can imitate other real-life motions, or movements, combining selected text with the appropriate audio and/or video.

Table 23: Multimedia for Chinese Language Learning (Mowry, 1997, p.118)

Multimedia for Chinese Language Learning
1. Pronouncing dictionaries
2. An electronic dictionary or a reference tool can be networked to simultaneously accommodate multiple users. Retrieve data quickly and efficiently
3. Offer the student several activity options within a single package. Switching from one task to another. Self-study with reading, test, doing exercises and instant glossary
4. Feedback and keep student performance
5. Interactive
6. Update easily, customised to individual needs
7. Imitate movement, voice, using text with audio and/or video

In recent years, with the rapid development in computer technology, a great amount of CALL programs have been produced. Facing all this CALL, what would the students and teachers be wondering. Zhang (1998) thought of these questions:

> How effective are these programs? How worthwhile is it to spend time and money on them? How do we choose among so many offerings? Have the initial promises of CALL been realised? How do we improve? Is there any untapped potential left in CALL? (p. 51)

Out of 40 Intelligent CALL systems examined, Gamper and Knapp (2002) found one Chinese vocabulary tutor which addresses vocabulary, reading and writing skills. Jung (2002) documented the development of CALL with a total of 558 entries, mainly derived from post-1997 journal articles and book publications, searching from more than 50 national and international journals, came up with two articles on the Chinese language. So one can see that not too many articles address CALL in terms of the Chinese language. The time has come to take a critical look at the technology, the media, and the present state of CALL for Chinese learning.

5.11 Strengths and Limitations

Has the full potential of the current technology been realised or has the limitation been overestimated? Zhang (1998) pointed out both the strengths and limitations of CALL in Table 24.

Table 24: Strengths and Limitations of Chinese CALL (Zhang, 1998, pp. 54-55)

	Strengths	Limitations
CALL	1. Store and manipulate data 2. Instant retrieval of vocabulary, grammar explanation. 3. Easy learner control 4. Keep score, log errors and track learner performance 5. Repeated capability 6. Interactivity 7. Feedback 8. Learner-centred 9. Multimedia	1. Difficulty in providing feedback to learners' speech 2. Learners' creative and open-ended output cannot be easily evaluated

In Table 24, in terms of strengths, because of its random and rapid access, the computer is able to store and manipulate data, which allows the instant retrieval of lesson, vocabulary and grammar explanation. It also contributes to easy learner control. The computer's ability to store and manipulate data also

makes it possible to keep score, log errors, and track learner performance. The consistency and patience of the computer is crucial for learning by association and repeated exposure. Interactivity is a crucial strength of the new technology. It allows instant feedback and is especially suited for implementing learner-centred teaching materials. Multimedia is truly revolutionary for language pedagogy. The sound and graphic capabilities not only have improved presentation, they have also made possible what conventional textbooks cannot do. The teaching of Chinese characters' stroke order and direction and pronunciation are made possible, which is what the researcher of this study intends to do with the CD-ROM project.

In Table 24, in terms of limitations, Zhang (1998) said that although speech recognition is already commercially available, this technology has not been perfected yet. Due to the complexity of natural language parsing, the learners' creative and open-ended output cannot be easily evaluated. Because of the difficulty of speech recognition and natural language parsing, the interactivity of the computer does not go too far yet. However, the researcher of this study agrees with Gamper and Knapp (2002) that as technology advances, speech recognition system can become fast and reliable in the future. The future speech recognition system can correct students' pronunciation, vocabulary building, speaking skills, and particularly with 4 tones and provide faster and more reliable verbal computer input for Mandarin learning. Speaker independent systems will be more developed, they will be able to judge continuous spoken speech with different accent and tone without training, and they will also be able to tell the difference between native and nonnative speaker speech and a faulty microphone and a faulty pronunciation as problems raised by Bernstein et al. (1999) (see p.151).

5.12 Types of Chinese CALL

Zhang (1998) claimed that there are two types of CALL: receptive and productive. Of the four skills of speaking, listening, reading and writing, CALL programs more commonly address the receptive skills of listening and reading. With receptive skills, the learner is on the receiving end and any response from the learner is restricted to choice type comprehension questions that may be processed by computers. But with productive skills, the computer is on the receiving end; it cannot easily process and give feedback to learner-produced language, if the language is open-ended and/or delivered orally or by free-hand writing. The presentation of lessons has not only been aided by multimedia, it has also benefited from the easy retrieval feature of the computer in providing on-line explanations.

Zhang (1998) indicated that in terms of the level of instruction, the beginning level has attracted the most attention from CALL developers. The most common areas addressed by CALL are pronunciation, vocabulary and characters. These time-consuming but less creative tasks turn out to be what the computer is best suited for. Not only can these tasks take advantage of the consistency and patience of the computer, they can also capitalise on its data-handling and multimedia capabilities.

Zhang suggested that the use of technology has to be guided by pedagogy and most CALL programs are designed for general linguistic abilities and targeted for a true beginner with no language background. More CALL programs that serve students with wide backgrounds should be developed. The following kinds of programs would be very useful to such students (Zhang, 1998, p. 60):

1. Pronunciation programs for dialect speakers.
2. Programs teaching romanisation to Mandarin speakers.
3. Programs teaching correspondence between simplified and traditional style characters would be useful for learners who already know one style.

5.121 The PLATO System

Mowry (1997) indicated the PLATO System signified the beginning of Chinese CALL. The hardware and Chinese character writing were distinctive for the researcher of this study to learn from its history. Chen and Cheng (1976) reported the Chinese PLATO project and discussed two main tasks that included the design of Chinese characters and the structure of the teaching material. The Chinese PLATO project resulted in the creation of a file of three thousand characters.

They emphasised that the PLATO System was supplementary in nature. The program had been most helpful to the student in the teaching of character writing by means of automatic, stroke-by-stroke drawing on the screen; reinforcement through drill; and synthesised review of grammar. These were achieved by effective utilisation of the two most important features: immediate feedback and self-paced, interactive instruction. They also noted that the success of a program was contingent on how well it was integrated into the overall course instruction, with close coordination with classroom activities.

5.1211 Contents of PLATO System

PLATO contained of sixty-six lessons and was done purposely to avoid monotony. Most lessons provided three areas for the student to choose from: vocabulary, grammar, and exercise. The vocabulary section was designed to help the student with new characters and new words encountered in the lesson. The

grammar and exercise sections were not necessarily rigidly separated. Drills often followed the explanation of a grammatical point. The writing on the PLATO screen was in Chinese characters, pinyin, and/or English.

According to Chen and Cheng (1976), recognising and writing characters is probably part of the most difficult but rewarding experience of learning Chinese. The vocabulary section was set up to help students recognise and remember characters. The students could see the correct stroke sequence of a character. Moreover, they could control the duration of the pause between strokes during the writing.

The lessons on pronunciation focused on tones and consonants in which most students found help necessary. In going through a pronunciation lesson the student could not only imitate sounds, but was also required to successfully distinguish them in quizzes. A similar approach was also applied in teaching tones. While the students were listening to a tone they were also seeing on the screen a drawing of the contour of the tone synchronous with the voice. Such a visual display helped them to have a clearer picture of the relative pitches of the tones. The teachers had also utilised PLATO's interactive capability to design games for the students to play, games that would combine fun with learning.

5.122 CyberChinese

Yu and Michaels (1998) said that CyberChinese provided students with a stimulating and responsive environment for learning pronunciation, tones, vocabulary, and grammar, with the aim at improving the listening and reading skills of students of beginning Chinese. The software links main modules to graphics, movies, sound files and text containing cultural notes. The software's flexible environment allows the students to tailor the tutorial to their individual

schedules, needs, learning styles and interests.

Yu and Michaels (1998) administered a survey to the entire first year Chinese class. They divided the student responses into three categories according to language background: Chinese students (students who can speak a Chinese dialect but have had no prior exposure to Mandarin), other Asian students (students whose native language also uses Chinese characters as one of their written forms, such as Japanese), and non-Asian students (includes Chinese-American and other Asian-American students who have no prior knowledge of Chinese).

Yu and Michaels (1998) asked the students questions related to the usability and effectiveness of the program. In terms of general utility of CyberChinese, it was most helpful to non-Asian students, students without any background in either spoken or written Chinese. In terms of learners' behaviours, students from different language backgrounds reacted differently regarding the usefulness of various multimedia links. Non-Asian students preferred the link that allowed them to watch characters being written on the screen and that provided them additional examples of usage of the word. This was probably because students, who grew up using alphabets, found it difficult to learn how to draw characters. In addition, since Chinese is structured very differently from European languages, these students found it helpful to learn a new word in context. Non-Chinese Asians found both pronunciation and the written English definition most helpful. This was because students from Japanese and Korean backgrounds would be familiar with most characters, but not with the Chinese pronunciation or definition of the words that those characters represent. Chinese students, like non-Chinese Asians, also ranked pronunciation and the written definition the highest because they may speak different Chinese dialects. Perhaps they ranked

the written definition higher because they found the English equivalent of the characters more meaningful than the actual writing or the structure of the characters.

Yu and Michaels noted that CyberChinese could never replace instructors. Rather, it aids the instructors by allowing them to spend their time and energies more effectively on diagnosing and addressing learning problems than on the day to day task of drill and practice.

5.1221 Contents of CyberChinese

The program, which corresponds with the fifty lessons, consists of pronunciation, tone, vocabulary, radical, and grammar, which are divided into drills and exercise sections. In the drill section, students are introduced to new material followed by a review module in game format. The students see that CyberChinese as a computer teacher assistant to them, always ready to drill them and review with them and the instructors find that it helps them assess students' performance and needs.

CyberChinese has two important pedagogical features; it employs multiple media links; and it provides students with immediate feedback on their language skills. With multiple media links, it is commonly accepted that different individuals adopt different learning styles, whether visual, textual, auditory, or tactile-kinaesthetic. Multiple media links allow CyberChinese to address to most of these learners. With immediate feedback, CyberChinese makes this easier by incorporating video game style practice drills designed to give students immediate feedback on their recognition skills while stimulating their interest and providing a bit of entertainment.

5.123 Vocabulary Learning

According to Blok, Daalen-Kapteijns, Otter and Overmaat (2000), the

number of computer programs intended for word learning is rapidly increasing. Goodfellow (1995) made a distinction between two generations of computer-assisted vocabulary learning. The first generation programs emphasised retrieval testing, capitalising on the computer's simple capability to match input and target patterns. Second generation computer-assisted vocabulary learning came about as a result of the technical developments in applications software such as word-processors, graphic user interface, and hypertext.

Luk and Ng (1998) conducted a study, with students from Primary 4 to Secondary 2 and their teachers, which included an exploratory survey, design and implementation of a prototype, and a usability test, to determine how a computer can be used as an aid to learning Chinese idiom. Chinese vocabulary learning is considered important for language proficiency and for traditional Chinese pedagogy. Chinese idioms play an important role in Chinese vocabulary learning as well as having a cultural and social function. The basic idea of designing a CALL package for Chinese idiom learning is to supplement material in the curriculum, not to replace it. The results of the exploratory survey showed that primary students were considered to be the most in need of support from the program. It pointed to two functions that the program should offer to primary students. First, since students found difficulty in searching and using the idiom dictionaries, the program should provide a user-friendly interface to mitigate these difficulties. Second, exercises in the form of educational games should be provided to arouse interest. A prototype program was designed based on the results of this exploratory survey.

After the prototype system was built, two separate evaluations were carried out. Data collected from the interview evaluation reviewed that both students

and teachers felt that the searching facilities were convenient and helpful. For the educational games, students found the level of difficulty of the games reasonable. Their interest was aroused by these games since they were willing to try for the correct answer when mistakes were made. Data collected, two years after the prototype program was built, during this time, multimedia systems and the World Wide Web have become very common, showed that students were not interested in learning Chinese idioms. They were more interested in Putonghua pronunciation, general vocabulary learning and simplified character reading and writing. Though 94% of the subjects still liked using a package for computer assisted learning of Chinese idioms.

Luk and Ng (1998) suggested that the use of questionnaires to resolve some of the prototype design issues and to evaluate the prototype is promising. The main reason was to ascertain the needs of the users, both the teachers and students and to quantify their needs. Through analysis, the ergonomic and pedagogical reasons become apparent in explaining the questionnaire results. The consistency of opinions between different groups of subjects in answering the questionnaire for the design and evaluation of the prototype confirmed the utility of the questionnaire in the design stage of the prototype. Since a good prototype acts as a springboard for the development of a final product, development cost would be saved from successive revisions after a feedback of every evaluation. This becomes important to a large-scale development of CALL due to the cost incurred and to the introduction of new technology when the context of its appropriate use is uncertain. The present study started with a prototype and went through the user-interface focus group to ascertain the needs of the users.

5.124 Character Writing

Li (1996) indicated that tackling written Chinese is a daunting task for many students. Each character usually has to be copied ten or twenty times before it can be remembered, and there is no guarantee that it will be incorporated into permanent memory. The result is a painful learning process and poor retention. Li claimed that mastery of the Chinese writing system requires: 1) the courage to learn; 2) the ability to memorise and write several thousand characters; 3) the ability to understand or write them in different context.

Li conducted a study of a computerised program, HyperCharacters, for learning Chinese characters. The students who used the program had a better grasp of the radicals than the students who only attended the lecture and the novelty of using a computerised learning program could have had an effect on it. The interviewees stated that the principles of the formation of the characters and the visualised description of the characters helped them learn this writing system in an understanding manner instead of by rote memory. The common feedback on the evaluation was that the more explanation and comprehension are involved in the learning process, the easier the learning is and the more stable the retention of the memory (p. 88).

Li also said that there was a positive relationship and attitude or confidence in learning the radicals. Usually students start a course enthusiastically, highly motivated to learn. If they fall short of expectations and find themselves among the low achievers, they can easily give up. The computer program maintains the students' positive attitude and motivation towards learning because it made them feel that the characters are not as terrible as they seem to be. The results also showed that students preferred user-controlled learning over instructor-driven classroom presentation. Students who controlled their own

learning explore knowledge voluntarily and tended to have more self-confidence, which is a vital component of successful learning. Some students said that instructors should incorporate programs like HyperCharacters into their curriculum, not necessarily to use it in class. The instructors can serve as facilitators to encourage students to ask good questions and help them find out answers.

5.125 Reading Comprehension

Knight (1994) said that vocabulary learning is no longer a primary classroom focus, something to be taught and tested, but rather, something to be acquired incidentally by the student while reading. Lu (1997) suggested ways to use a computer to aid in Chinese reading to overcome the difficulties of learning Chinese. Computer dictionaries could be used as an aid in reading Chinese, providing users with an instant access to the pronunciation and definition. In terms of interest-oriented practical reading, Lu noted that practical reading is the type of reading that provides the reader with entertainment and world knowledge other than knowledge about language itself. Because the materials for practical reading are interesting and informative, the enjoyment would override the usual dullness of language learning. In terms of showing word boundaries with computer-editing, Lu (1997) commented that in writing, Chinese does not mark word boundaries. Presenting characters in word chunks is expected to have an impact in facilitates reading. Its benefits can be seen from an analogy to that of punctuation for native speakers of Chinese.

Hong (1997) evaluated the effectiveness of multimedia computer-assisted reading in Business Chinese. With this software, students can use the online assistance functions, such as sound, glossary, and English definitions of certain phrases. The results showed that students' reading scores were much higher

with the multimedia method than with the conventional method. It can be concluded that the multimedia method was more effective than the conventional method in improving students' reading proficiency. The readings were selected under such criteria such as interest level, difficulty of vocabulary, and cultural authenticity.

Hong also commented that the significantly higher overall scores with the multimedia method were attributed to several features of multimedia, which includes audio effects, online glossary, and speed and convenience in using these functions. Since the students obtained much higher comprehension scores in less than half the time with multimedia computers than with paper and dictionary, Hong (1997) therefore recommended that such technology, audio effects and online-glossary should be frequently applied in foreign language teaching to effectively develop the learners' speaking, listening, reading, and writing skills.

5.13 Summary of Chinese CALL

In this section, different Chinese CALLs were discussed. Zhang (1998) claimed that there are two types of CALL: receptive and productive. CALL programs more commonly address the receptive skills of listening and reading. The beginning level has attracted the most attention of CALL developers. The most common areas addressed by CALL are pronunciation, vocabulary and characters. The Chinese PLATO System and CyberChinese were discussed to give the reader a sense of what Chinese CALL was like in the 1970s with emphasis on character writing and in the 1990s with emphasis on pronunciation, tones, vocabulary, and grammar. CALL software relating to vocabulary: character writing, pronunciation and reading skill, was also discussed.

In terms of learning Chinese idioms, Luk and Ng (1998) found that students were more interested in pronunciation, general vocabulary learning, and

simplified character reading and writing. In terms of character writing, Li (1996) showed that students preferred user-controlled learning over instruction-driven classroom presentation.

In terms of using a computer to aid in Chinese reading, Lu (1997) suggested three ways: using computer dictionaries can be used as aid in reading Chinese, finding practical reading that are interesting and informative, and showing word boundaries with computer-editing. In terms of reading, Hong (1997) showed that the students' reading scores were much higher with the multimedia method.

5.2 Criteria for Evaluating CALL for Mandarin Learning

What makes one CALL better than another? How can CALL be evaluated? What are the criteria for evaluating CALL? The researcher of this study hopes to answer these questions, respectively, with the help of the following authors: Goyne, McDonough, and Padgett (2000), Reeves (1992), and Kuittinen (1998).

Goyne, McDonough, and Padgett (2000) said that teachers are under increasing community and cultural pressure to make computer-assisted instruction a highly visible part of their instruction. One daunting task for teachers is the selection of software. What makes one educational software program better than another? The authors raised twelve questions that teachers and administrators should ask when evaluating educational software in Table 25.

Table 25: Questions for Evaluating Educational Software (Goyne, McDonough, and Padgett, 2000, p. 345-347)

1. Is the software consistent with the curriculum and learning outcome?
2. Does the software offer the learner choices and control?
3. Does the software provide a variety of appropriate media and activities?
4. Does the software provide positive, formative feedback and achievement measures?

5. Is the software appropriately challenging?
6. Does the software have high-quality technical components?
7. Does the software provide opportunities for practice and review?
8. Does the software present material in an enjoyable, interesting manner?
9. Is the software interactive?
10. Will the software allow for social interaction?
11. Will the software foster learning in an authentic, relevant context?
12. Will the software be accessible to students?

Table 25 corresponds to several points with the factors that influence the motivation and engagement of adult learners for interactive multimedia described by Stoney and Oliver (1998) in Figure 9. The researcher of this study considers that question 2 corresponds to learner control, question 5 corresponds to challenge, question 3, question 8 and question 9 correspond to play and flow, and question 10 corresponds to collaboration.

Goyne, McDonough, and Padgett (2000) presented the above questions as guidelines for evaluating software before it is purchased and said that the most important factor determining the success of an educational software is how it is used in the classroom as it will never replace the teacher, which is in line with what Ahmad, Corbett, Rogers and Susex (1989) said about the computer not being a complete substitute for a teacher. Li (1996) pointed out that in a school setting, even if the instructor employs a computerised learning program, classroom teaching remains an important means for active learning and constructing knowledge. The computer program did not seek to compete with nor to supersede conventional classroom instruction but to provide another channel to facilitate learning. In the process of applying technology, the instructor's role might change but the teacher will always be a significant learning resource and an indispensable guide for leading individual student

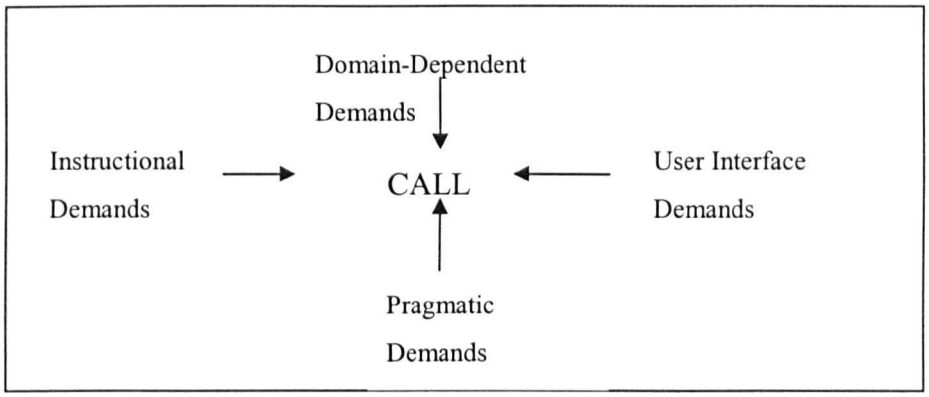
through the learning process.

Reeves (1992) claimed that the effectiveness of multimedia is constrained by two important factors: the design of the user interface, and the motivation and expertise possessed by the users. The success of multimedia heavily depends on the user interface and the user. The quality of interaction is determined by the skills and experiences learners have with the medium and the degree to which the medium has been designed to support the interaction.

Reeves (1992) suggested that a multimedia program should be evaluated with the following considerations. First, it should only be evaluated within the context of its use. Second, individual differences among users with respect to aptitude, knowledge, skills, attitudes, personality characteristics, previous experience, motivation must be accounted for in any evaluation. Third, the interactions among these individual differences and aspects of the user interface should be a major focus for evaluation. The goals of using a multimedia program should be nothing less than fundamentally improving the conditions of teaching and learning in education and training. Except aptitude, Reeves' suggestion is similar to what the researcher intends to investigate in this research, as shown in Figure 20 (p. 109), previous knowledge, computer skill, personality characteristics in terms of learning style, attitude, and motivation. The context of the evaluation is the use of the Mandarin CD-ROM in Macao with adult learners.

Kuittinen (1998) suggested that several points of view must be considered when designing and evaluating CAI applications, such as domain-dependent demands, instructional demands, user interface demands, and pragmatic demands. The researcher of this study intends to apply these criteria to Mandarin CALL, as shown in Figure 21.

Figure 21: Evaluation Perspectives of CALL (Kuittinen, 1998, p. 2)



According to Kuittinen, the four chosen perspectives are natural points of view to a CAI application. Clearly a good CAI application considers both the domain-dependent requirements of the teaching subject and the human learning processes. In addition, the user interface should be carefully designed and implemented, and some practical matters should also be considered. The researcher intends to discuss the four perspectives in Table 26 in the following subsections.

Table 26: Criteria for CALL Evaluation (Kuittinen, 1998, p. 2)

Perspective	Criteria
Domain-dependent demands	1. How topic is taught 2. Methods
Instructional demands	1. Student-centred learning 2. Instructional Support - Motivation - Interaction and feedback - Repetition - Practice
User interface demands	1. Interactivity 2. Screen Design - Display elements and connections between them - Colour and highlighting
Pragmatic Demands	1. Hardware and software requirements 2. Human resources and attitudes

5.21 Domain-dependent Demands

Kuittinen (1998) implied that different teaching methods play an important role in Mandarin instruction. What kind of things are to be taught and how they are taught should be addressed in the criteria of the domain of Mandarin learning. So how the Chinese language is learned, particularly vocabulary learning and listening comprehension are discussed. In this section, Lin (2000) discovered that vocabulary acquisition, which is very important not only for reading and writing but also for listening and speaking, could be influenced by students' motivation, their learning strategies, their learning experience, and the effect of the teaching they encountered. Based on Lin's discovery, factors affecting vocabulary learning, which includes students' motivation, their learning experience, their learning strategies, and the effect of teaching are discussed.

5.211 Chinese Language Learning

Lin (2000) indicated that for the beginning level, Chinese learners have to learn two representations of written Chinese, one in pinyin and the other in characters. The reality of learning Chinese is challenging for learners because of the lack of a match between the sound and the written form of Chinese words. Many learners and teachers as well try to avoid Chinese characters by emphasising only oral/aural Chinese, postponing the study of Chinese characters, or putting light weight on reading and even less on writing in the beginning stages of learning. Everson's (1998) study concluded that phonetic encoding is a necessary part in learning words written in characters. It seems that in order for Chinese foreign language learners to remember characters, they are employing strategies that are in some way very reliant upon their ability to pronounce them (p. 200).

According to Chu (1997), the grammatical structures of Chinese are

comparatively simple. At the same time, the semantic value for each syllable and for each scripted character is comparatively more difficult. Therefore, emphasis must from the beginning be put, first, on the correctness of pronunciation, especially that of the tones in this tonal language, and second on the capability in character-recognition and the production of this language that uses script. Yu and Michaels (1998) said that the written Chinese language requires the beginning student to learn three written forms of each new vocabulary item: romanisation, traditional Chinese character, and simplified Chinese character.

Yeh (1997) said that listening is the foundation of language acquisition. Therefore, teaching the comprehension of spoken speech, as Rivers (1981) recommended, should be of primary importance in a second-language classroom. Feyten's (1991) study revealed that better listening ability did not only contribute to the speaking ability, but also to the overall language proficiency. Herron and Seay (1991) pointed out that improving students' listening skills has been a long-standing goal of foreign language teaching.

Lin (2000) indicated that it is now more confident to say that second language acquisition is vocabulary acquisition. True vocabulary acquisition requires full vocabulary knowledge. According to Yang (2000), written word recognition is one of the low-level reading skills. It is one of the most basic reading skills in that while good word recognition does not guarantee good general reading proficiency, good readers are almost without exception good at word recognition.

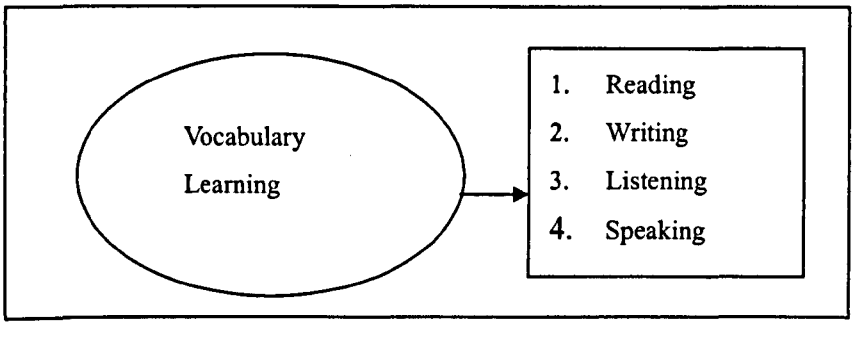
In the following subsection, vocabulary acquisition regarding pronunciation, character writing, and reading comprehension are discussed. Lin (2000) examined the relationship between vocabulary acquisition and language

acquisition. Everson (1998) suggested that there is a strong relationship between knowing a word's meaning and knowing its pronunciation for beginning level of Chinese as foreign language (CFL) learners. Ke (1996) made a study on character recognition and character production. Packard (1990) conducted a study to determine the effects of time lag in introducing Chinese characters into the elementary Chinese curriculum. Yang (2000) investigated the effect of word recognition in non-native adult learners and Shen (2000) investigated the interconnection of reading comprehension and reading-text-based writing performance among intermediate CFL learners.

5.2111 Vocabulary Acquisition

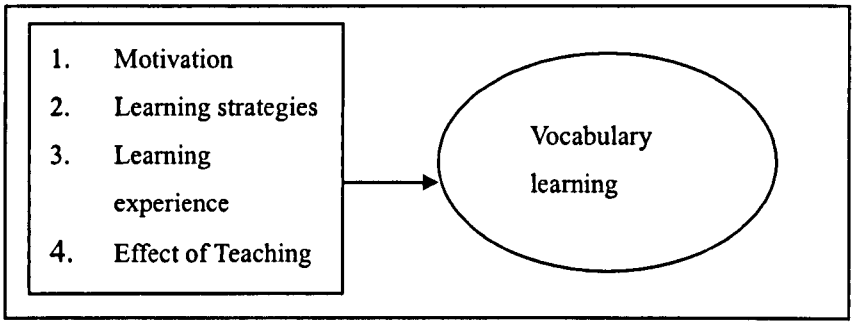
Lin (2000) said that passive vocabulary is demonstrated when the learners can make connections between sounds and meanings only, while active vocabulary is demonstrated when learners can relate not only sounds to meanings, but also can write out the words in characters. Lin's (2000) results were summarised in the following ways. The data seemed to suggest that a strong active vocabulary base is very important not only for reading and writing but also for listening and speaking. So the influence of vocabulary learning on reading, writing, listening, and speaking is shown in Figure 22.

Figure 22 : Influence of Vocabulary Learning on Language Skills in Lin's Study (Lin, 2000, p. 98)



Third, as learning progressed, the development of one's vocabulary knowledge from passive to active became easier, faster, and of better quality. In general, vocabulary acquisition could also be influenced by students' motivation, their learning strategies, their learning experience, and the effect of the teaching they encountered, as shown in Figure 23.

Figure 23: Factors that affect Vocabulary Learning in Lin's Study (Lin, 2000, p 99)



Lin (2000) made the following recommendation for Chinese language learning. First, develop well-rounded vocabulary knowledge in Chinese as foreign language (CFL) learning, which is in line with the vocabulary learning of the Mandarin CD-ROM development in this study. If teachers can put some effort into developing students' knowledge of characters, words, and word associations (glossary), the students' vocabulary acquisition will be more successful and therefore improve their language proficiency. Second, make the learning tasks within the limits of students' learning capacity. This corresponds to Caffarella's (1993) suggested autonomous behaviour of adult learners: their level of technical skills, their familiarity with subject matter, and their sense of personal competence as learners. Shorter dialogues and texts may allow learners to spend attention on vocabulary recall, sentence organisation and comprehension, which was information chunking, a factor contributing to the success of multimedia instruction suggested by Bagui (1998) who also stated that

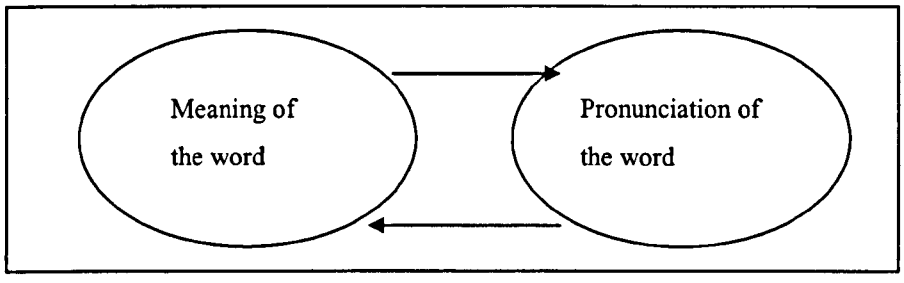
according to the information processing theory, an average person can hold up to seven chunks of information at a time in the short-term memory, and information is processed more easily and faster if it is appropriately chunked. Third, integrate listening, speaking, reading and writing in the teaching activities such that the process of teaching should be from input to output. A corresponding teaching approach that can promote better vocabulary acquisition is one that puts the listening activity before the speaking activity and the reading activity before the writing activity. Fourth, establish clear goals for students on written Chinese requirements. As suggested by Salomon (1983), when the perceived demand characteristics (PDC) of a medium were manipulated, such as just for fun or to watch carefully to learn as much from it, the latter condition was assumed to induce greater amount of invested mental effort (AIME) and lead to more learning. Teachers may need to establish clear goals for learners on how many words they expect them to have as active vocabulary and a good reason to learn written Chinese, such as trying to obtain an average of 250 active characters in one semester, with a gain of 2,000 characters in four years (Zhang 2000).

5.2112 Pronunciation

McGinnis' (1997) study favoured the adoption of pinyin as the means of providing basic pronunciation training in Mandarin Chinese. Everson (1998) investigated the relationship between pronouncing aloud and identifying groups of two-character combinations-word. The data suggested that among Chinese as foreign language (CFL) learners at this beginning level, there was a strong relationship between knowing a word's meaning and knowing its pronunciation. In Everson's (1998) study, when the participants knew the meaning of a word,

there was a mean probability of 91.4% that they also knew how to pronounce it, implying that for these students learning characters it is necessary to link the meaning with the spoken language, as shown in Figure 24.

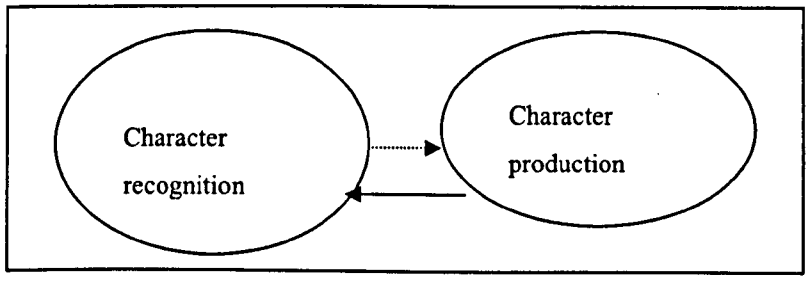
Figure 24: Relationship between Identification and Pronunciation of a Word in Everson's Study (Everson, 1998, pp. 199-200)



5.2113 Character Writing

Ke (1996) investigated the effects of instruction on both recognition and production performance. The results showed that students performed better in the recognition tasks than in the production tasks and with low density characters than high density characters in the production tasks. The correlational data seemed to suggest that poor character recognisers tend to be poor character producers and that good character recognisers also tend to be good character producers, suggesting that there was a stronger relationship between character production and character recognition among beginning CFL learners, as shown in Figure 25. However, Ke argued that those students who are good in recognising character can also be poor in producing character.

Figure 25: Relationship between Character Recognition and Production in Ke's Study (Ke, 1996, p. 345)

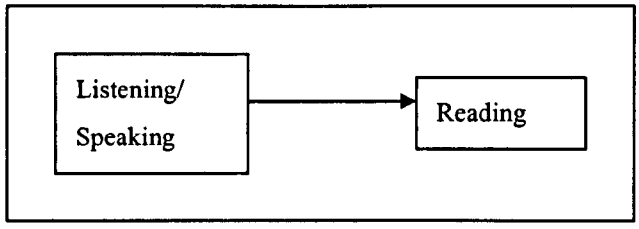


Packard (1990) tested the delay in the introduction of characters. For the lag group, the characters were introduced three weeks after the course began. The results supported the idea that providing students with a grace period before characters are introduced into the elementary Chinese curriculum is beneficial to the second language acquisition of Chinese and suggested that not delaying may detract both from students' ability to discriminate Mandarin sounds and from their fluency of the spoken language. It was found that it is the spoken language that benefits the most from the delay of the introduction of character.

5.2114 Reading Comprehension

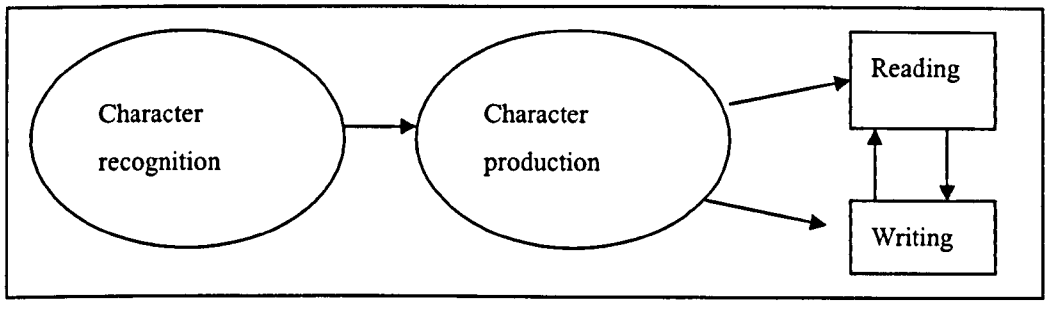
According to Knight (1994), students acquire vocabulary learning incidentally while reading. Yang (2000) said that written word recognition is one of the low-level reading skills and investigated the effect of word recognition on reading in Chinese by non-native CFL adult learners. Background learners are either those of Chinese background who can read and write Chinese or that their first language reading experience are similar to Chinese writing system, such as Japanese and Korean backgrounds. Non-background Chinese learners are of either English or Spanish background. The findings in Yang's study strongly supported those of Everson's (1998), showing that there is a strong correlation between being able to pronounce a word and being able to correctly identify its meaning. Yang concluded that in word recognition, beginning learners rely heavily on what words they have learned and how they have learned them and that the priority of a basic Chinese language study should always be given to spoken proficiency development. To become competent in reading in a second/foreign language needs a solid foundation in listening and speaking skills in that language (p. 15), as shown in Figure 26.

Figure 26: Relationship of Listening/Speaking Skills with Reading Comprehension in Yang's Study (Yang, 2000, p. 15)/



Shen (2000) investigated the interconnection of reading comprehension and reading-text-based writing performance among intermediate CFL learners and made three conclusions. First, reading comprehension contributes to the acquisition of writing skills. Second, writing as a production task also contributes to meaning acquisition in reading. Third, the association of character recognition and production contributes to the reading/writing connection as shown in Figure 27. She believed that learning characters integrated with reading and writing will greatly facilitate learning characters, which in turn promotes better reading and writing.

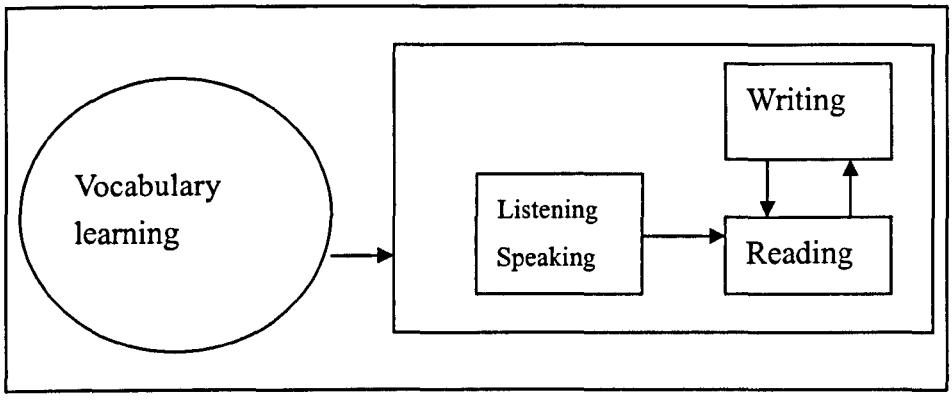
Figure 27: Relationship between Character Recognition/Production with Reading/Writing in Shen's Study (Shen, 2000, p.45)



5.2115 Conclusion of Chinese Language Learning

Based on the outcomes of the studies in the subsection, the researcher mapped out the relationship between vocabulary learning, listening/speaking skills, and reading/writing skills and it is shown in Figure 28.

Figure 28: The Relationship between Vocabulary Learning, Listening/Speaking Skills and Reading/Writing skills (researcher's viewpoint)



From Figure 28, vocabulary learning affects all language skills. As suggested respectively by both Yeh (1997) and Lin (2000) that listening and vocabulary acquisition are the foundation of second language acquisition, the Mandarin CD-ROM in this study provides authentic recordings for listening, and definition, translation, and word usage for vocabulary learning. This corresponds to Newnham's (1997) and Yu and Michael's (1998) advice with the implementation of the CD-ROM with the concentration on vocabulary learning: pronunciation, pinyin, meaning, and character writing. The implementation of authentic recordings for listening, definition, translation and word usage for vocabulary learning also corresponds to the decision of the Mandarin teacher in the main study who preferred the students to practise their speaking skills with him and their listening skills with the Mandarin CD-ROM, whether in class or at home.

5.212 Factors Affecting Vocabulary Learning

From Figure 20, the relationship of Dunn and Dunn learning styles model and Mandarin learning with the CD-ROM, the reader can see previous experience and beliefs, learning style, and attitude towards language learning can

affect motivation, which is the central point of that diagram, which in turn influences Mandarin learning with the CD-ROM. This corresponds to what Lin's (2000) claim about students' motivation, their learning strategies, their learning experience, and the effect of the teaching they encountered having an effect on vocabulary learning.

In the next section, case studies of students' motivation, their learning experience, which includes their beliefs, and finally their learning strategies, and teaching effects are discussed. Relationships between learning style, previous experience, beliefs, learning strategies, attitudes, motivation, and progress/achievement in language learning are drawn in Figure 33 (p. 220).

5.2121 Motivation

Sung and Padilla (1998) said that motivation plays an important role in achieving proficiency and students in the advanced classes of their study reported having greater motivation than did beginning level students in their study. Gardner and MacIntyre (1991) said that instrumental motivation is based in terms of the practical value and advantages of learning a new language while integrative motivation is individual-based, by having a personal interest in the people and culture. In this subsection, Sung and Padilla (1998) examined the motivation of elementary and secondary students towards the learning of Chinese and Wen (1997) investigated the motivational factors of students who were from Asian and Asian American backgrounds learning Chinese at the university level.

Part 1 of Sung and Padilla's study contained instrumental and integrative motivation for Asian language study, as shown in Table 27.

Table 27: Integrative/Instrumental Motivation for Studying Asian Languages in Sung and Padilla's Study (Sung and Padilla, 1998, p.207)

Studying Chinese is important because…
1. I will be able to participate in cultural activities for the language group
2. I will be able to meet and converse with more people.
3. It will enable me to better understand and appreciate art and literature of the culture.
4. It will allow me to be more at ease with native speakers of the language.
5. It will make me a more knowledgeable person.
6. I will need the language for my future career.
7. It will be helpful someday to get a job.
8. I will get respect from others if I know a foreign language.

Part 2 of the study included: a) motivation based on ethnic heritage, b) school-related motivation, and c) reasons based on personal interests. Reasons for studying Asian languages are shown in Table 28 and attitudes towards foreign language learning are shown in Table 29.

Table 28: Reasons for Studying Asian Languages in Sung and Padilla's Study (Sung and Padilla, 1998, p. 208)

I chose to study Chinese because….
1. It was my heritage language.
2. I want to converse with my relatives
3. I want to converse with my friends.
4. My parents encouraged me to study the language.
5. I heard that language classes at my school were good.
6. I heard that language teachers at my school were good.
7. I have friends who decided to study the language.
8. I want to study in a foreign country as a study abroad student.
9. I want to travel to countries where the language is spoken.
10. I thought that studying the language would be interesting.
11. I thought it would be more interesting than studying French, German or Spanish.

Table 29: Attitudes Towards Foreign Language Learning in Sung and Padilla's Study (Sung and Padilla, 1998, p. 209)

It is important to study foreign language because…
1. I wish to read newspapers/magazines in another language.
2. I want to read literature in the original language, not in translation.
3. I wish to learn many foreign languages.
4. I enjoy meeting and listening to speakers of other languages.
5. Studying a foreign language is an enjoyable experience.
6. I wish I could speak another language perfectly.
7. It is important for everyone to learn a foreign language.
8. If I stay in another country, I can use the language.
9. I want to speak the language if I visit a foreign country.

Female students had higher instrumental/integrative motivation to learn Asian languages. Overall, students in the advanced classes reported having greater motivation than did beginning level students, in instrumental/integrative motivation, ethnic heritage-motivation, and personal interests-related motivation. For the perception of parental involvement, female students' perceptions of their parents' involvement in Chinese language courses was significantly higher than that of male students. Sung and Padilla interpreted that parental involvement had an impact on ethnic heritage-related motivation. Motivation is also fostered by the students' interest in learning their ancestral language. In general, the longer students study a foreign language, the more motivated they appear to be.

Wen (1997) investigated the motivational factors of students who were from Asian and Asian American backgrounds learning Chinese at the university level. Four factors were found and conceptualised as motivation of instrumentality, intrinsic motivation, expected learning strategies and efforts and passivity towards requirements as shown in Table 30.

Table 30: Motivation, Expected Learning Strategies and Efforts, and Passivity towards Requirement in Wen's Study (Wen, 1997, pp. 238-239,248-250)

Instrumental Motivation
1. to use Chinese when travelling to a Chinese-speaking country
2. to meet and converse with more and varied people
3. to use it with Chinese-speaking friends
4. Chinese is an important language in the economic development of the world
5. to learn about other cultures to understand the world better
6. someday be useful in getting a good job
Intrinsic Motivation
1. because of interest in my cultural heritage
2. to better understand and appreciate Chinese art and literature
3. enjoy doing all the work
4. to better understand the problems that Chinese speakers face
Expectations of Learning Strategy and Efforts
1. think about the words and ideas which I have learned in my classes daily
2. spend about more than six hours per week to practise the language after class
3. will volunteer answers as much as possible
4. After I get my Chinese assignment back, I will always rewrite them, and correcting my mistakes.
5. I will try to speak Chinese after class in a wide variety of situations and as much as possible
Passivity towards Requirements
1. need to study a foreign language as a requirement for my degree
2. feel the class is less demanding than other five-unit courses
3. need it for study abroad

Findings indicated that two factors accounted for students beginning to learn the Chinese language. The first was intrinsic motivation; that was, to be interested in one's own cultural heritage and to better understand and appreciate Chinese art and literature. Intrinsic motivation had significant correlation with the desired outcome: understand Chinese people. Students who had culture-oriented motivation started to learn Chinese and to receive high achievement scores in their course. Another factor that motivated students to learn Chinese was passive attitude towards requirements. The presumption was that Chinese classes were less demanding and the reason for fulfilling requirements stimulated students to enrol in Chinese classes; however, it only

stimulated students to the extent of registering for a Chinese course. Their expectation of the learning task may not match the reality: that was, Chinese language courses were much more demanding than they expected. Students who had these passive factors received low test scores and were more likely to discontinue their study before reaching the intermediate level. Students who study Chinese for one year gradually understood the importance of memorising characters and developed their expectations of learning strategies. At this stage, expected learning tasks and strategies became the primary factor in predicting learning achievement. When students thought that outcomes and learning performances would lead to certain meaningful results, they were most likely to be motivated to exert effort in learning.

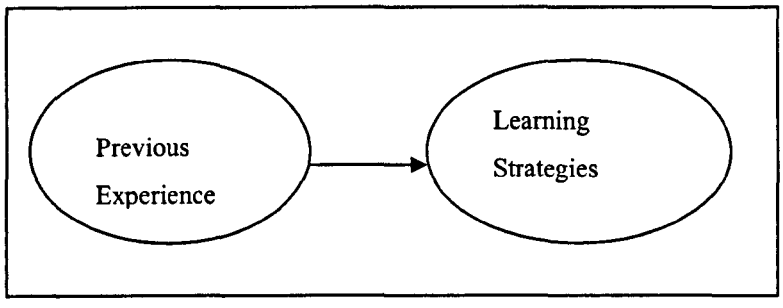
5.2122 Learning Experience

In this subsection, Bar-Lev (1995) performed a test with Mandarin Chinese who were categorised as either belonging to the HE (Home Exposure) or NHE (Non Home Exposure) group. Chao (1998) conducted an ethnographic study on speaking attitude on two university students, studying Chinese at the intermediate level in an intensive summer immersion study. Finally, Hayden (1998) performed a study to find the influence of a semester abroad on reading proficiency.

Bar-Lev (1995) performed a test with 6 Mandarin Chinese who were either with home experience (HE) or non-home experience (NHE). HEs did make fewer vocabulary errors and acquired Chinese word-order better than the classroom-taught NHEs. HE subjects tended to use code-switching, English words as a strategy for maintaining communication more often than NHEs did. In addition, they spoke with a less standard Mandarin accent as measured by

pronunciation errors. NHEs had more errors in vocabulary acquisition, tone acquisition, and word-order acquisition. It was possible that HEs' previous exposure to Mandarin may have had a positive effect in earlier acquisition. Based on this data, the researcher of this study can make the assumption that previous experience will affect their learning strategies as shown in Figure 29.

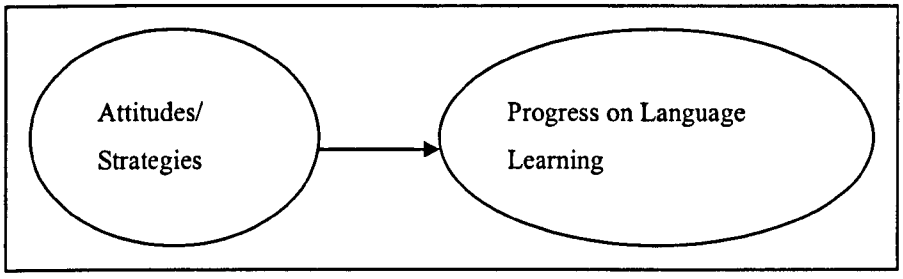
Figure 29: Influence of Previous Experience on Learning Strategies in Bar-Lev's Study (Bar-Lev, 1995, p. 61)



Bar-Lev noted that although the HEs are bilingual, they still use sentences as simple as those used by NHEs. They also tend to stammer and hesitate as much as the nonnative learners. HEs may hover somewhere between native and nonnative speakers. For this reason it seems that there is a need for different teaching strategies for this type of student. Despite the variety in their knowledge, HEs have enough basic knowledge to start formal Chinese studies from a different perspective.

Chao (1998) conducted an ethnographic study on speaking attitude on two university students, studying Chinese at the intermediate level in an intensive summer immersion course. A review of data pointed to the important role which students' attitudes and strategies towards the mandate to speak only Chinese had, in determining their progress as language learners, as shown in Figure 30.

Figure 30: Influence of Attitude/Strategies on Language Learning Progress in Chao's Study (Chao, 1998, p. 2)



There were two students involved: Daniel and Karen. In Daniel's case, he was not ready to speak Chinese, at least not in the sense of total immersion. His unreadiness stemmed largely from his attitude towards learning. Frequently Daniel expressed frustration at the beginning confined to speaking only Chinese. During the first few weeks of the course, he felt apprehensive when speaking Chinese in public. He saw himself as inarticulate and realised the limits of his language ability. On occasions when he had to mix with more advanced students, Daniel would remain silent to cover his embarrassment at not understanding the conversation. He shied away from sitting with teachers as well, since he knew that they would correct his Chinese in front of other students. Not able to perform well academically, Daniel's disposition might have exacerbated his problems in speaking Chinese. The midpoint of the course marked a clear change in Daniel's attitude towards learning. After the mid-term exam, partly because of physical fatigue, and partly because of disappointment in his performance, Daniel began to withdraw and to refer to himself as a bad student. His motivation to learn Chinese had apparently disappeared. His change in self-image from a confident to a hesitant learner stemmed from the inability to be perfect in whatever task he chose. If he could not perform at the highest level, Daniel preferred utter failure to mediocrity. Many of the characteristics descriptive of Daniel may be gender specific. In one of his journal entries,

Daniel maintained that overall women fare better than men as language learners because they are more verbal, while men are often thinkers who do not care to make small talk. The immersion environment challenges self-image. Daniel's case confirmed what Walberg and Uguroglu (1980) said about students who get off at a bad start in school may become less motivated, learn at a lower rate, and fall increasingly behind in both learning and motivation.

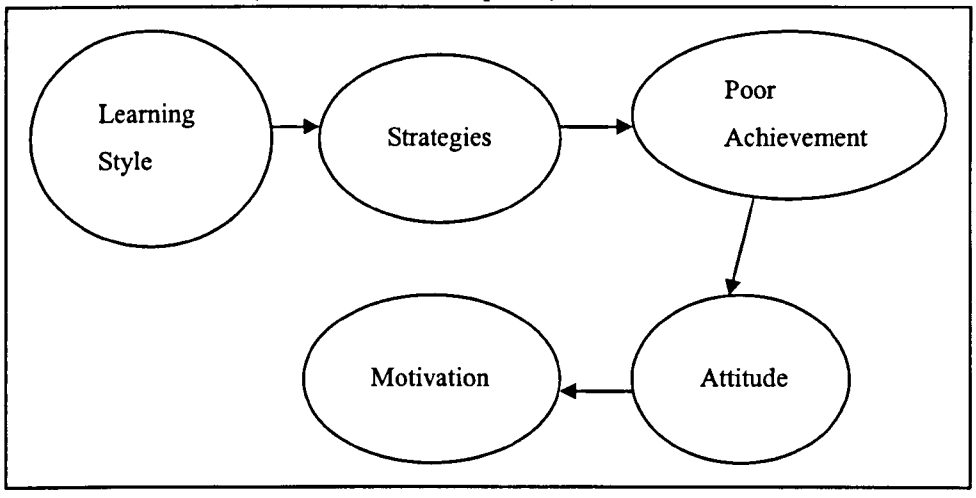
For Karen, the necessity to use Chinese in all circumstances lent excitement to her days. She claimed that she really liked to speak Chinese and she enjoyed the challenge. Karen had confidence in her ability to deal with everyday situations in Chinese. She noted, 'I think that I can tolerate the simplicity of my Chinese' (p. 5). Rather than engage in self-criticism, Karen held a constructive attitude towards her limited language performance. She found that free conversations out of class also provided valuable opportunities to practise Chinese. After class, Karen enjoyed taking part in as many extracurricular activities as time allowed. She especially enjoyed Chinese movies and valued them for what they revealed about Chinese culture. When Karen joined the theatre group, she did not mind being assigned only a few lines in the play.

Chao (1998) claimed that the two cases of Karen and Daniel represented the receptivity and defensiveness of attitude and suggested that a receptive learning attitude derived from an accurate understanding of the immersion environment is the key to effective learning. Clearly, Karen modelled receptivity, searching actively for opportunities to use Chinese while Daniel retreated behind a wall of defensiveness. The immersion created pressure to perform in and out of the classroom, and students experience various kinds and degrees of anxiety. Whereas Daniel sought to insulate himself against his perceived failure with the simplicity of his Chinese language, Karen cultivated the extracurricular scene for

sources of social and intellectual stimulation. After the summer course, in the interviews, both Karen and Daniel agreed with the rationale that the more one speaks, the more one will become proficient, and the less one will feel intimidated. Throughout the course, Daniel held a guarded attitude towards his surroundings. Karen, on the other hand, fully grasped the significance of the total language environment, by not allowing her friends to speak English. In addition, Karen liked to communicate with people in Chinese in different situations. As a consequence, her practice in Chinese escalated and her language proficiency improved quickly.

Daniel being an introvert exacerbated his difficulties in learning and created strategies that he would remain silent to cover his embarrassment at not understanding the conversation, shielding away from sitting with teachers and being afraid that they would correct his Chinese in front of the others. The result of his midterm examination changed his attitude by withdrawing and referring himself as a bad student, and his motivation to learn Chinese had apparently disappeared at the midpoint of the course. Based on Daniel's case, the researcher of this study can make the assumption that learning style will affect learning strategy and learning outcome and finally attitude and motivation as shown in Figure 31.

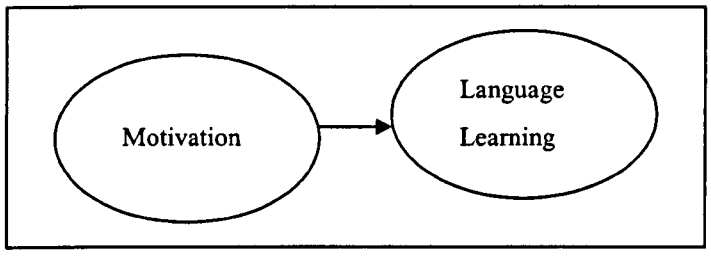
Figure 31: Effect of Learning Style on Attitude/Strategy/Achievement and Attitude/Motivation (researcher's viewpoint)



Hayden (1998) performed a study to find the influence of a semester abroad on reading proficiency. Only two students out of twenty-one students showed reading proficiency gains. Of those students who showed no gain in reading proficiency, Hayden (1998) suspected that they apparently experienced an increase in vocabulary and character recognition. Three reasons that could possibly explain this no gain in reading situation are not doing enough reading, not preparing for class, and motivation. The participants reported that they did not do much reading apart from preparing the classroom materials. Only six actually went out of their way to read material outside of what was presented in their textbooks. Four participants felt overwhelmed by the amount of time required in attending that class time in China was a waste of time. Three participants even went so far as to stop attending some of their formal class hours by the tenth week of the semester. Many of the participants admitted that they felt that they did not prepare much for their classes. They also reported that, depending on whether tests were approaching, or other possible external activities, the time they spent preparing would vary. A possible factor in the

overall gain in reading proficiency may be the amount of reading for pleasure students do on their own. Hayden (1998) said that the participants' reported motivation for coming to China to study varied. The influence of motivation on language learning is shown in Figure 32.

Figure 32: Influence of Motivation on Language Learning in Hayden's Study (Hayden, 1998, p. 22)



A majority of them stated that their main goal during this period of study abroad was oral proficiency development. Of the twenty-one participants surveyed, fourteen said that they wanted to work on their speaking abilities. Of the remaining seven participants, four said they wanted a total immersion experience, two said they wanted to specifically develop reading skills, and one listed developing writing skills as the most important.

5.2123 Beliefs

Previous experience was just discussed. Samimy and Lee (1997) pointed out that beliefs are influenced by previous experience in Figure 2 (p. 25) and Horwitz (1988) indicated that students' beliefs about language learning could be based on limited knowledge and/or experience. Therefore student' beliefs are discussed in this subsection.

Samimy and Lee (1997) compared learners' beliefs and their instructors' beliefs. Eighty-one percent of the students and all of the instructors responded

that Chinese is a "very difficult" or "difficult" language. Forty-six percent of the students and 67% of the instructors respectively chose writing as the hardest. When they were asked to compare reading and writing skills with speaking and listening skills, both students and instructors felt that reading and writing skills were more difficult than speaking and listening. In terms of strategies, 58% of the students agreed that the most important part of learning a foreign language is vocabulary learning while only 20% of the instructors agreed with this and 40% of them disagreed. Similarly, while 50% of the students felt that grammar was very important only 10% of the instructors agreed and 40% of them disagreed. In addition, among the students, over one-third of them thought the most important part of learning Chinese was a matter of translating from English to Chinese. Eighty-nine percent of the students and 90% of the instructors felt that accurate pronunciation was important for communication in the target language. Both the students and instructors agreed that it was important to repeat and practise as much as possible, which is similar to the audiolingual approach, which emphasise accuracy and repetition.

Overall, there was a good fit between the students' and teachers' belief systems about learning a foreign language as well as learning Chinese. In terms of beliefs and learning outcome, those students who receive higher grades tend to have a combination of integrative, instrumental, and intrinsic motivation. Integrative motivation, such as "I would like to have Chinese friends" and instrumental motivation, such as "If I learn Chinese very well, I will have better opportunities for a good job" seem to be related to higher grades. Another observation was that when a student has a higher grade, he or she tended to have intrinsic motivation, "I want to learn to speak Chinese very well" (p. 51). The results clearly indicated that the majority of the learners' beliefs are shared by

their instructors except in a few instances. The differences in their belief systems which may stem from the students' lack of experience in language learning in general and in learning Chinese, which confirmed that fact of what Horwitz (1988) said that students' beliefs about language learning can be based on limited knowledge and/or experience.

5.2124 Learning Strategies

Based on what Bar-Lev (1995) said about previous experience will affect students' learning strategies, learning strategies are discussed. Ke (1998) explored the relationship between strategies and achievement in character learning. Hayes (1988) investigated the amount of phonological, visual and semantic processing strategies among native and non-native readers of Chinese Mandarin. And finally, Hong (1998) evaluated politeness strategies employed in Chinese business letters.

Ke (1998) explored the relationship between strategies and achievement in character learning and found that the majority of the learners valued the strategies that involved the learning and use of character components (radical and phonetic), but also felt the need to memorise a character as a whole and practise writing it repetitively. More non-heritage learners considered practicing character writing more effective than reading a character text for character learning and considered associating new characters with characters they were already familiar with in terms of graphic structure to be more effective than associating them with sounds, which is different from Everson's (1998) finding.

Hayes (1988) performed an experiment of two word (character) recognition tests. At the word level of processing, the native Chinese immediately associated the symbol with a particular sound and the non-native readers seemed

to use a mixed strategy of phonological and graphic processing. At the sentence level, the natives used a mix of graphic and semantic strategies and the non-native readers used a visual strategy.

Hong (1998) evaluated politeness strategies employed in Chinese business letters. Results showed that L2 learners were deficient in producing culturally appropriate speech acts such as apology and request in a written form. Since learning a foreign language is a cultural experience, Hong (1998) suggested that target culture and linguistic behaviour appropriate to that particular culture be taught to the students in the entire learning process.

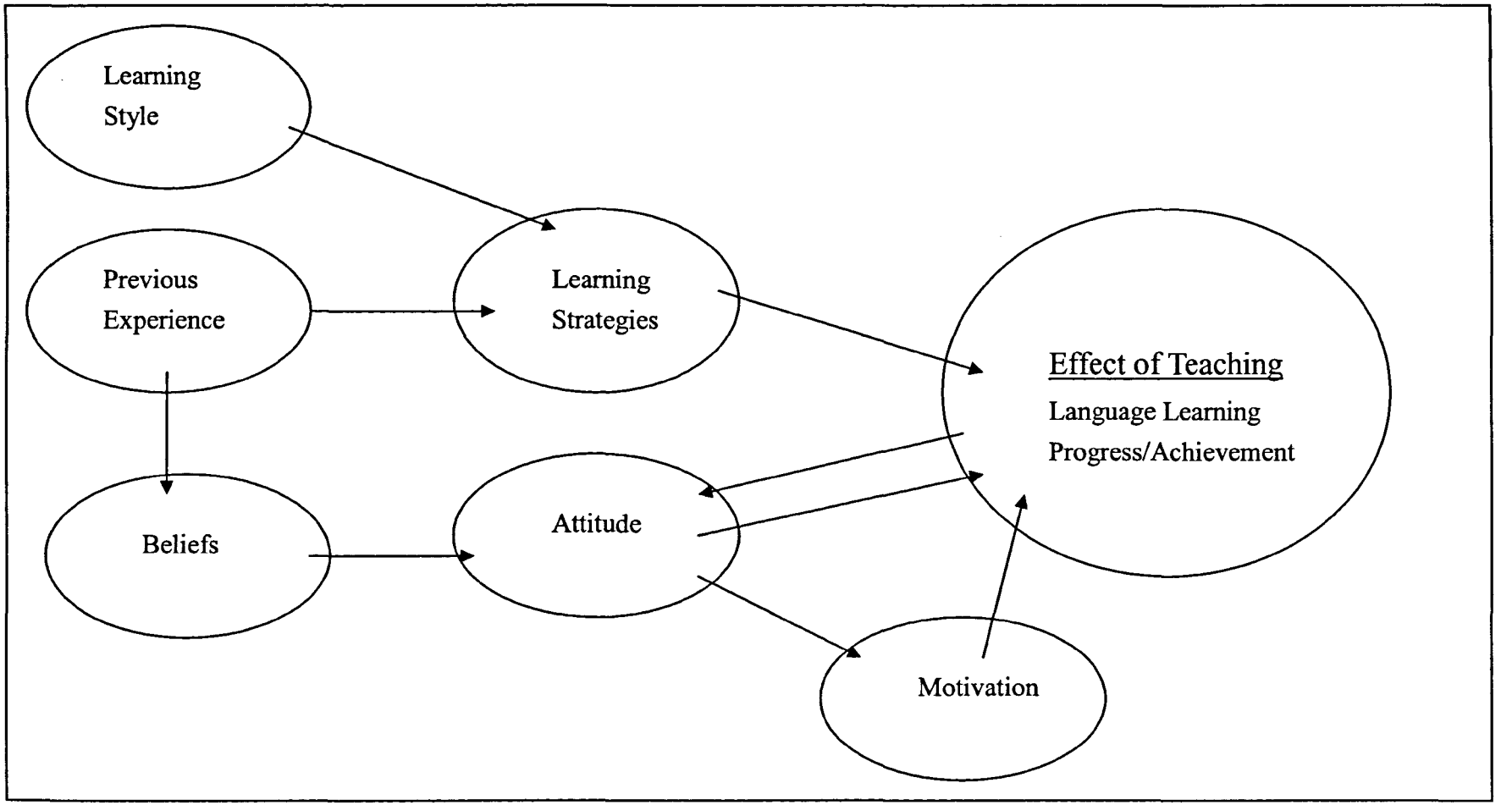
5.2125 Effect of Teaching

Chiang (2002) said that one primary challenge encountered by Chinese language teachers is how to structure effective beginning Chinese courses. Research in this field has been growing in various directions since 1997, along the lines of learner-centred research. She believed that learners' perspectives on learning CFL have a role to play in deciding what is the best approach to teach beginning-level Chinese. Based on her belief, this research also emphasises learners' perspective on learning CFL.

In this subsection, the relationships between previous experience, beliefs, strategies, attitude, motivation, and effect of teaching are drawn out followed by Chiang's investigation into the process of learning Chinese.

First, based on the outcomes of the studies in the previous subsections, the researcher of this study believes that the effect of teaching is how well learners learn at the end of the given instruction, which will depend on their motivation, their attitude, their belief, their previous experience, and their learning strategies as shown in Figure 33.

Figure 33: Relationships between Previous Experience, Beliefs, Strategies, Attitude, Motivation and Effect of Teaching (researcher's point of view)



In Figure 33, Samimy and Lee (1997) pointed out that students' beliefs are influenced by their previous experience which in turn affects attitude towards language learning (Figure 2, p. 25). Bar-Lev (1995) said that previous experience affects learning strategies (Figure 29, p. 211). Chao (1998) pointed out that learning strategies and attitudes affect progress on language learning (Figure 30, p. 212). Hayden (1998) said that motivation affects language learning (Figure 32, p. 216). The researcher concluded that learning style affected learning strategy and achievement and finally attitude and motivation (Figure 31, p. 215). Students' language learning progress and their achievement are the effects of teaching.

Chiang (2002) investigated the process of learning Chinese. The learners' own words were presented to disclose individual Chinese learning experiences are displayed in the following tables. Table 31 summarises students' responses on difficulties in Chinese language learning.

Table 31: Summary of Students' Response on Difficulties in Chinese Language Learning in Chiang's Study (Chiang, 2002, p. 48)

Memorisation	5	20%
Tones	5	20%
Speaking	5	20%
Listening	4	16%
Characters and Writing	4	16%
Semantic Distinction	2	8%
Reading	1	4%
Integrating	1	4%
Thinking	1	4%

In general, students regarded tones, speaking, and vocabulary retention as more difficult than character writing. Table 31 also shows that speaking is difficult for 20% of the participants and tone is also difficult for 20% of the participants. Chiang (2002) pointed out that producing correct tones is not easy.

It requires correctly perceiving the tones, distinguishing the tones, memorising the tones, producing the tones in isolation, and finally, producing the correct tones for every word in natural speech. The student responses also showed that learners vary from person to person in their language-learning ability. It is important for the teacher to be aware of students' individual preferences, whether they are visual or auditory learners. Out of the 25 responses, only three students said grammar was the comparatively easier aspect in Chinese learning. Chiang (2002) pointed out that some beginning-level Chinese teaching has turned away the difficult aspects of Chinese learning and moved towards teaching the easier aspects of Chinese—teaching Chinese without instruction in tones and characters. The students' responses on learning strategies are summarised in Table 32.

Table 32: Summary on Students' Response on Learning Strategies at the Beginning Level in Chiang's Study (Chiang, 2002, p. 50)

Pay more attention to pronunciation	12	48%
Pay more attention to character-writing	4	16%
Practice patterns/grammar more	4	16%
Establish good study habits	3	12%
Learning about radicals and components	2	8%
Same as before	2	8%
Read more	1	4%
Learn more about history and culture	1	4%
Start before puberty	1	4%

In Table 32, learning characters, pronunciation, and grammar were the predominant learning methods that students responded on. Chiang's finding reassured that in first-year college-level Mandarin teaching, the linguistic core is more essential and more difficult to master than are the social and cultural components of China or the Chinese language.

Chiang said that in the transition from the audiolingual approach to the

communicative approach, some teachers sought to supplement a structure-oriented textbook with functionally oriented activities, authentic reading and listening materials and a wide range of cultural topics. Some teachers added computer-assisted language learning (CALL) materials to their curriculum. Table 33 shows a summary of students' suggestion on classroom activity.

Table 33: Summary on Students' Response on Classroom Activity in Chiang's Study (Chiang, 2002, p. 52)

Encourage student-to-student conversation but with teacher correction	11	44%
Prefer teacher-to-student conversation or feel student-to-student conversation not helpful	10	40%
No difference	4	16%

The responses proved that students would seek proficiency but consider teacher correction necessary to achieve improvement. Chiang also hoped that findings have raised teachers' awareness of the Chinese-specific learning process. In terms of pedagogy, what students perceive about difficulties in learning Chinese, whether they prefer student-to-student conversation or teacher-to-student conversation, should shed some light in Chinese language teaching.

Chiang (2002) also made some teaching tips for beginning Chinese level based on learners' perspective in Table 34.

Table 34: Teaching Tips for Beginning Chinese Level in Chiang's Study (Chiang, 2002, p. 59)

1. Teach, practice, and test pinyin, tones, and tone rules. Require students to pay conscious attention to tones.
2. Help students retain their vocabulary by recycling the previously learned vocabulary.
3. Give a well-round vocabulary presentation during oral/aural exercises. Associate character, sound, and tones, with meaning.
4. Be aware of learning differences between visual learners and auditory learners.
5. Emphasise the linguistic core of the Chinese language system at the beginning. Correct students' errors.
6. When asking students to do student-to-student conversation in class, make sure it is always monitored and controlled.
7. Be sensitive to students' difficulties.
8. Encourage beginning students to use flash cards, listen to tapes, and set a specific time to study Chinese regularly every day.

Chiang's suggestion about giving a well-round vocabulary by associating character, sound, and tones, with meaning corresponds with Lin's (2000) recommendation for Chinese language learning about developing well-rounded vocabulary knowledge in CFL learning, which is in line with the vocabulary learning of the Mandarin CD-ROM development in this study with the concentration on vocabulary learning: pronunciation, pinyin, meaning, and character writing, as stated in the second chapter. Chiang's suggestion of being aware of visual and auditory learners is in line with this study's analysis of the students. Chiang also indicated that given the fact that Chinese has a unique tonal system and a nonalphabetic writing system, some learning process should be Chinese-specific. Major components of CFL pedagogy should grow out of direct observation of CFL learners. Teachers should not copy teaching ideas based on findings from the commonly taught languages without taking the distinct Chinese linguistic features into consideration.

5.2126 Conclusion of Factors Affecting Vocabulary Learning

Bar-Lev (1995) distinguished two types of students: Home Exposure (HE) and Non-Home Exposure (NHE), in studying the Chinese language and suggested different teaching strategies must be used for each type of student. Hayes (1988) performed his experiment of two-word recognition with native and non-native readers and found that they used different strategies in reading. For the purpose of investigation in this study, besides visual/auditory, inductive/deductive, knowledgeable/low prior knowledge and strong/weak students, the researcher of this study also classified students on whether they are home exposure or non-home exposure student, or whether they are Chinese, Macanese or Portuguese students.

Domain-dependent demands were just discussed, with emphasis on Mandarin learning and learners' perspective on their progress and achievement. Based on the evaluation perspectives in CALL as shown in Figure 21 (p. 195), instructional demands for CALL are discussed next.

5.22 Instructional Demands

According to Kuittinen (1998), CALL should be student-centred and based on students' needs. Consequently, it should be interactive and controlled together by a student and computer. These demands, when they are fulfilled, promote students' motivation. It is important that instruction should be based on students' previous knowledge to allow students to connect new information to their existing knowledge that strengthens their learning.

Kuittinen (1998) said that feedback, which plays an important role in a CAI application, could be divided into two categories: instructional feedback and technical feedback. Instructional feedback contains all feedback related to the subject domain and the contents of teaching material. Technical feedback

should be highly informative since the display size is limited, consequently, displaying unnecessary information should be avoided. Repetition is necessary for learning and it should be used for strengthening students' learning. Students should have a possibility to practise their new knowledge and skills. In this section, student-centred learning in the CALL environment is discussed first. Then instructional support such as motivation, interaction and feedback, repetition, and practice are mentioned in the pedagogical considerations for CALL.

5.221 Student-Centred Learning in the CALL Environment

Zhang (1998) suggested that CALL programs could be like modern human teachers who take on the role of facilitators by providing a learner-friendly and learner-centred environment. Such an environment should provide, within easy reach, all the tools necessary to read or write whatever text the learner chooses. What is needed is better integration of different resources. Two of the most important resources are the text editor and the dictionary. The computer text editor is far superior for pedagogical purposes to the conventional way of reading and writing. Reading electronically, even without on-line help in vocabulary and grammar, can help pronunciation and listening when digitised sounds are available. Writing electronically can allow one to gain facility in romanisation, recognition of characters and differentiation of homonyms. The dictionary represents one of the best uses of the computer technology. The most important advantage is the ease of sorting, retrieval and cross-referencing. The possibility of adding audio and video simply renders it even more superior to the printed medium. The two resources should be linked together to realise their full potentials. These links allow the users to instantly look up words and characters

in reading or writing.

According to Zhang (1998), the CALL environment provided a number of advantages. Firstly, while tutors and self-study courses are closed-ended and their usefulness does not last beyond the materials covered, a facilitative learning environment can have longer life spans. Secondly, these tools can be flexibly integrated with any curriculum. Thirdly, the use of such tools encourages learner initiative. Lastly, references and learning tools represented the best application of this environment. The researcher of this study feels that all these suggestions given by Zhang represent student-centred learning.

To facilitate self-learning, Zhang recommended several areas of ergonomics and they are menu, toolbar and navigation, help, terminology, integration, and personality. To facilitate usage, menu items should be descriptive; toolbar icons should be intuitive and navigation should be fast, simple or familiar to the user. In most CALL programs, on-line help is presented in pop-up text windows or dialog boxes. It seems that despite on-line help, the hard copy manual still has a number of advantages, catering to some users' preference, and plainly visible. The ability to have everything within easy reach should be an important ergonomic consideration. The best way to reach everything is to integrate the dictionary, pronunciation tutor, character tutor, and others in the same program. CALL programs can have personalities too. Some are charismatic and inspiring; some are quiet but helpful; some are pedantic and overbearing. Some are more fun than others.

The entire process of using a computer to assist language learning does not even require the teacher to be in direct contact with the students, although CALL works best when integrated with normal classroom teaching patterns (Ahmad, Corbett, Rogers and Susex, 1989, p. 5). Luk and Ng (1998) maintained that

CALL packages can be designed and used as supplementary materials to traditional classroom learning. This places an emphasis on the design so as to integrate existing curriculum with computer-based learning, focusing on areas where exercises or learning can reinforce material learned in class, providing a more stimulating and less stressful environment for learning, as well as improving computer literacy among students (p. 3-4).

5.222 Pedagogical Considerations for CALL

Zhang (1998) pointed out that there are four issues to be considered about CALL instruction, and they are material selection and sequencing, presentation, practice, and feedback. In terms of material selection and sequencing, the computer with its random-access ability allows the learner to control selection, sequencing and the pace of learning. Learner control allows accommodation of individual differences in background and ability and therefore increases the efficiency of the learning process. To allow learner control, with maximum redundancy, by providing on-line help for all vocabulary and grammatical items. Some learners, especially those at the beginning level, may feel overwhelmed when confronted with many choices. They may feel more comfortable following a teacher-suggested sequence of activities.

In terms of presentation, Zhang noted three features: multimedia, easy access, and timing control. Multimedia presentations have been used to various extents in all CALL programs. It allows instant retrieval of help for pronunciation and comprehension, with the simple "when in doubt, click" format. The easily available help also enables the option of hiding the help initially, hence making it possible for the learners to challenge themselves. Redundancy of glosses and explanations further encourages learner-choice in lesson selection and sequencing. Timing, impossible to do in a printed textbook, has been used in

some CALL programs. Comprehensibility should be the most important consideration in presentation.

In terms of practice, the most important pedagogical activity is undoubtedly the exercises, including drills, games and quizzes. Most CALL programs have taken advantage of the interactive capability of the computer and have provided various exercises. Zhang (1998) argued that there are more exercises for receptive skills than productive skills and recommended the Find/Identify and the Matching exercises.

Zhang also noted that a major reason for the usefulness of CALL programs as tutors lies in their abilities to provide feedback. There are a number of options for providing feedback. Feedback can merely inform the learner of error. It can also provide hints for the benefit of further trials. It can also go further and provide the correct answer. Feedback can also be immediate or delayed. While any feedback is an improvement over a printed textbook, it should be pointed out that there are questions about feedback. Which is better, the desirability of immediate and explicit feedback, or learners arriving at the correct answer rather than by direct disclosure? Zhang suggested 'there remains much room for improvement in the quality of feedback' (p. 72). The common problems with feedback are: categorical judgment, lack of explanation, and negativity. Categorical judgment emphasises absolute accuracy rather than the more realistic goal of fluency, lack of explanation reduces language learning to simple trial and error, and the negativity of feedback is detrimental to student affect. Interaction and feedback will be discussed more in the user interface demands section, which is discussed next.

5.23 User-Interface Demands

Kuittinen (1998) said that the user interface is an important part of CALL, since it is the only means for students to communicate with the computer. This reflects the comments of Reeves (1992) who said that the effectiveness of interactive multimedia is constrained by the design of the user interface. On one hand, the user interface should provide all the necessary information for students at any time, but on the other hand it should be kept simple in order that students do not lose the essential information. Milheim (1995) indicated that effective computer-assisted instruction includes the appropriate use of personalised feedback, intuitive screen design, the effective utilisation of colour, the availability of context-sensitive help screens, and relevant reinforcement. Interactivity and screen design in terms of display elements and colours and highlighting are discussed next.

5.231 Interactivity

Romiszowski (1993) said that interactivity can occur between teacher and learner, learner and learner, and learner and a computer-based system. Stemler (1997) pointed out that student's feedback, interactivity and screen design are features that are used for instructional purpose in the multimedia environment. Reeves (1992) pointed out that the quality of interaction is determined by the skills and experience the students have with the medium and the degree to which the medium has been designed to support the interaction. Milheim (1995) indicated that interaction can be simply defined as the two-way communication that occurs between a learner and the educational materials presented during an instructional lesson and therefore the significant use of interactivity would seem quite important for the effective design of instructional materials delivered by a

computer.

According to Kuittinen (1998), a computer application is highly interactive if the student and the computer control the flow of it together. Students should be aware of where they are in the application, what actions they have taken, whether these actions have been successful, and what actions should be taken next. Flexibility is an important feature of an application. Students should be able to undo and redo actions, look through a sequence of displays in either direction, move to different parts of applications as needed. User guidance and support should be informative, easy to use and relevant.

Sims (1997) described several classes of interactivity used in the development of the CD-ROMs in his study and they are object, linear and support interactivity. Object interactivity refers to an application in which objects, such as buttons are activated by using a mouse. When the user "clicks" on the object, there will be some form of audio-visual response. Linear interactivity refers to applications in which the user is able to move forward or backward through a predetermined linear sequence of instructional material. The inclusion of support interactivity extends the options of the developer to include both general and context-sensitive support, which may range from simple help messages to complex tutorial support.

Yang (1998) said that the central role played by learners' interactivity in multimedia applications is one of the obvious advantages of multimedia enhanced learning over traditional language learning that relies on textbooks and analog media. The use of multimedia applications creates an interactive learning environment that encourages proactive learning. Interactivity is vital for language learning because interaction (communication) in the language is not only the most effective approach to language learning but also its ultimate goal.

Feedback is discussed next. According to Stemler (1997), feedback is information about the appropriateness of the learner's response that is given to the learner by the courseware. It is interaction between the students and the computer. Brandl (1995) said that error correction and feedback have been considered to have an impact on second language acquisition. In CALL, the vast majority of drill-and-practice type software that deals with grammatical features consists of multiple-choice and fill-in-the-blank activities. Input from the users is generally limited to one or two words and usually feedback does not go beyond right or wrong. Pujolà (2001) identified the different types of feedback: immediate or delayed feedback, written, spoken or both feedback, negative or positive feedback, self –discovery or program disclosure feedback, and explicit or implicit feedback. In this subsection, van der Linden (1993) investigated whether or not feedback enhances computer-assisted language learning. Brandl (1995) analysed students' preferences for error feedback options and responses. Pujolà (2001) investigated learners' use of various help facilities with the focus on feedback.

van der Linden (1993) conducted a study to find out if feedback enhances computer-assisted language learning with first-year French students in a grammar course. It was found that individual differences played a role in the choice of students' strategies in the CALL application. Many problems arose from editing. The longer the feedback was, the less it would be read. van der Linden (1993) said that a practical conclusion arising from her study was that feedback, in order to be consulted, has to be concise and precise (p. 65). Long feedback, exceeding three lines is not read and for that reason is not useful.

Brandl (1995) analysed low- and high-achieving students' preferences for error feedback options and responses in a German CALL program. The high

achievement (HA) students showed more willingness to engage in the error correction than low achievement (LA) students. The strategy of looking up the correct answers was observed more often with the LA students than the HA students. It seemed important to the HA students to find the correct answers on their own. LA students seemed to prefer those strategies that demanded the least amount of effort. This study argued that deficiencies in the LA learners' language skills might contribute to lowering their engagement in cognitive and motivational processing.

Pujolà (2001) investigated adult Spanish learners' use of various help facilities with the focus on feedback. Students received immediate feedback for the general comprehension question. It was noticed that most students when they obtained the correct answer, skim read the feedback message quickly or simply read the "That's correct" message, without paying much attention to the sentence explaining why that option was the right one. It was also noticed that students who were convinced of an answer had more problems in understanding the explanation, since they had a fixed idea from their past experience and then had more difficulties in identifying where the source of error was. Students in general valued the fact that the program provided explanations and regarded the degree of help the explanations provided supplied them the particular details that they missed which was the cause of the error.

5.232 Screen Design

Kuittinen (1998) said that attention should be paid to several elements when designing a user interface. These elements include not only text, pictures and animation but also the connections between these display elements, usage of colours and highlighting, and how displays appeal to students. Good general rules in display design are to keep things simple and leave blank space around

elements. Organisation of different types of information affects the visual clarity of an application, since text and visual elements support each other when their connections are carefully designed. Kuittinen also suggested that authors of CAI should be careful when choosing and combining colours to the computer software, since depending on authors' ability to apply them, colours can help or hinder a design. Visual clarity of an application suffers from careless use of colours. Highlighting, like colours, affects the visual clarity of an application. Since highlighting is a useful tool in interface design, authors should remember several things in order to be successful in a design process. Highlighting should be used for providing a focus on the most important things and it should be used sparingly. Since if everything is highlighted, nothing is important. The use of too many colours or too many text styles in one display can be disturbing and diminish readability of information. There exist several ways of how a display can appeal to students. The basic rule is that new information should be near the most recently displayed information.

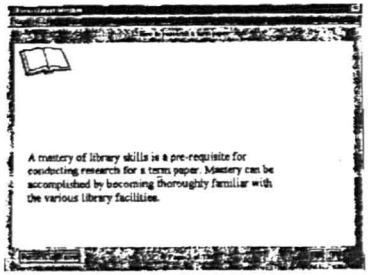
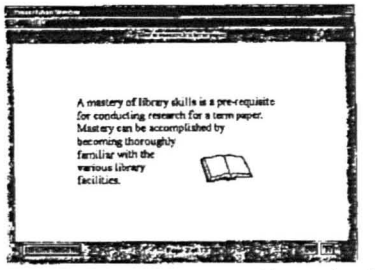
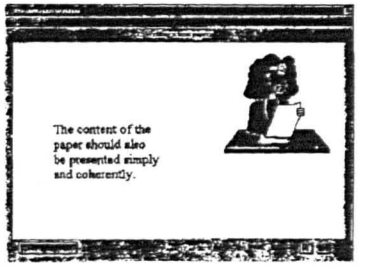
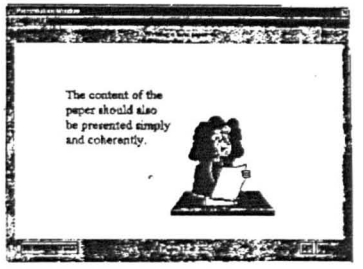
According to Szabo and Kanuka (1998), the principles of design included unity, focal point, balance and colour (see Appendix 4). Unity is also referred to as harmony. The basic assumption behind unity is that if objects in a design appear separate and/or unrelated, the pattern falls apart and lacks unity. Focal point is a point of emphasis or the centre of interest, which attracts viewer's attention and encourages the viewer to look further. Once a designer selects the images for a composition, a decision must be made on how these images are to be balanced on the page. There are two ways to balance: symmetry, and asymmetry. When there are objects of the same general size and shape placed in an equal distance from the centre, the result is a symmetrical balance.

In this subsection, Szabo and Kanuka (1998) conducted a research to

determine if screens that employ accepted principles of visual design influence learning process. Lin (1997) investigated how different combination of background colours, text brightness and text colour in the Chinese CAI that may influence the affection, perception, and cognition of students. Lee (1996) drew together interface guidelines from a variety of sources.

Szabo and Kanuka (1998) conducted a research to determine if screens that employ accepted principles of visual design, unity, focal point, and balance and colour, influence learning process. Colour was not included in this study. The independent variable was screen design as shown in Table 35; the dependent variables were recall learning, lesson completion time, and completion rate. There was no difference in achievement scores between students who used the lesson with good design principles and those who used lesson with poor design principles. However, students who used the lesson with good design principles completed the lesson in less time (21%) and had a higher completion rate (74% vs. 45%) than those who used the lesson with poor design principles. Therefore Szabo and Kanuka (1998) concluded that poor use of design principles was related to increased instructional time and a reduced completion rate, or persistence.

Table 35: Szabo and Kanuka's Screen Design (Szabo and Kanuka, 1998, pp. 33-35)

Design Principle	Description	Bad Design (BD)	Good Design (GD)
Unity	BD lacks unity because 1) The sum total of the square inches between the objects is greater the total of the square inches around the objects as a group 2) The objects are closer to the edge than they are to each other		
Focal Point	BD is too close to an edge, it will tend to draw the viewer's eye out of the picture In GD the dark edge of the book leads the viewer's eye into the text		
Balance	BD fails to achieve balance as the large dark graphic is placed too far away from the centre and higher than the lighter text In GD the large dark graphic placed closer to the centre and slightly lower balances the smaller and lighter text placed further from the centre		

Lin (1997) investigated how different combinations of background colour, text brightness and text colour in the Chinese CAI software may influence the affection, perception and cognition of the elementary school students. During the experiment, students were assigned to sixteen groups based on eight background colours: red, brown, green, light blue, blue, purple, white and black and text brightness: high and low. The results showed that purple background colour was significantly preferred over red background colour. However, background colour had no effect both on perception and cognition of elementary school students. As far as text brightness was concerned, there was no effect on affection, perfection and cognition. However, text colour had significant effect on affection and perception, but it had no significant effect on cognition. Lin (1997) suggested using purple background colour in the CAI software, allowing students the freedom of choosing the text brightness, and choosing preferred text colours on the computer screen since it has significant effect on students' affection and perception.

Lee (1996) drew together interface design guidelines from a variety of sources and they are practical advice that designers may implement in the design of user interface. The researcher of this study intends to apply some of these guidelines in the implementation of the Mandarin CD-ROMs, as shown in Table 36.

Table 36: Lee's Interface Design Guideline (Lee, 1996, p. 222-224)

Guidelines	What to implement in the Computer?
1. Concrete and visible	1. Uses icons, menus, pull down menus 2. Uses real-life objects as metaphors 3. Makes the button/objects obvious to the user
2. Navigation	1. Provides different searching tools 2. Provides menus as advance organisers 3. Lets users get in and out easily 4. Makes controls inactive when they are not used
3. Structure	1. Uses menus or metaphors that users are familiar with 2. Uses linear structure 3. Divides information into a few ordered hierarchies 4. Break up information into manageable chunks
4. Simplicity and consistency	1. Keeps screen layout and manipulation consistent 2. Keeps it simple and easy to operate 3. Limits the colour
5. Informing and control	1. Use visual effects to represent a change of action 2. Uses title and heading 3. Uses the user's language 4. Provides Help 5. Provide information to indicate that a task is finished
6. See-and-point	1. Gives lists to choose rather than type 2. Uses list box, check box 3. Provides defaults 4. Provides suitable input devices such as a touch screen, mouse or voice input.
7. Response	1. Provides audio or visual feedback 2. Provides easy reversal: undo 3. Provides immediate feedback and dialog 4. Provides prompt and direction
8. Media Integration	1. Uses media according to each medium's attributes 2. Uses media to create dramatic effects 3. Applies media in accordance with the metaphor and learning objective

Table 36 is the screen interface guidelines recommended by Lee (1996). In terms of concrete and visible, Lee suggested the use of icons, buttons, menus, pull-down menus, real-life objects as metaphors and make them obvious to the users. In terms of navigation, Lee suggested providing different searching tools, menus as advance organisers, letting users get in and out easily, and making controls inactive when they are not used. In terms of structure, Lee also suggested the use of menus or metaphors that users are familiar with and the use

of linear structure, dividing information into a few ordered hierarchies and breaking up information into manageable chunks, which agreed with Bagui (1998) about information chunking. In terms of simplicity and consistency, Lee (1996) suggested keeping the screen layout and manipulation consistent, simple and easy to operate and limiting the use of too many colours. In terms of informing and control, it was suggested to use of visual effects to represent a change of action, title and heading to let the user know where they are, the user's language so that they can understand the instruction, and providing a Help facility and providing information to indicate that a task is finished. In terms of see-and-point, Lee (1996) suggested giving lists to choose rather than to type by using the list box or check box, by providing defaults, and providing suitable input devices such as a touch screen, mouse or voice input. In terms of feedback, Lee suggested providing audio or visual feedback, easy reversal: undo, immediate feedback and dialog, and prompt and direction. In terms of media integration, Lee suggested to use media according to each medium's attributes, to create dramatic effects, and applying media in accordance with the metaphor and learning objective. Pragmatic demands are discussed next.

5.24 Pragmatic Demands

According to Knuittien (1998), hardware, software, human resources and both teachers' and students' attitudes and readiness to use computers are all to be considered as pragmatic demands in evaluating the CALL software. Availability and compatibility of hardware are important things to consider, just as the question asked by Goyne, McDonough, and Padgett (2000), 'Will the software be accessible to students?'. Any special arrangement, such as transporting computers from one classroom to another each time they are needed should be avoided, since such activities take too much time and effort in the long

run, and consequently, they may decrease teachers' willingness to use computers. Compatibility of hardware should be checked when running a CALL application which requires the use of external equipment. Like hardware requirements, software requirements of a CALL application also need to be considered. The CALL application may require certain software in order to run properly. Human resources concern both the teachers and other staff involved with the CALL application. Teachers must be available since students need guidance not only with the subject domain but also for becoming familiar with the CALL software and the computer. Other staff consist of persons who are responsible for the maintenance of computers and applications. Attitudes to computers should be positive both among teachers and students, otherwise the use of computers cannot be efficient. Readiness to use CALL means that users have appropriate skills and knowledge to interact with computers. Lacking such skills complicates the learning process, since users must concentrate on tools, rather than contents. Therefore, teachers and students should be motivated by telling them why and how computers can be useful in instruction, and they should be taught to use computers effectively. Teachers should know well any CALL application used by students in order to be able to assist students when they have problems. In this section, consideration for language laboratory and CD-ROM usage and both students' and teachers' attitudes and motivation towards using multimedia CD-ROM are discussed.

5.241 Consideration for Language Laboratory and use of CD-ROM

Crystal (1997) noted that the recorded material can provide a variety of authentic and well-recorded models for the training of listening comprehension and laboratories can be used as resources centres, or libraries, giving learners extra opportunities to practise at their chosen level. The value of the language laboratory will always depend on the development of appropriate teaching materials, which reinforce what has been taught in class and provide opportunities for creative use.

As discussed in the earlier chapter, besides quality of equipment, Rivers (1981) implied the preparation of students psychologically, in terms of instructions given to students, how much time spent in laboratory and preparation of materials. These are all important factors with CD-ROM learning in a language laboratory. First, audio quality of the equipment must be considered. Second, it is important to prepare students from the beginning for the kind of work they will be doing in the laboratory. Third, the students must then be given explicit instructions for the operation of the computer with the CD-ROM and different kinds of exercises. Fourth, an important question to consider is the length of time students can be expected to concentrate on practice in a laboratory situation. Twenty minutes of such concentrated attention without a break is ample at college level. Finally, for the full value of any set of audio recording to be realised, the teacher must be very familiar with the contents of each recording in order to ensure that the class is ready.

5.242 Students' Attitudes and Readiness to use Computers

From Figure 20 (p. 109), the relationship of the Dunn and Dunn learning styles model and Mandarin Learning with the CD-ROM, the readers learned that previous experience affects beliefs which affects the attitude towards language learning, and previous exposure to technology and computer skill affect the attitude towards using a computer in language learning. Therefore, students' computer usage and perceptions of multimedia are discussed.

In this subsection, Levine and Donitsa-Schmidt (1998) explored the relationship between computer experience, computer-related attitudes, computer-related confidence, and perceived computer-based knowledge. Stepp-Greany (2002) reported students using a combination of technologies. Trinder (2002) collected data on students' reactions to the integration of multimedia CD-ROM into their Business English language curriculum. Wishart (2000) investigated students' perception of motivation and learning through the use of a multimedia encyclopaedias on CD-ROMs. Finally, Ayres (2002) examined students' attitudes towards the use of computer-assisted language learning (CALL).

Levine and Donitsa-Schmidt (1998) hypothesised a causal model that linked measures of computer experience, computer-related attitudes, computer-related confidence, and perceived computer-based knowledge. The results suggested that, as predicted, computer experience such as exposure to a computer in school or at home, has a positive effect on both computer confidence, and attitudes towards computers.

Stepp-Greany (2002) presented survey data from beginning Spanish classes using a combination of technologies: Internet activities, CD-ROM, electronic pen pals, and threaded discussions. This study implied that instructors have an important role in technology enhanced learning environments. Students seemed

to believe that the lab activities were beneficial to their listening and reading skills; they preferred the CD-ROM over the Internet-based activities a little more and did not value the writing activities, such as pen pal letters or threaded discussion, that much, and a majority had gained confidence in their ability to use technology successfully. Students also attributed more learning value to the CD-ROM than to other components. It appeared that they perceived that they had learned the most from that which they enjoyed the most, attributing both learning and interest value to one component.

Trinder (2002) collected data on students' reactions to the integration of a multimedia CD-ROM into their Business English language curriculum. The students explained what they perceived to be the major pros and cons of using multimedia for language learning purposes, in the order of frequency, in Table 37.

Table 37: Students' Perception of Benefits and Shortcomings of Multimedia-assisted Learning in Trinder's Study (Trinder, 2002, p. 81)

Benefits	Shortcomings
1. Control over speed and path	1. No speaking and writing
2. Flexibility concerning time	2. No questions can be asked
3. Choice of topics and language area	3. Typical mistakes not pointed out
4. Control over number of repetitions	4. Pronunciation cannot be practised
5. Good for practising listening	5. No discussions
6. Good for grammar revision	6. No contact with peers and teachers
7. Possibly to listen to different voices and accents	7. No individualised explanations why something is wrong
8. Source of authentic language input	8. No alternative solutions admitted
9. Good auxiliary tool	9. Less fun, less motivating, less challenging than traditional classes
10. Good storage medium	10. Does not detect and address individual weaknesses.
	11. Too much contact with computers anyway
	12. No possibility to learn from peers

The students in Trinder's (2002) study showed a more guarded attitude towards a particular multimedia program due to the following reasons. First, the respondents were a group of very computer-experienced adults who were not impressed by the novelty of the medium, but very much aware of any technological shortcomings. Second, it has been shown that the feedback provided by the program was experienced as totally inadequate. Learners were not shown what progress they had made, correct responses were not given and motivation was not maintained. Third, the glossary and the help section were insufficiently exploited, maybe due to unclear screen layout and complicated handling. Furthermore, the combination of the input modes and support tools video, subtitles and tasks proved to be too much for many respondents. The conclusion one can draw is that it might be more advisable to develop courseware focusing on individual skills and language areas rather than trying to encompass too wide a range. A smaller number of support tools and options, if optimally designed and interactively linked, might be more effective.

Students in Trinder's study stated aspects could be improved in the CD-ROM. Respondents thought it should be possible to have more and more interesting video clips, better sound quality, a clearer user interface, easier handling, a more comprehensive glossary, more personalised feedback, correct answers on demand, and the possibility to go back just one step in the exercises. New suggestions mainly concerned increased individualisation: the possibility to printout, to store completed sessions, the option to enter exactly at the point at which one had quitted the previous section, the possibility to note down new vocabulary, a detailed progress report, regular reviews, and, perhaps most interesting, a function in the program that would remember and react to typical/recurring mistakes, and then provide links to explanations, corrections

and activities to remedy the problem.

Trinder (2002) said that the criticisms voiced by the students were pertinent and informative. They could be summed up as follows: from a multimedia program that was supposed to be able to fulfil the role of a teacher, learners expected more interactivity, more artificial intelligence, and more individualisation. Teachers should not lean back 'with a smugness because it has been once again [shown that] computers can never replace teachers' (p. 83). The point was not to prove that machines were better than human or vice versa. The vital task for those involved in CALL is to pinpoint those areas where 'computers can make valuable contributions by supplementing and complementing whatever the human teacher can bring to the learning environment' (p. 83).

Next, Wishart (2000) investigated students' perception of motivation and learning through the use of a multimedia encyclopaedias on CD-ROMs. Sixty-one students from eight schools were interviewed about their schools' use of multimedia CD-ROMs in teaching and learning. Overall, 79% had access to a computer at home, and 52% had access to a computer with a CD-ROM drive. The following three tables were comments from the students.

Table 38: Students' Comments of Why They Want to Use Multimedia CD-ROMs in Wishart's Study (Wishart, 2000, p. 341)

198 comments from 61 students	Percentage of 198 comments
Provides information	5%
Having a print facility	6%
Interesting	7%
Quantity and range of information	14%
Quicker to access and use	14%
Graphics, sound and video	15%
Easier to access and use	23%
Different and new	2%
Assists learning and work	3%
Interactiveness	4%
Fun and exciting	5%

The four key factors that made students want to use multimedia CD-ROMs, shown in Table 38, are a) ease of use (23% of comments), b) speed of use (14%), and c) the availability of graphics, sound and video (15%), and d) the quantity and range of the information (14%). It appeared that students were very keen to save themselves effort and time. Table 39 shows students' comments about the benefits of learning from multimedia CD-ROM.

Table 39: Students' Comments about the Benefits of Learning from Multimedia CD-ROM in Wishart's study (Wishart, 2000, p. 342)

137comments from 61 students	Percentage of 137 comments
Learning to use computers	4%
Quantity and range of information	6%
More individualised learning	6%
Having the print facility	8%
Quicker to use	9%
Enjoyable and fun	11%
Easier to use	17%
Graphic, video, and sound	22%
More interesting	3%
Relevant information	4%
Interactiveness	4%

Table 39 showed the most popular response was the presence of graphics, video, and sound (22%). Ease of use (17%), enjoyable and fun (11%), quicker to use (9%), and being able to print off from the CD-ROM (8%) was also mentioned. Table 40 are students' comments about what made multimedia CD-ROM more difficult to learn from.

Table 40: Students' Comments About What Makes Multimedia CD-ROM More Difficult to Learn from in Wishart's Study (Wishart, 2000, p. 343)

108 comments from 61 students	Percentage of 108 comments
Too much information	7%
Not enough depth or detail	7%
Difficulty with searching	7%
Eye strain	8%
Lack of availability	10%
Nothing	11%
Too complex	12%
Need to have learned how to use it	22%
Time consuming	5%
Need more help	5%
Restricted	5%

The necessity of learning to use a multimedia CD-ROM was mentioned most often (22%) as its most difficult aspect in Table 40. There was less agreement on other difficulties, with 12% of responses mentioning their being too complex, yet 11% who had no difficulty. Lack of availability of the CD-ROM computer to the students was also an issue (10%), and eyestrain was mentioned in 8% of the comments.

Wishart (2000) concluded that the students found the use of multimedia CD-ROM encyclopaedias were beneficial and motivating to learning. The multimedia CD-ROMs were easy and quick to use and made use of graphics, sound, and video. Thus, the researcher of this study feels that the students' perception of ease and convenience of use, together with the motivation engendered by being in control and the graphics and sound, are also some of the reasons that the adult students in Macao will mention in this study.

Finally, Ayres (2002) assessed how much learners valued the use of CAL in their language learning. There were five areas of findings. First, it was found that there were no statistically significant differences between learners of any particular gender or age when analysed according to perceived usefulness, ease of use and importance to the course. Nor were there any statistical differences

between the various nationalities. Second, more than 60% of the students placed themselves in the medium to high category for perceived skill level in listening, reading and writing. An average of 10% rated themselves as having very high skill levels in these three areas. Third, most of the participants had low computing skills with 60% of learners placing themselves in the beginner/no experience (or lower) levels. Fourth, students were asked to state what mode of learning they saw as being more helpful to their English language learning: computer, class or both equal. The learners favoured classroom-based teaching over using a computer, but also indicated that CALL held a strong place within the learning environment. The learners also appreciated and valued the learning that they did using the computer. In particular it is highly rated in the areas of writing and spelling, as well as its flexibility and interest for the learner. Finally, students were asked to state their perception of CALL and they are listed in Table 41.

Table 41: General Perceptions of CALL in Ayres' Study (Ayres, 2002, p. 247)

Responses from 157 students	% Agree	% Neutral	% Disagree
Easy to use and simple	68	23	9
Give good control over learning	60	34	6
Relevant to needs	80	17	3
An important part of course	65	22	13
Improve English skill	67	28	5
Computers give good info.	77	20	3
Computers are motivating	64	29	7
Should be used more	58	29	13

In Table 41, 80% of the students saw that CALL was relevant to their needs and 77% of the students said that the computer tasks provided information that was useful to them. The use of CALL especially seems to assist students in the areas of spelling, writing and grammar practices. CALL is a tool to supplement

the classroom, and needs to be tied into the curriculum closely. There appears to be a small halo effect or novelty value in terms of students' interest levels. 26% of the students saw that computers as more interesting than the classroom, as opposed to 18% of the students who saw the classroom more interesting than the computers. Ayres (2002) concluded that the classroom was favoured as being more motivating, more useful in all skill areas, more adaptable and relevant.

5.243 Teachers' Attitudes and Readiness to use Computers

In this subsection, Wishart (2000) also investigated teachers' perception of motivation and learning through the use of a multimedia encyclopaedias on CD-ROMs and Iding, Corsby and Speitel (2002) described results from a survey that addressed teachers' beliefs about technology, their technological resources, and support for the use of instructional technology in their classes.

In Wishart's (2002) study, twenty-six teachers from eight schools were interviewed about their schools' use of multimedia CD-ROMs in teaching and learning. The teachers' IT training varied from none (8% of the total) to those with post-graduate qualifications in IT (also 8%). Table 42 shows comments repeated by two or more teachers.

Table 42: Teachers' Comments of Multimedia CD-ROMs Usage in Teaching in Wishart's Study (Wishart, 2000, p. 338)

Tasks (64 comments from 26 teachers)	Percentage of 64 comments
Used for images or animations	5%
Used for teachers' own research	8%
Made for more student centred learning	8%
Makes students research quicker and easier	8%
Used for teaching researcher skills	12%
Teaching students IT skills	5%
Used for material that is otherwise unavailable	5%
Uses the library	5%
Used as an additional resource	18%
Motivate students and staff	13%
No effect	13%

In Table 42, it can be seen that students' and staff's motivation to use the multimedia CD-ROM encyclopaedias is one of the most repeated observations (13% of comments). However, this data was overshadowed by comments that refer to the CD-ROMs simply as an additional information resource (18%), and that having access to CD-ROMs had no effect on their teaching (also 13%).

Wishart (2000) concluded that the teachers found the use of multimedia CD-ROM encyclopaedias were beneficial to learning. There was also support from the teachers' responses, for the concept of students being motivated by being put in control of their learning of using the multimedia CD-ROM.

Iding, Crosby and Speitel (2002) conducted a survey with preservice and practicing teachers. Their access to computers at home is almost universal. The majority of the respondents (65%) described themselves as average, 12% as high in their level of computer knowledge and 18% as fair or using applications with assistance. Respondents also reported the types of activities for which they use technology per week and they are listed in Table 43.

Table 43: Teachers' Activities with the Computer in Iding, Crosby and Speitiel's Study (Iding et al., 2002, p. 157)

Comments from 78 teachers	Percentage of comments from 78 teachers
e-mail	80%
Finding teaching resources	42%
Finding resources for projects	39%

In terms of use and access to technology at school, 55% reported that their schools have computer labs that students have access to, 52% reported that there is a single computer per classroom, and 36% reported having several computers per classroom. In terms of students' technological expertise, the majority (59%) rated their students as fair, or capable of using applications with assistance, 34% rated their students' competence as average, or able to use applications like word processing, spreadsheets, and/or basic web searches.

In terms of importance of technology used in school, both teachers' and how teachers rated their administrators' responses are shown in Table 44.

Table 44: Beliefs of Learning with Computers and Technology in Iding, Crosby and Speitiel's Study (Iding et al., 2002, p. 159)

Comments from 78 teachers	Absolutely Essential	Very Important	Important	Not very Important	Irrelevant
Teachers' viewpoints	32%	39%	24%	4%	
How Teachers rated their Administrators' Beliefs	20%	33%	33%	11%	2%

In Table 44, when asked to rate the extent to which the teachers believed learning with computers and technology to be important, 32% reported that it as absolutely essential, 39% as very important, 24% as important, and 4% as not

very important. In contrast, when the teachers were asked to rate the extent to which their administration believes learning with computers and educational technology is important to students, 20% rated it as absolutely essential, 33% as very important, 33% as important, 11% as not very important, and 2% as irrelevant.

In terms of beliefs about instructional technology, 53% were more confident about the information found from books than from the information they got from the Internet. Some respondents were critical of the Internet resources and some were not very enthusiastic about the quality of the software they used. Some respondents saw that there is a need to develop high-quality educational software in all areas.

In terms of beliefs about social aspects of computer use, 68% agreed that chatrooms can encourage isolated students to find their peer groups. However some respondents have doubts about the chatrooms with 60% agreed that computers can interfere with the social development of the students.

In summary, Iding et al. (2002) concluded that teachers and preservice teachers were at least moderately proficient with computers, have access to computers at schools, and were interested in learning more about using computers and technology for instructional and educational purposes. However, they appeared to be unaware of educational software that could be helpful in their teaching, and the majority did not use technology in many teaching-related tasks.

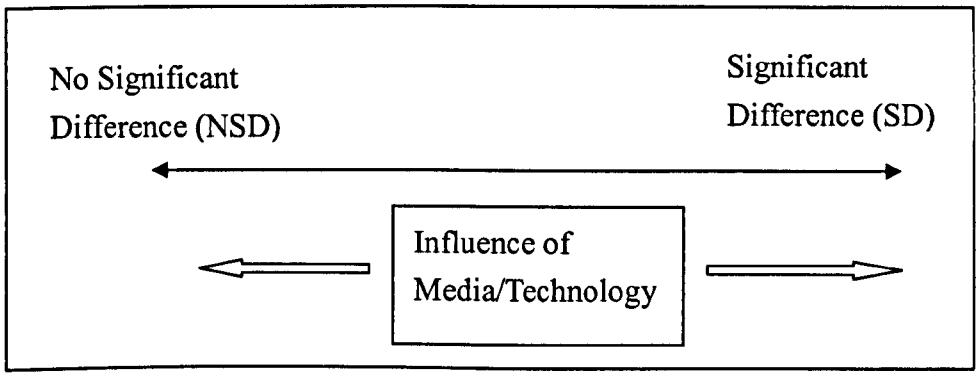
Although there are so many positive comments from both the students and teachers that multimedia CD-ROMs are beneficial to learning, the researcher of this study finds a bit puzzling about what is shown in Table 42, that out of the 64 comments, 13% of them indicated that having access to CD-ROMs had no effect

on their teaching. Therefore she is investigating what the educators have to say about whether media has any effect on learning with the Clark and Kozma's argument.

5.244 The Clark and Kozma's Argument

Do media influence learning? Clark (1983) contended that media do not influence learning under any condition. He concluded, '...media are mere vehicles that deliver instruction but do not influence student achievement any more than the truck that delivers our groceries causes changes in our nutrition' (p. 445). However, Kozma (1991) saw learners actively collaborate with the medium to construct knowledge and therefore 'learning occurs as the result of instruction being delivered by some (or any) medium' (p. 179). Kozma indicated that learning with media could be thought of a complementary process within which representations are constructed, sometimes by the learner and sometimes by the medium. The researcher of this study likes to think of Clark and Kozma's argument along an axis, with no significant difference (NSD) on one end and significant difference (SD) on the other end of the spectrum, representing whether media/technology has any influence on learning, as shown in Figure 34.

Figure 34: Influence of Media/Technology on Learning along the NSD-SD axis (researcher's viewpoint)



5.2441 Richard Clark – Media do not influence Learning (No Significant Difference)

Clark (1994a) claimed that instructional methods have been confounded with media and it is methods that influence learning. He defined methods as the provision of cognitive processes that are necessary for learning but which students cannot provide for themselves. He insisted that teachers must always choose the less expensive way to achieve a learning goal. Certain media and attributes are more efficient for certain learners and if learning occurs as a result of exposure to any media, 'the learning is caused by the instructional method embedded in the media presentation.' (p. 26).

Clark used the medicine analogy where he mentioned that different forms of media are like different forms of medicine. The medicine includes tablets, liquid or injected form of treatment, each with different levels of efficiency. The active chemical ingredient of these medical media is analogous to the necessary method in instruction; he said that 'some forms of delivery get the active ingredient to the patient much faster (or slower) in quantities which are more "pure" or more "diluted" at greater or less cost to the patient' (p. 26). He would suggest using the least expensive solution and give up enthusiasm for the belief that media attributes cause learning.

5.2442 Robert Kozma – Media influence Learning (Significant Difference)

Kozma (1994) cited two instructional environments, ThinkerTools and the Jasper Woodbury Series, where students benefited from the use of computers and from the use of television, respectively. He claimed that when learners have difficulty providing representations and operations that are sufficient for learning, either because of limited prior knowledge or limitations in working memory, they will likely benefit from the use of the capability of a particular medium. The

attributes of a medium are its capabilities; the capabilities of a medium are always present. He urged teachers to specify the appropriate uses of these capabilities in which they may be used to influence the learning for particular students, tasks, and situations. Medium enables the use of a particular method and methods take advantage of these capabilities, 'If medium are going to influence learning, method must be confounded with medium' (p.16). He suggested making a more productive approach to the design process, as a dynamic, creative interaction between the designer and the situation. The capabilities of a medium constrain what it is that designers can do, but these capabilities also enable designers with resources. He made a comment, 'Media capabilities have changed considerably since the time of the studies reviewed by Clark (1983), and they will change even more in the near future' (p. 17). The task of the designer is to use the capabilities of the medium to create interesting and effective interaction that influence learning. He believed that one should move from "Do Media influence learning" to "In what ways can we use the capabilities of media to influence learning for particular students, tasks, and situations?" (p 18).

Kozma's (1994) view is in line with Trinder's (2002) suggestion, that the vital task for those involved in CALL is to pinpoint those areas where computers can make valuable contributions by supplementing and complementing whatever the human teacher can bring to the learning environment, not to prove that machines were better than human or vice versa. This is what the researcher of this study tries to do, to find out what students' and teachers' perceptions of the Mandarin CD-ROM usage is and how to best use the CD-ROM in Mandarin learning.

5.2443 The Debate between Clark and Kozma

The debate between Clark and Kozma carried on for many years. In this subsection, debates of the 1990s and 2000s are discussed. Morrison (1994) argued that Clark and Kozma were asking a different question and Reiser (1994) thought that Clark failed to acknowledge the fact that certain media attributes make certain methods possible. Finally, Jonassen, Campbell and Davidson (1994) agreed with both Clark and Kozma.

Morrison (1994) concluded that Clark and Kozma were asking a different question. He claimed that the two studies cited by Kozma, 'received a different instructional strategy (e.g. manipulation of objects vs. traditional instructional, and contextual examples versus abstract examples)' (p. 42). He pointed out that Kozma's (1991) identification of the capabilities of the medium were not unique to the investigated media. For example, moving objects were represented in film and video long before the invention of computers. Morrison suggested that 'it is not the capabilities of the media that facilitates learning, but the creative development of the instructional strategy which actively engaged the learners' (p. 42). He recommended that practitioners should consider which strategies work and with what media such strategies are most easily implemented, and are the most efficient, with the least cost.

Reiser (1994) felt that Clark's - it's the method, not the medium argument was correct in stating methods are what cause learning to occur, however 'he (Clark) fails to acknowledge the fact that certain media attributes make certain methods possible' (p. 45). Reiser (1994) claimed that Clark's (1994a) medical analogy failed to hold, arguing that the successful delivery of instructional methods is dependent on the attributes of the medium, for example, 'the successful delivery of frozen foods requires the use of a vehicle with

refrigeration' (p. 45). While he agreed that it is the medication itself that helps cure illness, if there is no proper means of delivering that medication, it will be ineffective.

Jonassen, Campbell, and Davidson (1994) agreed with Clark (1994a) that "media are substitutable", and agreed with Kozma (1994) that 'any reasonable interpretation of an instructional medium should be more than a mere vehicle, that media are synergistic combinations of technology, task and context' (p. 31). They offered a middle ground to the debate by 'suggesting that media are more than mere vehicles; they are resource enabling tools which if selected properly can enhance cognitive processing and affect learning efficiencies' (p. 37). They also saw that

> 'Vehicles are not mere because they cannot function in isolation...Trucks would be unable to deliver anything if there were not highways, fuel distribution centres, and public safety infrastructures. We cannot think about media without considering the context in which they function...Media are not responsible for learning; learners are' (p. 38).

5.2444 Kozma's Reflections in 2000

Kozma (2000a) said that educators' goal should be to provide students with the tools and resources that get them where they want to go, empower them to do what they want to do. The medium shapes the way teachers' think and what they do; it both enables and constrains the designs created by teachers. If teachers understand the media they use, they can inspire their creativity and enable powerful designs. Kozma (2000a) believed that no other area of research in education is now as productive and intellectually stimulating as that related to educational technology and the research now combines design with advanced technology, new collaborations, large-scale implementation, and

alternative research methodologies.

Kozma noted that all of these projects use technology to take design beyond the exclusive domain of the instructional designer and engage adults and children, teachers and students in the design process. As a result, users learned not only academic content but also how to use technology to design solutions to problems they encounter in their everyday life. The projects were possible only because the powerful processing capabilities of computers enabled their design.

Concerning design and technology, Schwartz (1999) and his colleagues took a constructivist approach to the design process and used it to teach problem solving, to engage college students in the design of instructional products, and to help them understand the academic content. Not only did students learn educational psychology concepts and principles from this environment but they produced instructional products that they left behind as a legacy for students who subsequently took the course.

Resnick (1998) and his colleagues created Lego-LOGO that they used to engage young students in the process of design and experimentation. With these toy-like tools, students have created and programmed robotic creatures that move around, communicate, and change each other's behaviour.

Shneiderman et al. (1998) supported university professors in designing computer-based activities for the courses they teach. The resources and classroom activities have resulted in significant changes in faculty teaching, moving them from a style predominated by stand-up lecture to classes that emphasise active individual learning, small group learning, and entire-class collaboration.

Concerning collaboration with new partners, perhaps the most ambitious collaborative project was the NSF-funded national Centre for Innovative

Learning Technologies (CILT), directed by Pea et al. (1999). CILT was specifically established to mobilise the multiple cross-sector collaborations and partnerships that were needed to stimulate R&D of technology-related solutions to critical problems in K-14 science, math, engineering, and technology learning.

Concerning scaling up R&D projects, Shneiderman (1998) and his colleagues have worked with 74 faculty members in excess of 260 courses to affect more than 7,500 college students. Resnick (1998) and his colleagues developed Lego-LOGO and through the cooperation of a toy manufacturer, was used by 20,000 elementary students.

Concerning alternative research methodologies, as both Richey (1998) and Driscoll and Dick (1999) pointed out, in the uncontrolled context of real-world educational technology, R&D demands alternative research methodologies. Driscoll and Dick (1999) included case studies, surveys, program evaluation, developmental research, and qualitative-naturalistic empirical approaches that can enrich the IT researcher's repertoire. According to Driscoll and Dick (1999), curriculum was changed to take advantage of the technology. Technology was used as part of the assessment. Teachers were trained on both the operation of the hardware and software and its integration into their teaching.

Kozma (2000a) argued that media should not be ignored and should not be treated as mere delivery devices. Kozma (2000b) said that research should focus on the nexus of two things: design and technology—media and method—not just one or the other. Teachers can use these powerful computers as a delivery device to provide students with programmed instruction on the screen. The technology will not drive new designs, but enable new designs. Teachers can choose to use this capability to explore new methods, to think about new experiences for students, and to find new ways to improve education.

5.2445 Conclusion of Clark and Kozma's Argument

The researcher of this study agrees with Ross (1994a) that the "media effects" debate is not trivial. It has stirred up debate in the 1980s, 1990s, and now well into 2000s. Just like Ross (1994b) described, when the researcher examined the articles of this debate, she also 'had anticipated that each reading would bring her closer to personal resolution regarding which perspective (Kozma's or Clark's) was more convincing'. Surprising, it didn't happen that way. Each time she considered either position, she became more convinced of its merit and thought that this would be the position she would take. Finally, she came to agree with Jonassen et al. (1994) to take the middle ground to the debate by 'suggesting that media are more than mere vehicles; they are resource enabling tools which if selected properly can enhance cognitive processing and affect learning efficiencies' (p. 37).

Jonassen et al. (1994) suggested that the debate should change its focus in three ways. The first way is from instruction- and media-centred to a learner-centred conception of learning. The second way is to focus less on media attribute vs. instructional method and more on the role of media in supporting, not controlling the learning process. The third way is to focus the debate on media, however defined, to be used to facilitate knowledge-construction and meaning-making on the part of the learner. They see media as offering the means for empowerment. The researcher of this study would like to take their advice and approach her study to examine the multimedia CD-ROM as a supporting tool to facilitate knowledge construction for individual learner.

5.25 Summary of Criteria for Evaluating CALL for Mandarin Learning

Kuittinen (1998) suggested that several points of view must be considered when designing and evaluating CAI applications, such as domain-dependent demands, instructional demands, user interface demands, and pragmatic demands. Domain-dependent demands discussed vocabulary acquisition being very important in all four language learning skills, could be influenced by students' motivation, their learning strategies, their learning experience, and the effect of the teaching they encountered. In the motivation subsection, Sung and Padilla (1998) found that motivation is fostered by the students' interest in learning their ancestral language, which corresponds what Warner (2000) said that if the content of a course is of no interest to the students, it is unlikely they will have much motivation. Wen (1997) indicated that two factors accounted for students beginning to learn the Chinese language: intrinsic motivation and passive attitude towards requirements as part of their college curriculum.

In the learning experience subsection, Bar-Lev (1995) found that the Home Exposure (HE) subjects tended to use English words as a strategy for maintaining communication more. Chao (1998) suggested that a receptive learning attitude derived from an accurate understanding of the immersion environment is the key to effective learning. Hayden (1998) discovered that the attitude and motivation affects the reading proficiency of a semester abroad.

In the beliefs subsection, Samimy and Lee (1997) said that those students who receive higher grades tend to have a combination of integrative, instrumental, and intrinsic motivation. When a student has a higher grade, he or she tended to have intrinsic motivation. In the learning strategies subsection, Ke (1998) suggested that students valued the learning and using of their knowledge of graphic structure and character components for their character learning. Hayes (1988) discovered that at the word level, the native Chinese immediately

associated the symbol with a particular sound and at the sentence level, the natives used a mix of graphic and semantic strategies. Hong (1998) found that in student business writing strategies, students were deficient in producing culturally appropriate speech acts.

In the effect of teaching subsection, Chiang (2002) believed that learners' perspective on learning Chinese as foreign language have a role to play in deciding what is the best approach to teach beginning-level Chinese. As shown in Figure 33, both learning style and previous experience affect learning strategies, and finally learning strategies, attitude, and motivation affect learner' language learning/achievement, which are the effect of teaching.

Instructional demands included student-centred learning and instructional support such as motivation, interaction and feedback, repetition, and practice. Zhang (1998) suggested that CALL programs can take on the role of facilitators by providing a learner-friendly and learner-centred environment, which provides within easy reach, all the tools necessary to read or write whatever text the learner chooses. The four pedagogical issues described by Zhang (1998) are material selection and sequencing, presentation, practice, and feedback. Since the learners can control the sequencing and the pace of learning, they can repeat and practise as much as they like with the exercises provided by the computer. The easy access allows the users to interact with the computer, to retrieve of help for pronunciation and comprehension in the "when in doubt, click" format.

The user-interface demands included interactivity and screen design. van der Linden (1993) found that individual differences played a role in the choice of students' strategies in the CALL application. Long feedback, exceeding three lines is not read and for that reason is not useful. Brandl (1995) discovered that the high-achieving students showed more willingness to engage in the error

correction and tried to find the answers to their errors themselves. Pujolà (2001) found that some students would skim read the feedback message quickly and those students who had preconceived ideas or past belief of the correctness of the answers had a difficult time understanding the source of error.

As far as screen design goes, Kuittinen (1998) suggested that text, pictures and animation, connections between these display elements, usage of colours and highlighting, and how displays appeal to students are important elements of a user interface. Szabo and Kanuka (1998) concluded that poor use of design principles as related to increased instructional time and a reduced completion rate. Lin (1997) suggested using purple background colour in the CAI software, allowing students the freedom of choosing the text brightness, and choosing preferred text colours on the computer screen since it has significant effect on students' affection and perception. Lee (1996) provided the use of the following guidelines in interface design: concrete and visible, navigation, structure, simplicity and consistency, informing and control, see-and-point, response, and media integration.

According to Knuittien (1998), hardware, software, human resources and both teachers' and students' attitudes and readiness to use computers are all to be considered as pragmatic demands in evaluating the CALL software. As far as hardware, software, and human resources go, Crystal (1997) indicated that language laboratories, incorporates computer-assisted language learning workstations, can be used as resources centres, or libraries, giving learners extra opportunities to practise at their chosen level. Rivers (1981) implied that quality of equipment, preparation of students psychologically, giving instructions to students, how much time students spent in laboratory, and preparation of materials are important factors with CD-ROM learning in a language laboratory.

Regarding students' attitudes and readiness to use computer, Levine and Donitsa-Schmidt (1998) found that exposure to a computer in school or at home has a positive effect on both computer confident and attitudes towards computers. Stepp-Greany (2002) implied that instructors have an important role in technology enhanced learning environments. In Trinder's (2002) study, the students showed a more guarded attitude towards a particular multimedia program.

Wishart (2000) concluded that the students found the use of multimedia CD-ROM encyclopaedias were beneficial and motivating to learning. In Aryes' (2002) study, it was found that learners appreciated and valued the learning with the computer. Regarding teachers' attitudes and readiness to use computer, Iding et al. (2002) concluded that teachers and preservice teachers were unaware of educational software that could be helpful in their teaching, and the majority do not use technology in many teaching-related tasks. Wishart (2000) found support from the teachers' responses that students felt motivated by being put in control of their learning of using the multimedia CD-ROM. Since 13% of the comments indicated that having access to CD-ROMs had no effect on students' learning, investigation of Clark and Kozma's argument by the researcher came to this following conclusion. Jonassen et al. (1994) said that media are more than mere vehicles; they are resource enabling tools which is selected properly can enhance cognitive processing and affect learning efficiencies and saw media as offering the means of empowerment. The researcher of this study likes to examine the multimedia CD-ROM as a supporting tool to facilitate knowledge construction for individual learners, and intends to explore the computer's capability to explore new methods, to think about new learning experiences for students, and to find new ways to improve education, as pointed out by Kozma

(2000b).

In this chapter, CALL for learning the Chinese language was discussed. The beginning level has attracted the most attention of CALL developers and they commonly address the receptive skills of listening and reading. Several points of view must be considered when designing and evaluating CAI applications and they are domain-dependent demands, instructional demands, user interface demands, and pragmatic demands. Chinese PLATO system and the CyberChinese software were discussed, to give the reader a sense of what Chinese CALL was like in the 1970s with emphasis on character writing and in the 1990s with emphasis on pronunciation, tone, vocabulary, and grammar to improve listening and reading skills. Their contents will be used to set the stage for the CD-ROM development in this study. Now that the reader has a better understanding of multimedia and Chinese language learning, the researcher will discuss the Mandarin CD-ROM development in the next chapter.

Chapter 6: Development of the CD-ROM

Since one of the major issues of this research is the development of the Mandarin CD-ROMs from existing textbooks and CD recordings, the CD-ROM development is discussed here. In this chapter, first the rationale for using an instructional model in the CD-ROM development process and the Knirk-Gustafson instructional model are discussed. Then, the Click! Interactive Mandarin CD-ROM series is discussed in terms of its background, technologies, and implementation.

6.1 Rationale of Using an Instructional Development Model

According to Willis (1993), the research-to-support technology (RTST) model is a typical model that compares a type of courseware such as drill and practice to "traditional methods". If the results favour the courseware, it can be concluded that the software is more effective as an instructional strategy than traditional methods. In an emerging applied field like technology, there are several reasons to reject the RTST model and opt for a more applied, more product-oriented model. First of all, the conclusions drawn from general reviews such as Roblyer, Castine and King (1988) are, positive towards computer-based instruction, and there is no doubt that as traditional research studies in the area of technology accumulate, similar positive reviews will be written on those studies. However, from a broader perspective, there are reasons to question the validity and generalisability of both individual research studies and research reviews. Secondly, Clark (1985) argued that most of the comparisons between traditional instruction and computer-based instruction are fatally flawed because they fail to control potentially powerful confounding variables. These variables- different content or instructional strategies, more or less study time, or different instructor-could account for the superiority of the

computer based instruction (CBI) group. If confounding variables such as instructional strategy and content are controlled, there is no reason to expect that CBI will be any more effective than instruction delivered through any other medium. Clark (1985) has suggested that 'studies comparing computer[s] with more conventional instruction or media should be discouraged' (p. 147).

Willis (1993) said that much of the appeal of CBI lies in the computer's ability to deliver instruction with features that would be impossible, or very expensive and difficult, to deliver through any other medium and that computer assisted instruction and traditional instruction represent the essence of two types of instructional strategies. Cunningham (1986) suggested research is not a process of discovering knowledge but a process of constructing knowledge.

> Let's invest our energies in exploring the potential utility of as many instructional techniques as we can think of rather than putting them against one another. Is CBI better than TI? Since the question cannot be answered, why don't we simply try to do as good a job of each as we can. The result might even be good instruction. (p. 6-7).

According to Willis (1993), if teachers adopt Cunningham's (1986) perspective, it does not mean that research on technology in the RTST model is useless, but it simply means the results of those studies must be interpreted in a much more circumscribed, localised way. He suggested one attractive option to the RTST model is the Instructional Development (ID) model.

> In the ID model, the primary goal is not to prove that one general type of instruction is better than another; the goal is to develop high quality instruction. In accomplishing that goal, the developer is likely to violate many of the basic guidelines of the RTST model. For example, the instructional package need not be limited to one particular instructional approach. (p. 44)

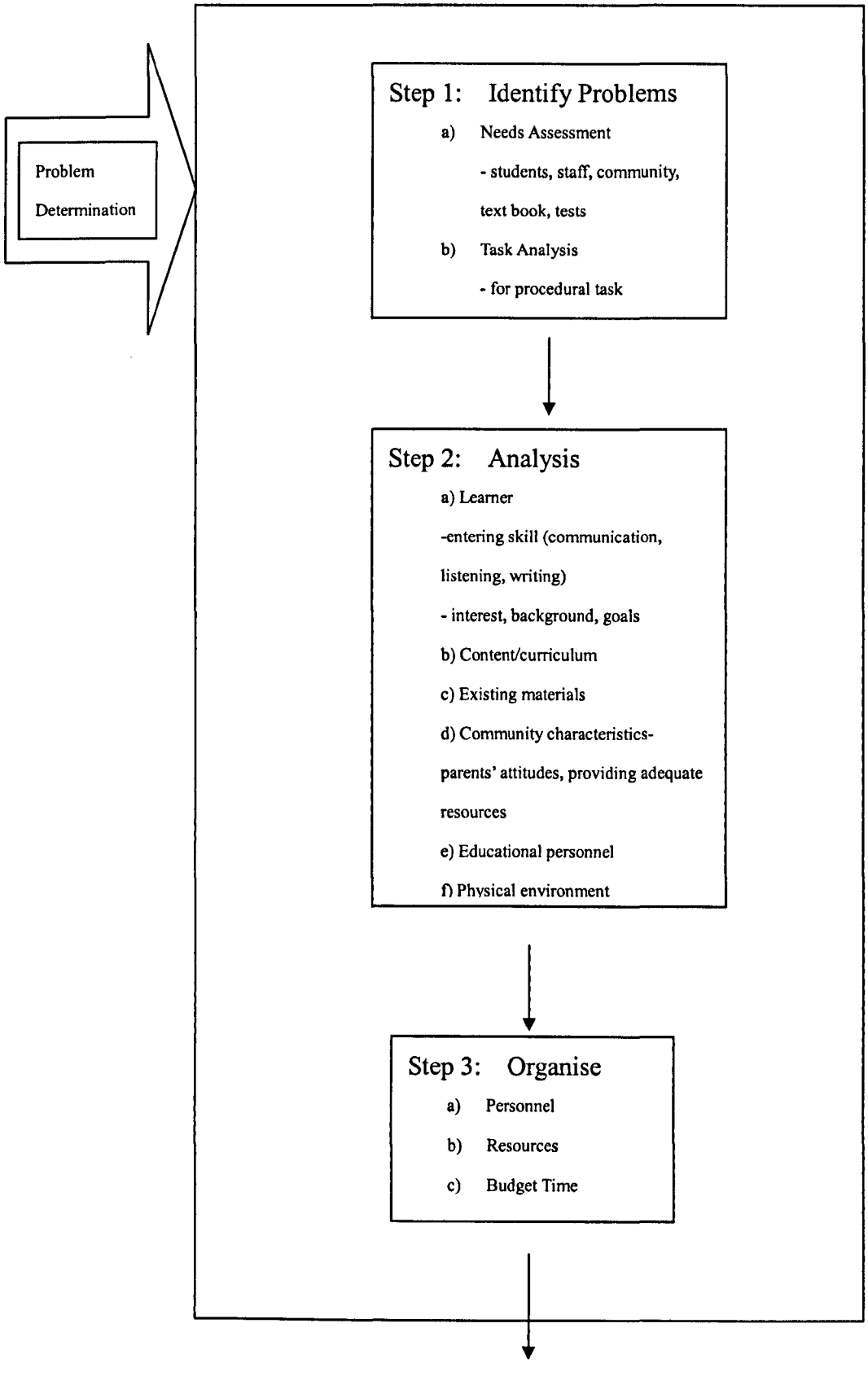
Willis (1993) went on to note that the purpose of the Instructional Development (ID) model research is to evaluate the effectiveness of a specific instructional package. A major factor in most success stories is the instructor, even when the technology is a major part of the instructional delivery system.

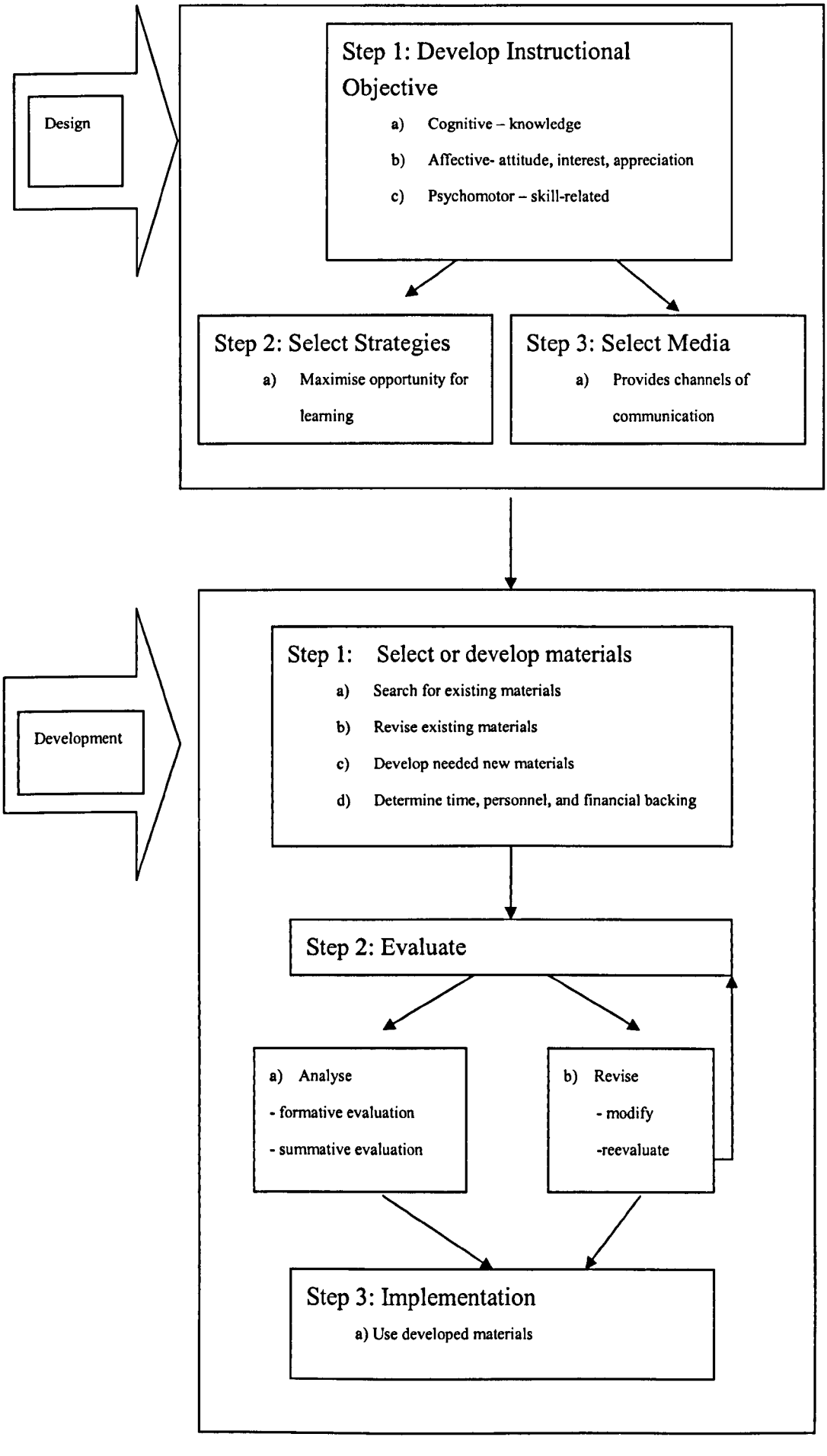
Diamond (1989) said that most instructional systems models have much in common and contain many of the same elements. There are many variations of the ID research model, which provides a framework within which to think about the process of designing instructional material. Almost every model includes somewhere in the process the stating of the objectives, a pre-assessment of students, the design and implementation of formal instruction, and evaluation which serves as the basis for revision. In addition, many also contain a needs assessment step early in the development process as shown in Appendix 5. Diamond indicated that most models do not appear to be extremely linear in their overall design.

6.11 The Knirk – Gustafson Instructional Development Model

The researcher decided to adopt the Knirk - Gustafson model to develop and evaluate the multimedia Mandarin CD-ROMs in this study. The stages of the instructional development model are problem determination, design, and development, as shown in Figure 35. It is a simple three-stage model, however, their third stage contains three of the five general instructional design stages. If analysis, design, development, implementation, and evaluation are basic stages a design should be, Knirk and Gustafson break their model into just the same way: 1) Problem determination (analysis), 2) Design, 3) Development (includes evaluation and implementation). Development stage is the iterative step and it is the reason why this model is chosen.

Figure 35: Knirk and Gustafson Instructional Development Model (modified from Knirk and Gustafson, 1986, p. 27)




Design
Step 1: Develop Instructional Objective
a) Cognitive – knowledge
b) Affective- attitude, interest, appreciation
c) Psychomotor – skill-related
Step 2: Select Strategies
a) Maximise opportunity for learning
Step 3: Select Media
a) Provides channels of communication
Development
Step 1: Select or develop materials
a) Search for existing materials
b) Revise existing materials
c) Develop needed new materials
d) Determine time, personnel, and financial backing
Step 2: Evaluate
a) Analyse
- formative evaluation
- summative evaluation
b) Revise
- modify
-reevaluate
Step 3: Implementation
a) Use developed materials

The first stage of the Knirk-Gustafson design model is, Problem Determination, which involves assessing the whole learning situation involving several steps. In the first step of the Problem Determination stage, needs assessment provides a format for ensuring that real problems are identified. Need statements refer to problems to be resolved and should be learner oriented. Students, staff, as well as the community should be questioned for their concerns and their desires. Examination of the current textbooks and other materials will also provide useful information. Existing tests are another excellent source of desired objectives. The needs assessment and task analysis will help to refine or specify the instructional goal. Having identified needs, it is often desirable to perform a task analysis in order to specify in greater detail the activities to be accomplished. In other cases, Knirk and Gustafson said that it may be possible to skip this step and proceed directly to writing the instructional objective. The decision depends on whether or not the task is procedural and sequential. Since Mandarin learning is not a procedure but a sequential task, task analysis was not done in this study. In this study, students and teachers were questioned to find out their needs and current textbooks and CDs were examined to elicit useful information.

In the second step of the Problem Determination stage, an analysis on the learner's entering skills, content/curriculum, existing materials, and the community's characteristics will be conducted. Each learner is obviously unique: backgrounds, abilities, goals, and interest. Knowledge of the learners' communication skills, listening comprehension and writing skills may be determined at this time. According to Knirk and Gustafson, assessment of learning style is difficult. Some students like to work alone, some like to learn in a structured situation, and some are more visually oriented. Attitude and motivation affect learning. Knowing the learners' learning styles may permit

tailoring the design of instruction to match that style. The difference between the students' entering knowledge and the instructional goal represents the instructional problem statement. What methods should be used in presenting the materials and whether or not there is any continual curriculum revision are some issues in content/curriculum design. Characteristics of educational personnel should also be examined because if teachers and others hinder the implementation, even an excellent innovative instructional program will fail. Existing materials should also be evaluated to see if materials are out-dated, suitable, adequate, or motivationally enough for the students. The physical environment should have ample space to house students, enough laboratory areas, and acoustics appropriate for both instruction and learning. Whether or not the community is providing resources for the learning or parents' attitude towards the school, schooling and learning should also be evaluated. In this study, learners' entering computing skill, their learning style, attitude and motivation were examined.

In the third step of the Problem Determination stage, a channel must be established to ensure that the project will run smoothly and successfully. Resolving a problem requires personnel, resources, and time. When developing a program, personnel may have to be located, hired, and trained. Budgeting must be done and required materials and equipment must be determined. Instructional designers must learn to operate within their resources to complete the project. Because of the support of her school (School of Public Administration), the researcher of this study was able to hire an assistant to develop the program, and conduct in-class observations and focus group discussions with staff as well as teachers from other schools.

The second stage, Design, is where instructional objectives are developed, then where strategies are developed for implementing the objectives, and finally

where the objectives and strategies can suggest the appropriate media to carry the instructional details to the learners. Instructional objectives fall into three taxonomies: cognitive (knowledge-related), affective (attitude-related), and psychomotor (skill-related). The cognitive domain is concerned with the intellectual responses of the learner. The affective domain concerns the attitudinal, emotional, and valuing responses desired of the student. These are also called interest, attitudes and appreciation. The objectives of the psychomotor domain fall into the general area of muscle development and coordination. Knirk and Gustafson (1986) said that the instructional design should reflect the objectives, students' abilities, and instructional media available. The objectives should also include the instructional method to use. The instructional designer should select strategies and media which maximise opportunities for learning based on whether or not students learn from it. Another design consideration involves determining to what degree the instructional environment will be interactive or linear. An attractive and pleasing instructional environment will encourage students to engage more in learning initially. When selecting media in the Design stage, the most significant conclusion concerning the use of instructional media is that they work. Knirk and Gustafson said that students do learn from media. The media provide channels of communication a single teacher could not begin to offer. Instructional strategy and media selection decisions are interrelated and should be done concurrently, after instructional objectives have been developed. The instructional medium should present instructional stimuli in an efficient, easily understood manner. The objective of this project was to determine the attitude and motivation of adult learners with the Mandarin CD-ROM. The CD-ROM was chosen as the medium of instruction in this project.

In the third stage, Development, Knirk and Gustafson included the

remaining three general instructional stages: development, evaluation, and implementation. Materials are first selected and developed, then implementation of all that has been developed, followed by an analysis of the results of the instruction and revision of the materials. The questions to be asked would be whether or not the product is well organised or whether or not it can hold the learners' attention, or whether or not there is sufficient repetition in the instructional material. If there are no materials available that meet the requirements, then production may occur. Knirk and Gustafson (1986) said that producing instructional materials is both expensive and time-consuming. Often a team of individual specialists work together to produce instructional materials, and they include a curriculum specialist, an evaluation specialist, a management specialist, a content specialist, and perhaps others may be brought together to design, develop, and refine a set of instructional materials. Before deciding to proceed with developing new materials, the instructional designer must determine whether or not there is enough time, personnel, and financial backing with which to produce the needed materials. The next steps involve producing the materials, completing the formative evaluation, performing a summative evaluation of the entire package, and adopting the materials. Evaluation is a form of quality control. Formative evaluation looks at the process of learning and teaching while the instructional design is being developed and the materials are produced. Summative evaluation is performed near the conclusion of the teaching/learning process to draw inferences or conclusions about the effectiveness of the instruction. Knirk and Gustafson noted that formative evaluation is to improve whereas summative evaluation is to prove. Only formative evaluation was used in this study because the purpose of this research was to try to improve the multimedia Mandarin CD-ROM rather than to prove that it works or not. It was decided by the school that the researcher would be

converting existing materials from textbooks and CD recordings to the CD-ROMs.

Since this research is going to use the Knirk and Gustafson model to develop the multimedia Mandarin CD-ROMs, the researcher needed to consider some of the issues in the debate over whether or not media influences learning (Clark, 1994a). One area that might need change is at the first stage where the learners are assessed for their entry-level skills. In the face-to-face learning environment, the skills under consideration would focus on the learner and the subject matter. But when looking at these issues in a computer environment, there are a considerable number of skills the learner needs simply to be able to use the hardware and software just in order to appreciate the value of the multimedia environment.

In the light of the debate over whether or not media influences learning, these necessary modifications to the model could be just additional technical details that have to be included, or they could be significant potential influences on the instructional outcomes. Media choices would have to be analysed and developed with the idea in mind whether they have any influence on learning or are simply 'mere vehicles that deliver instruction but do influence student achievement any more than the truck that delivers our groceries causes changes in our nutrition' (Clark, 1994a).

Maddux (1993) pointed out that mere exposure to computers might not have any value. With regard to the case of research and practice in word processing and writing skills, it was assumed that just teaching students how to use the word processing software would automatically improve writing skills. Now perhaps the most significant point is that 'word processing tends to produce improved student attitudes toward writing' (Maddux, 1993, p. 20). With word processing, with Logo, and with any other computing applications, Maddux (1993) indicated

that 'efficacy depends on how they are used, rather than on their mere presence or absence in school' (Maddux, 1993, p. 20).

Taking the same idea from Maddux (1993), perhaps the most significant point the researcher learned is that multimedia capability "tends to produce improved student attitudes toward" language learning. Just like Logo, efficacy of multimedia "depends on how they are used, rather than on their mere presence or absence in school."

In this research, the researcher is adopting Cunningham's (1986) suggestion that research is a process of constructing knowledge. She does not plan on answering if the multimedia CD-ROM is better than traditional teaching. She is simply trying to do as good a job as she can to produce good instruction. She does not intend to prove one general type of instruction is better than another. Her goal is to develop an instructional package to help the students in Macao in their Mandarin learning. The instructional model provides a framework in which she can investigate into the benefits and limitations of the multimedia CD-ROM in Mandarin learning. The third stage of the model, Development, will be done in a spiral fashion such that the research will be going through constant changes to produce improvements over three different volumes of the CD-ROMs based on suggestions from users.

6.2 The Click! Interactive Mandarin CD-ROM series

The Click! Interactive Mandarin CD-ROM series consisted of a set of five volumes, in which 3 volumes are under investigation in this study. The project started in 1998 and it had been a continuous project up until September of 2002. During the past four years, improvements were made to each volume of the CD-ROMs to try to improve the usage of it. Technical as well as content issues were resolved in the last four years. The reason that the system is called "Click!"

is because the researcher needed to find a name that could be understood in both English and Portuguese, and a participant in the study suggested this name.

6.21 Background

The purpose of producing the CD-ROMs back in 1998 was to promote Mandarin learning in Macao. It was anticipated that the production of the Click! System would provide a much-needed practical element. It was thought that the provision of sound and visual effects and answers to exercises would be an extremely useful mechanism for consolidating the materials covered in class.

Macao Polytechnic Institute has published a series of textbooks in teaching Mandarin and has successfully trained many Macao civil servants in the process. The textbooks and the CD-ROMs described in this paper are the first three in the series. This research capitalises on the computer's data-handling and multimedia capabilities, and concentrating mainly with the beginning level of the Mandarin course.

The initial Mandarin prototype was developed by one of the students in the Higher Diploma of the Computer Studies Program in the Macao Polytechnic Institute in June of 1998. The project was left aside without anybody noticing it and the researcher realised this was something she could build upon. She was interested in how multimedia could be used in learning. So this was a perfect opportunity for her, to investigate how multimedia could be used in Mandarin language learning. With the support of her school (the School of Public Administration), she launched the multimedia Mandarin CD-ROM project in September of 1998. The first volume of the CD-ROM series was completed on March 9, 1999, the second volume was completed on August 13, 1999, and the third volume was completed on March 13, 2000 (see table 45).

Table 45: The Mandarin CD-ROM Production and Study Schedule

		Date
Prototype		June 1998
Pilot Study	User-Interface Focus Group	November 11, 1998
	Pilot Interview	Feb 22 to Mar 22, 1999
CD-ROM I		March 9, 1999
Main Study	Teacher focus group	April 21, 1999
	In-class observation	March 4 to June 3, 1999
	Main Interview	April 20 to June 16, 1999
CD-ROM II		August 13, 1999
Follow-up Study	Follow-up Interview	July 7 to July 24, 1999
CD-ROM III		March 13, 2000

From the very beginning the researcher had to make sure she would have enough money and manpower to support this project. With the help of her director and some convincing facts that this was to be a good project for the school, this project was designated as a joint project between her school and the Public Administration and Civil Services. One function of the Public Administration and Civil Services is to initiate training courses for the civil servants. The Macao Polytechnic Institute has been conducting joint training courses with them and the Mandarin course happens to be one of the courses.

According to Knirk and Gustafson (1986), because producing instructional materials is both expensive and time-consuming, selecting appropriate commercial instructional media is desirable. However, in this study, the researcher, with the approval of her school, had already decided from the start to develop the multimedia CD-ROMs. So selection of media and existing instructional materials was not necessary. She needed to have a team of individual specialists who worked together, also suggested by Knirk and Gustafson. There were more than ten people assisting this project, with the

researcher serving as the coordinator of the project. She managed as well as evaluated the entire effort. There were the content specialist, graphics designer, audio specialist, programmer, and Portuguese and English translators. Efficient time, personnel and financial backing were essential ingredients in the success of this project.

Much time and effort were needed for input and translation of data. The issues that the researcher had to resolve during the process included the speed of the system, installation of the CD-ROM, different language displays, translation, graphics/animation, user-interface design and navigation.

6.22 Technologies

To implement the Click! System, a careful examination of the available technologies was necessary. Tsutsui, Kato and Mohr (1998) suggested the following capabilities: multimedia, direct access to video segments, instantaneous video playback and stop, capability to store and retrieve large volume of video segments and multi-language capability. This study took Tsutsui et al.'s (1998) suggestion, but instead of video, it changed its focus to audio. The Click! System has multimedia capability with audio as well as text. It has the ability to play back the audio at relatively high quality. In order to play a major role in language teaching, the Click! System must be able to retrieve a large number of separate segments and these segments must be retrievable on demand. The multi-language capability is required because the technology must allow for simultaneous display of multiple languages: English and Chinese, or Portuguese and Chinese, as well as easy switching from one language mode to another for the Chinese, English, or Portuguese users.

6.221 System Requirements and Authoring software

The Click! System runs on a personal computer with 80486 or higher microprocessor in the Chinese Windows or English Windows with a Chinese language viewer. The screen resolution works best with 800 times 600 pixels. It requires a CD-ROM drive and sound card with headphones or speakers.

The authoring software used to develop this system includes Microsoft Visual Basic, Microsoft Access, ForeFront's ForeHelp, Adobe PhotoShop, Syntrillium Software Corporation's Cool Edit Pro, Arphic Technology Co.'s FontMate, Macromedia Fontographer, Hypercam, Adaptec Easy CD Creator and two shareware - GoAudio and Paint Shop Pro. These software tools were used to support the creation of an interactive, non-linear experience that allowed several pathways through the multimedia learning material.

6.23 The 'Click!' CD-ROM Implementation

Based on the following statements/conclusions drawn, listening skills, reading skills and vocabulary learning are implemented in the CD-ROMs:

1. Vocabulary learning is the area of concentration in this study as suggested by the researcher in the Chinese Language section of the second chapter.
2. The Mandarin teacher in the main study suggested putting the emphasis on listening skill for the CD-ROM learning in the Foreign Language section of the second chapter.
3. The researcher drew the conclusion that the multimedia CD-ROM is probably suitable for the listening and reading skills in the conclusion of the Multimedia and Language Learners of the third chapter.

4. Kidd (1997) indicated that vocabulary, reading, listening are the benefits of implementing CALL, in Table 18 of the fourth chapter.

The researcher implemented audio recording for listening skill, an electronic dictionary and glossary for reading and vocabulary learning, audio narration (with reading text) for reading comprehension in the 'Click!' CD-ROMs to help students in their Mandarin learning in Macao.

Furthermore, the researcher took Yang's (1998) suggestion in her development of the elementary Mandarin CD-ROM. Activities that will help students learn pronunciation basic vocabulary, grammar, and simple sentence structure are developed. Listening comprehension development at the word and sentence level based on sound clips and grammar training in the form of multiple-choice and fill-in-the-blank exercises are also incorporated in the CD-ROMs. As mentioned before, because of time and money constraints and lack of existing resources, speech recognition technology, vocabulary building by means of picture based exercises, and listening comprehension development based on video clip was not considered in the development.

The 'Click!' CD-ROMs contain a library of short, digitised audio segments and an interface, which helps learners practise the dialogues presented in those audio segments. The digitised audio for each dialogue is accompanied by dialogue text in Mandarin and English or Portuguese translation. The translation is designed to convey the overall meaning of the dialogue, rather than providing word-by-word glosses. In this way, the 'Click!' CD-ROMs try to lead learners to focus on messages they are supposed to convey instead of the meaning of each vocabulary item.

6.231 Design Considerations

This development project comprises of multimedia elements: such as text, picture/animation, and audio. The lessons learned from the literature review of multimedia are used as a design guideline in this project. The idea is how to put multimedia at its best, by which learners profit more from studying with multimedia. This software makes extensive use of sound. It allows the students to get the audio version of the information displayed on the screen at different levels: character, word, and even sentence level. The following are a recapitulation of the important issues in the multimedia components that were used in the development of the CD-ROMs with regard to dual coding, subtitles, student control, character writing, and use of audio.

In terms of dual coding, the researcher has implemented both the recording and text reading in the CD-ROMs, with the Play ALL button, based on the results of Shih and Alessi' s (1996) study suggesting that hearing explanation without reading text seemed to hinder learning. Bradey and Henderson (1995) pointed out that since some students could only concentrate on the voice-over or the text, voice-overs interrogating the text could occur after the user clicks to continue. The researcher took Bradey and Henderson's suggestion and implemented the Text section of the Mandarin CD-ROMs with authentic recording, text and translation/subtitle, the user can choose to click on the sound or simply read the text or read the translation first. The user can then listen more constructively having already visited the text for meaning making, and the text is still present on the screen for reference.

In terms of subtitles, the researcher used English or Portuguese translation as subtitles in the development of the CD-ROMs, based on Vanderplank's (1988) suggestion that subtitles might help to develop language proficiency through enabling learners to be conscious of a new and unfamiliar language that might

otherwise simply be lost in the stream of speech.

In terms of student control, the researcher added the Repeat and the Stop buttons, based on two cases. Bradey et al.'s (1995) recommended that 'learners should have a fair degree of control over selecting whether to play, turn the sound off or replay in order to enhance their perceived learning needs at the particular time or studying' (p. 114). Some students in Beccue, Vila and Whitley's (2001) expressed concern that they were not able to play clips in random order and that they were forced to listen to all clips. Therefore sound clips in the CD-ROMs can be played at random with user control.

In terms of character writing, the researcher produced the character writing as static pictures in the first volume of the CD-ROMs, based on Park's (1998) suggestion that static graphics with motion cues should be considered as an alternative to graphics animation if such cues can adequately represent task attributes. The researcher improved the character writing as animation in the subsequent version of the CD-ROMs, based on Park's claim that animation is more effective than static graphics if static graphics do not adequately represent the dynamic nature of animation.

In terms of audio use, the researcher decided not to use video in the Text section of the CD-ROMs to accommodate the weaker students, based on Baltova's (1994) suggestion that the stronger students were able to benefit more from the instruction with video. She implemented all the listening tests in the CD-ROMs via an audio mode, based on Coniam's (2001) suggestion that listening tests should be implemented via an audio mode.

6.232 Pedagogy Considerations

The teaching methods and media used were chosen to hold learners' interest, to remind them of earlier learning, to stimulate new learning, to give them rapid

feedback to their answers, and to encourage them to practise and review. The language pedagogy used is the importance of meaning, interaction, practice, and learner-centeredness. It should not be overlooked that learning with computers is often fun! This system can be both motivating and stimulating. The essential pedagogical idea underlying the production of this package is that of opening up new opportunities for students to learn. It enables them to study whichever particular area they wish, and when and where they find it most convenient, and at their own individual pace.

Zhang (1998) said that meaning is the most important factor in language acquisition as well as language use and that interaction is both important in language learning and language use. In the 'Click!' CD-ROMs, meanings of the text as well as of individual words are provided. Also provided are the feedback in the exercises as well as in the Speech Sound Table. Encouraging the students to practise as much as possible, the researcher of this study tried to make the program as useful and interesting as possible. Because the CD-ROM drive is a random access device, the learner can control the material sequencing and selection and the pace of progress.

The system is suitable for Chinese as well as Western students. For the Chinese students, they can listen to selected recordings as often as they like. For the Western students, other than listening to the recordings, they can visually see how Chinese characters are written and they can practise as often as they like with the exercises. With the capabilities mentioned in the system, the researcher is hoping she can achieve her goal of holding their interest, reminding them of earlier learning, and to encourage them to practise and review as often as necessary.

6.24 Contents of the Click! System

The Click! Interactive Mandarin I System is mainly divided into four major parts: Speech Sound, Text, New Words, and Exercises. The Speech Sound Table, consisted also of the Initials and Finals, which made up the fundamental pronunciation of Mandarin. The Text, which consists of an Explanation section, is where the dialogue is. The New Words, which consists of the Animated Characters, includes all the new vocabulary learned in that particular lesson. Exercises are divided into four types of Exercises: Tones/Sound Discrimination, Substitution/Extensions, Questions/Answers, and Matching. Tones/Sound exercises include all those exercises with the sound recording. There are a total of thirty lessons in volume I, from lesson 1 to lesson 30.

What makes the system unique is the following: Portuguese/English translation, sound/visual effects, and display of answers. The system provides either Portuguese or English translation in the following sections: Text, New Words, and Questions/Answers. It provides sound effects in the following sections: Speech Sound Table, Text, and New Words. It provides visual effects in the Animated Characters section. It provides answers in the Exercises section.

From Click! - Interactive Mandarin II, there were some changes in the system. The system is divided into five major parts: Speech Sound, Text, New Words, Exercises, and Glossary. As a result of more literature reviewing, a glossary was added so that the learner can look up the vocabulary in this volume and jump to its associated chapter. Two other changes were made based on students' suggestions. Chinese characters were now displayed in the direction of the stroke to make it easier for learners to see how the characters are written. A Test button was enabled in the Speech Sound Table and Play All buttons were added in the Text section and in the Tone/Sound Discrimination Exercise.

There are a total of twenty lessons in volume II, from lesson 31 to 50.

From Click! - Interactive Mandarin III, the simplified Chinese character writing and a dictionary with pinyin, Chinese character, English, or Portuguese input were added. Students can now learn how to write simplified as well as traditional Chinese writing. If they have any problems with a vocabulary, they can simply look up the meaning in the dictionary provided with the CD-ROM. There are also twenty lessons in volume III, from lesson 51 to 70.

The contents of the 'Click!' CD-ROMs was built based on the existing textbooks and CDs, the contents of the PLATO and CyberChinese systems, and Zhang's (1998) suggestions. The PLATO user-interface was written in Chinese characters, pinyin, and/or English. While the students were listening to a tone, they were also seeing on the screen a drawing of the tone symbol with the voice. The PLATO System incorporates a vocabulary section to help the student with new characters and new words encountered in the lesson and it was set up to show the students how to write each character where the student could control the duration of the pause between strokes during writing. Based on the PLATO System, the user-interface of the 'Click!' CD-ROMs was written in Chinese characters, pinyin, English or Portuguese. The student can listen to a tone while the Chinese character, and pinyin and translation will be displayed on the screen. The New Words section of the 'Click!' CD-ROMs resembles the vocabulary section of the PLATO System which helped the student with new characters and new words encountered in the lesson with a sound recording. In addition, how characters were written was shown stroke-by-stroke where the students could control the duration of the pause between strokes during writing.

CyberChinese incorporated a drill section where the students were introduced to new material. The students saw CyberChinese as a computer teacher assistant to them, always ready to drill them and review with them.

Based on the CyberChinese System, the 'Click!' CD-ROMs include drill and practice exercises such as Tones/Sound Discrimination, Matching, and Questions and Answers to let the students review the material, just like a teacher assistant. Two important pedagogical features of CyberChinese inspired the implementation of 'Click!': it employed multiple media links and immediate feedback on their language skills. Media links allow students with different learning styles, whether visual, textual, or auditory, to use the system. The 'Click!' CD-ROMs provide immediate feedback in the Speech Sound Table and the exercises sections.

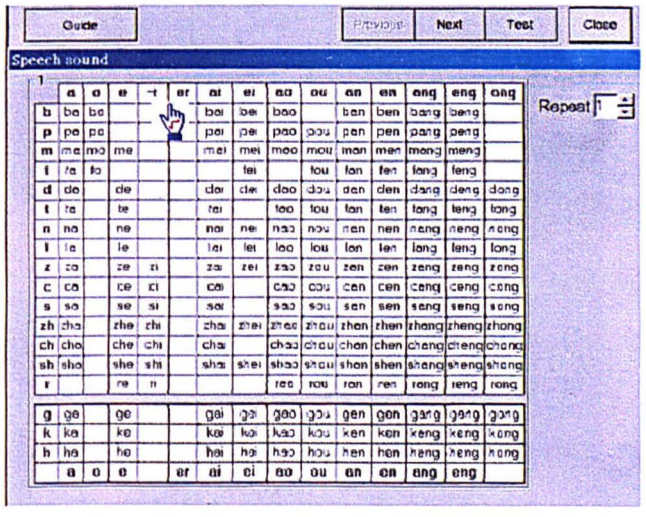
Since the initial effort of the CD-ROM production was for the beginning level and taking Zhang's (1998) suggestion, the 'Click!' CD-ROMs also address the common areas: pronunciation, vocabulary, and characters. The researcher made sure that the CD-ROM was useful to the students in Macao by providing a pronunciation table and teaching romanisation to Cantonese speakers, and teaching correspondence between simplified and traditional style characters for students who already knew one style.

Zhang also described an exercise that the researcher has implemented in the CD-ROMs. The exercise is the Find/Identify exercise, which is the Tones/Sound Discrimination exercise in the CD-ROMs. In such exercises, the computer presents a linguistic token aurally and then a number of choices visually, one of which is the correct answer. The user finds/identifies and clicks on it. The exercise practices either listening alone or a combination of listening and reading.

6.25 Practice Sessions

The 'Click!' CD-ROMs are designed so that learners can master model dialogues as effortlessly as possible by following a series of sessions in order. For those students who are new to Mandarin, they may like to learn their pronunciation and intonation from the Speech Sound Table. For those who like to learn new vocabulary, they can use either the New Words or the Dictionary section. Those who like to practise dialogue can use the Text section. For those who like to review grammar, they can use the Exercises section. For those who like to look up word usage, they can use the Glossary section. For those who want to review or to learn Chinese character writing, they can use the Animated Character section. Each practice session is discussed next.

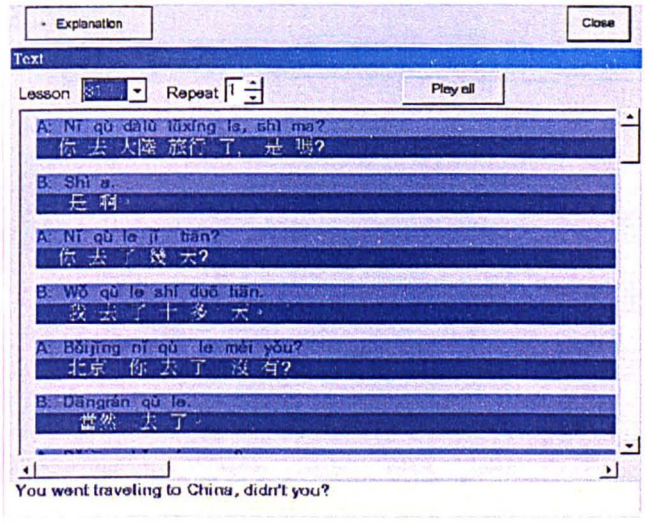
6. 251 Beijing Dialect Speech Sound Table



The Speech Sound Table represents all the possible sounds in the Mandarin language and it is available in all three volumes of the CD-ROMs. The Next button represents another page of the Speech Sound Table and there are a total of 3 pages. The student can click to listen to each sound as much as he or she likes

and test himself or herself with the Test button. The test (available from volume II onwards) begins with a randomly selected sound from the table and the student then clicks on the symbol that represents that sound. The system will then tell the student whether he or she is correct or not.

6.252 Text



The Text section of the CD-ROM represents all the dialogues in the textbook. Each sentence is displayed with Chinese characters, pinyin, and the corresponding English or Portuguese translation located at the bottom of the screen. The student can click to listen to each sentence at a time for as many times as he or she likes or he or she can click the Play All button (available from volume II onwards) and listen to the entire lesson at one time with the Stop button to stop the recording at any time.

6.253 New Words



The New Words section is where the new vocabulary is being introduced with its pinyin and meaning in either English or Portuguese. The student has three ways of listening to each word as much as he or she likes. He or she can click on the pinyin to listen to the pronunciation one word at a time, select those words that he or she has trouble with and just listen to those words, or use the Play All button to listen to all the words sequentially with the option of stopping at any time.

6.254 Chinese Character Writing

Click! I Click! II Click! III

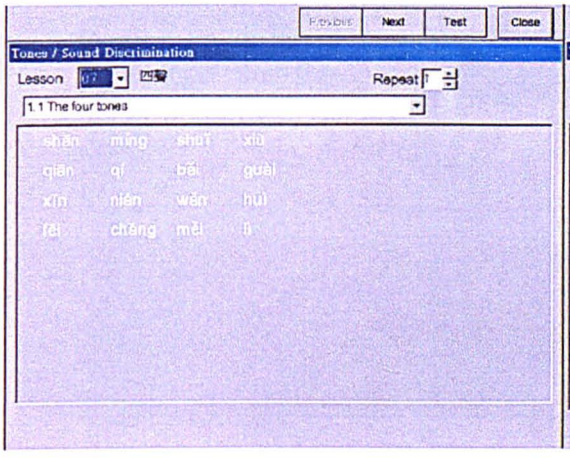


The Animated characters section teaches the students how to write a Chinese character. The three volumes have gone through major changes. The first volume of the left hand side could only show the stroke order, but not the direction in printed format. The second volume made changes so that the

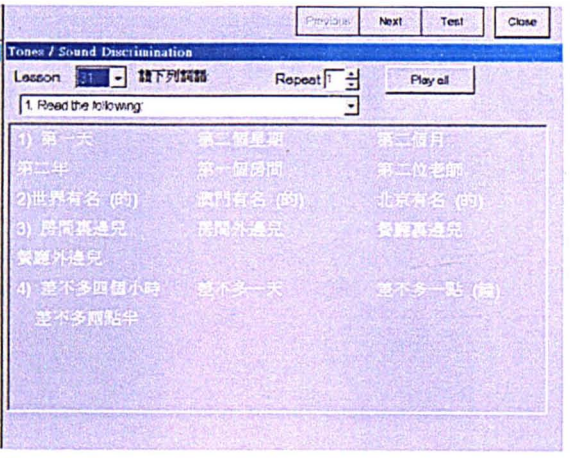
direction of the stroke showed in a more natural way of writing. Then finally in the third volume, those characters with simplified character format can also be displayed.

6.255 Tones

Click! I

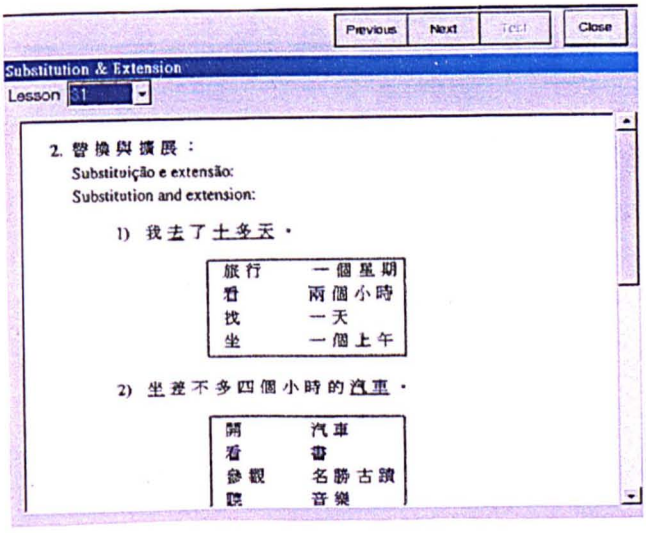


Click! II



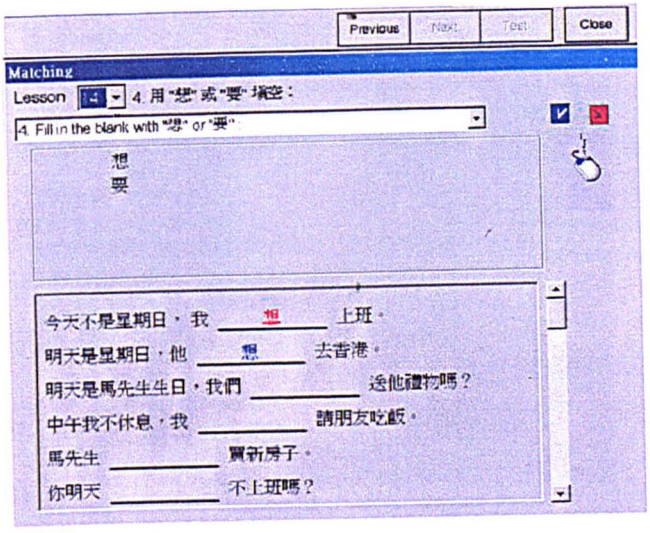
The Tones/Sound Discrimination section is the first part of the exercise. The student can listen to the one tone or one phrase at the time as much as he or she likes or use the Play All button (available from Volume II onwards) to listen to given tones or phrases. The test begins with a randomly selected tone or phrase from this list and the student then clicks on the tone or phrase that represents that sound. The system will then tell the student whether he or she is correct or not.

6.256 Substitution



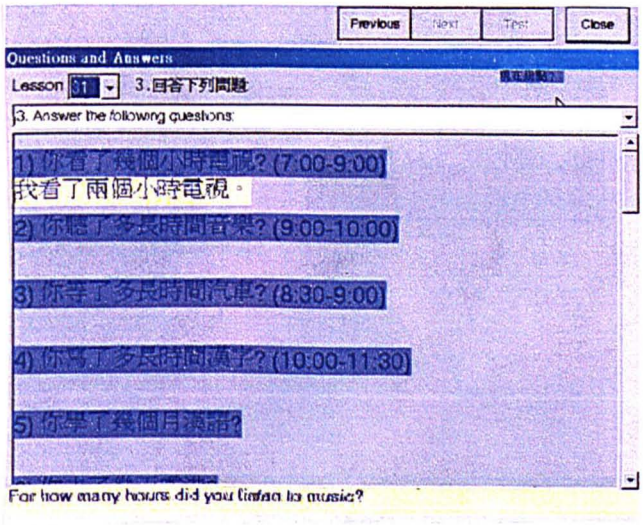
The Substitution section is the second part of the exercise. The student cannot interact with this part except using it to do substitution exercise with the teacher in class or review on his or her own at home.

6.257 Matching



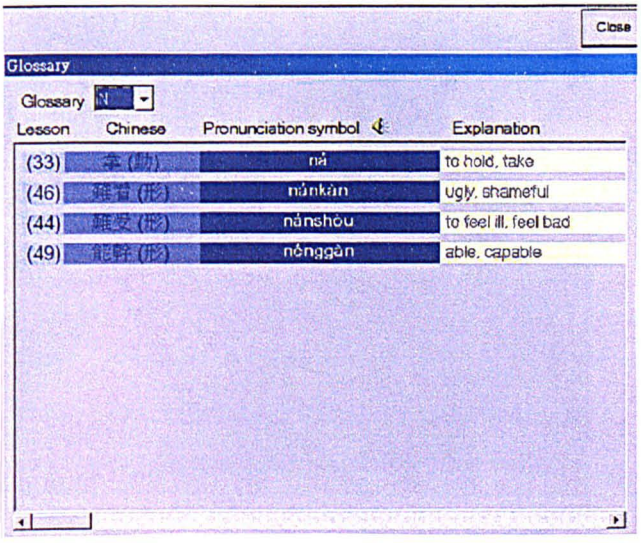
The Matching section is the third part of the exercise. Given several choices in the middle rectangle section, the student can drag and drop the correct answer to the underlined portion of the sentence. The correct answer will be displayed in blue and the incorrect answer will be displayed in red. The student has an option to try to answer as much as he or she likes until he or she gets all the correct solutions.

6.258 Questions and Answers



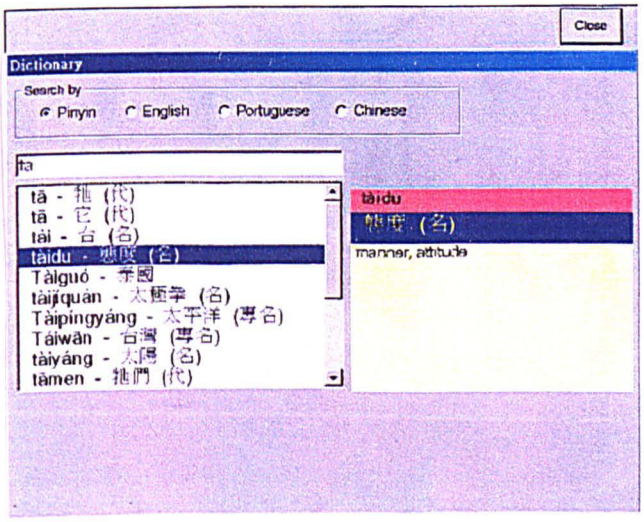
The Questions and Answers section is the fourth part of the exercise. Given each question displayed in blue, the student can either click to see the solution or simply read the translation in either English or Portuguese at the bottom of the screen.

6.259 Glossary



Starting from Volume II of the CD-ROM series, a glossary section is provided for the students to search for a particular word with the option to jump to the corresponding lesson to see sample usage of that word. Otherwise the screen is just like the New Words section, the student can listen to the pronunciation and view the meaning of the word either in English or Portuguese.

6.260 Dictionary



The Dictionary section is only available starting the volume III of the CD-ROM series. The student can search for a word using one of the four options: pinyin, English, Portuguese, or Chinese characters. Once the word is typed, words with similar spelling will also be displayed. The student can then choose the word he or she likes, listen to the pronunciation or view the meaning of the word either in English or Portuguese.

In this chapter, the rationale for using an instructional model in the CD-ROM development process and the Knirk-Gustafson instructional model were discussed. Then the development of the Click! Interactive Mandarin CD-ROM series was also presented. In this research, the researcher adopted Cunningham's (1986) suggestion that research is a process of constructing knowledge. She did not plan on answering if the multimedia CD-ROM is better than traditional teaching. She did not intend to prove one general type of instruction is better than another. Her goal was to develop an instructional package to help the students in Macao in their Mandarin learning. The Click! Interactive Mandarin CD-ROM series consisted of a set of five volumes, in which 3 volumes are under investigation in this study. With the Knirk-Gustafson Instructional Development model, the researcher implemented audio recording for listening skill, an electronic dictionary and glossary for reading and vocabulary learning, audio narration (with reading text) for reading comprehension in the 'Click!' CD-ROMs. Now that the reader has a better understanding of the Mandarin CD-ROM development in this study, the researcher will discuss the research methodology in the next chapter.

Chapter 7: Research Methodology

With the Knirk-Gustafson Instructional Development model, the researcher of this study attempted to use an ethnographic research method within the constructive/interpretive paradigm to explore the benefits, the limitations, and the appropriate use of multimedia in Mandarin learning. The chapter begins with an introduction of educational research and qualitative research. Then ethnographic research is discussed in detail in terms of its characteristics, strengths and weaknesses, data collection methods, and analysis and grounded theory. Furthermore, the feasibility of ethnographic research in a classroom is reviewed. Finally, research instruments, the research model, research questions, and design of the study are discussed. The instruments used were interviews, focus groups, in-class observations, logs and journals, and questionnaires. Hypotheses, a formative research model, and research questions are created to guide the development of this research.

7.1 Educational Research

Creswell (2002) indicated that the 20th century began with one major approach to educational research and ended with two major approaches. The development of the two approaches, quantitative and qualitative research, is not a case of one approach replacing the other; instead, it reflects the addition of qualitative inquiry to the traditional quantitative approach. Creswell pointed out that quantitative researches may include experimental and quasi-experimental designs, correlational study, and descriptive survey whereas qualitative researches may include case studies, grounded theory research, narrative inquiry and ethnography.

Wiseman (1999) described quantitative research that gathered numerical data on observed behaviour with a view to subjecting the findings to statistical analysis and qualitative research that emphasises the meaning of events as expressed by those who experience them.

Creswell explained three factors that need to be considered when deciding whether to use quantitative or qualitative research and they are the audience for the study, the experiences and training that researcher has, and perhaps most importantly, the type of research problem that is to be addressed. If the audience does not know the approach of the study, the researcher may need to educate readers about the basic characteristics of the approach. If the researcher is not trained in conceptualising, conducting and writing the research, he or she may have to be educated about the skills. When addressing a problem in which the issue requires that trends be described or that variable relationships be explained, the researcher chooses quantitative research. When the researcher is interested in exploring and understanding a central phenomenon, such as a process, an event, or concept, he or she chooses qualitative research.

Trochim (2001) discussed positivism and post-positivism in educational research. Positivism holds that the goal of knowledge is simply to describe the phenomena that are experienced and the positivists believe in empiricism--the idea that observation and measurement was the core of the scientific endeavour. The key approach of the scientific method is the experiment, the attempt to discern natural laws through direct manipulation and observation. Positivists believe that objectivity was a characteristic that resided in the individual scientist. Scientists are responsible for putting aside their biases and beliefs and seeing the world as it really is. On the other hand, post-positivists recognise that all observation is fallible and has error and that all theory is revisable. Because all

measurement is fallible, the post-positivists emphasise the importance of multiple measures and observations, each of which may possess different types of error, and the need to use triangulation across these multiple error sources to try to get a better view of what is going on in reality. The post-positivists also believe that all observations are theory laden and that scientists are inherently biased by their cultural experiences and world views. Some qualitative researchers fit comfortably into the post-positivist tradition of post-positivism common to much contemporary quantitative research. Increasingly, researchers are interested in blending the two traditions, attempting to take advantage of each.

Hitchcock and Hughes (1995) said that those scientists who hold the positivistic tradition are for many reasons likely to concentrate upon the collection of large amounts of data since the concern is with establishing patterns and regularities in their data. As a consequence, this approach is likely to be quantitative in orientation. On the other hand, the post-positivists argued for the importance of discovering the meanings and interpretation of events and actions and adopt the interpretative or qualitative approach in their research.

7.2 Qualitative Research

The researcher decided not to use the quantitative approach and used qualitative approach for this research for the following reasons. First, Reeves (1992) said that evaluations of multimedia software utilising experimental or quasi-experimental designs should not be carried out until the software is optimised through various formative evaluation strategies. Since this research was only involved with formative evaluation and the researcher already ruled out the use of experiment to compare between courseware to the traditional methods of teaching, so experimental and quasi-experimental designs were not considered.

Second, this study planned to investigate whether or not these human factors shown in Figure 14 (see page 75), affect Mandarin learning with the CD-ROM and whether or not the new experiences provided by the CD-ROM can change the attitude and the motivation of the learners, so correlational design of measuring the degree of relationship among variables was not considered. Finally, the researcher was only working with a small sample of students[4], so describing trends in a large population of individuals as in the survey design was not considered.

Trochim (2001) believed that the quantitative-qualitative debate is philosophical, based on ontological and epistemological assumptions. Hitchcock and Hughes (1995) pointed out that ontological questions surround the social world and the concern of being and epistemological questions surround the questions of knowing and the nature of knowledge.

Trochim said that many qualitative researchers operate under different ontological assumptions about the world. He believed that everybody experiences reality from his or her point of view and the reality is socially constructed. He argued that the researcher is a unique individual and that all research is essentially influenced or biased by each researcher's individual perceptions.

Trochim added that many qualitative researchers also operate under different epistemological assumptions from those that quantitative researchers follow. Many qualitative researchers believe that the best way to understand any phenomenon is to view it in its context. They see all quantification as limited in nature. For some qualitative researchers, the best way to understand

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[4] Macao Polytechnic Institute assigned ten Portuguese students for the main study of this research

what is going on is to become immersed in it. Rather than approach measurement with the idea of constructing a fixed instrument or set of questions, allow the questions to emerge and change as one becomes familiar with subject matter.

In this study, the researcher took the ontological assumptions that all research is essentially influenced or biased by each researcher's individual perceptions and the epistemological assumptions that the best way to understand what is going on is to become immersed in it, therefore an ethnographic approach was attempted in this research.

7.21 Ethnographic Research

The researcher wanted to use an ethnographic approach in this study because she came across two articles that inspired her (Antón, 1996; Novak-Aitken, 1993). Antón (1996) said that the proponents of an ethnographic approach find this method a more successful approximation to the study of classroom interaction than the use of quantitative analyses and despite its limitation, the use of ethnographic techniques can be a powerful tool to provide language educators with some insights on the culture of particular classrooms. Novak-Aitken (1993) suggested that ethnographic research has great potential for examining issues related to technology use, such as the evaluation of instructional programs, the exploration of innovative uses of technology, and the relationships between teacher and computer, student and computer.

Creswell (2002) described three forms of ethnography: the realist ethnography, the critical ethnography, and the case study. A realist ethnography is an objective account of the situation reporting on the information learned from

participants at a field site whereas a critical ethnography includes an advocacy perspective to ethnography, such as empowering people by giving them more authority and challenging the status quo. A case study ethnographer searches for cultural theme and shared pattern of group behaviour over time. When the case itself is of interest, it is called an intrinsic case. Alternatively, the focus of a qualitative study may be a specific issue which is called instrumental case. Case studies may also include multiple cases, called a collective case study.

7.211 Characteristics of an Ethnographic Research

Creswell identified several characteristics that typify an ethnographic study. Ethnographers are interested in the knowledge about culture and studying specific cultural themes, which is a general position declared or implied that is openly approved or promoted in a society or group. They identify a single site, locate a group within, and gather data about the group and look for shared patterns of behaviour, beliefs, and language that the culture-sharing group adopts over a prolonged period. A culture-sharing group in ethnography is two or more individuals that have shared behaviours, beliefs, and language. The ethnographers collect data through spending time at participants' sites where they live, work or play. During data collection the ethnographers begin to forge a study. This consists of analysing the data for a description of both the individuals and sites of the culture-sharing group; analysing patterns of behaviour, beliefs, and language; and reaching some conclusion about the meaning learned from studying the people and the site. After description and analysis comes interpretation. In interpretation, the ethnographers relate both the description and the themes back to a larger portrait of what was learned, return to the literature on the cultural themes and raise further questions based on the data.

They then present the description, themes and interpretation within the context or the setting of the culture-sharing group with a good understanding of the context involved. Ethnographic researchers make interpretations and write their report reflexively. Reflexivity in ethnography means that the researchers are aware of and openly discuss their role in the study in a way that honours and respects the site and people being study. Being reflexive also means that researchers' conclusions are often tentative or inconclusive, leading to new questions that need to be answered and pondered.

Schensul, Schensul and LeCompte (1999) explained that ethnography is a scientific approach to discovering and investigating social and cultural patterns and meanings in communities, institutions, or other social settings. One primary difference between ethnography and other methods is that ethnographers discover what people do and why before they assign meaning to behaviours and beliefs. Ethnography depends on the researcher as the primary tool of data collection, so ethnographers pay special attention to issues of bias and ways of ensuring accuracy of data. Wolcott (1997) said that 'it is the write-up, rather than in the fieldwork, that materials become ethnographic' (p. 343). Novak-Aitken (1993) noted that ethnographic research reports often take the form of descriptive passages as viewed by the participants to outsiders, or write-ups which outline any theories uncovered or suggest future research avenues.

Spindler and Spindler (1992) said that at least in the initial stages of a project, the ethnographers should not work out specific hypotheses, coded instruments, or even highly specific categories of observation. However, there is no hard or fast rule. The ethnographer usually starts off being interested in a problem area. As a rule, the specific problem, with related hypotheses, is

developed as the fieldwork proceeds. The ethnographer knows something interesting is going on and tries to relate to it. Eventually, the observations begin to fall into categories and be governed by models. The important criterion is that the ethnographer should proceed in the initial stages of investigation with as open a mind as possible. Soon one begins to formulate hypotheses that are explored and tested by continued, repetitive observation and data elicitation.

The characteristic of the ethnographic research in this study is as follows. As stated earlier, due to special circumstances that Macao was going to be handed back to China at the end of 1999 and the Portuguese participants would have been long gone if the researcher of this study did not collect the data, literature review and data collection were done at the same time. The researcher started with an area of interest in the use of multimedia in Mandarin learning. From her initial literature review, she wanted to study more on perceptions, preferences, motivation, and amount of invested effort as shown in Figure 14 (see page 75). Therefore questions from Table 8 (see page 76) were created to facilitate the interview process. Figure 20 (see page 109) was created as a result of the initial literature review and data collection from the pilot interviews. Second literature review and the pilot study were proceeding at the same time. Hypotheses were formulated as the observations and interviews were taking place. Finally, the observations fell into categories and governed by the research model.

7.212 Strengths and Weaknesses

Crowl (1993) said that ethnographic research is rapidly gaining popularity as a way of studying educational phenomena. A major criticism is the

subjective way in which findings may be made and interpreted. However, Fraenkel and Wallen (1993) noted that ethnographic research provides the researcher with a much more comprehensive perspective than do other forms of educational research. By observing the actual behaviour of individuals in their natural settings, one may gain a much deeper and richer understanding of such behaviour. They pointed out several ways where ethnographic research can be used in education. First, ethnographic research lends itself well to research topics that are not easily quantified, such as thoughts and ideas of teachers and students. Second, ethnographic research is particularly appropriate to behaviours that are best understood by observing them within their natural settings, such as the dynamics of a faculty meeting or the interaction between students and teacher in a classroom. Finally, ethnographic research is especially suited to studying group behaviour over time, such as to understand as fully as possible the life of a school over a year-long period.

Novak-Aitken (1993) discussed the strengths and limitations for the use of ethnographic methods in technology use. As far as strengths go, first of all, this method promotes a holistic view of a research issue including the identification and exploration of all possible aspects and components. Secondly, along with the inductive analysis process, which is central to this method, it allows for unexpected findings to evolve. As far as limitations go, first of all, one of the greatest hindrances is the vast amount of time required in the field to collect the data. Secondly, intensive data collection produces substantial amounts of raw data, which must be organised, analysed, and interpreted. Thirdly, another difficulty associated with this type of research is the researcher's subjectivity and bias. Finally, with the ethnographic method it is difficult to replicate a study, since it is generally intended as an examination of a specific situation.

7.213 Ethnographic Data Collection Methods

According to Novak-Aitken, ethnographic researchers rely on three main types of data collection methods: interviews, observations, and written documents.

> Interviews are a central part of ethnographic research because they allow understanding of others' perspectives by attending to what they say. ...Observations, particularly participant observations, are a second major aspect of ethnographic research... The first-hand knowledge and awareness gained through participant observation encourages reflection on the part of the researcher and promotes the discovery and inductive nature of this type of research. A third source of information for the ethnographic research is written documents. These may be archival documents, such as correspondences, budgets, charts, lesson plans or grade books. ...In addition, the researcher's fieldnotes are a vital part of the written documents which play a part in the data collection and analysis process (pp. 104-105)

Using these three different methods of data collection, also known as triangulation, Novak-Aitken claimed that it enhances understanding, builds credibility, strengthens confidence, and increases validity of ethnographic research. The information gathered from one method can be compared to that collected using alternative methods, and weaknesses in a particular methods can be overcome by the use of others.

Crowl (1993) said that ethnographers begin their observations with only a vague notion of the problem they intend to investigate, which are sometimes called foreshadowed problems. The actual problems investigated emerge only as the study takes place and researcher begins to detect patterns of behaviour. In ethnographic research, the researcher typically spends an enormous amount of

time observing a situation. The researcher makes written notes, called field notes. It is common for ethnographers to make memos and draw diagrams concerning possible interpretations of their field notes. In addition to recording field notes based on observations, ethnographers may also carry out interview, administer questionnaires and use written records. Throughout the study, the ethnographer constantly shifts back and forth from observing and notetaking to analysing the observation. They are constantly proposing a theoretical notion and checking to see if the notion is verified. The results of this interplay lead to what is sometimes called grounded theory.

7.214 Analysis and Grounded Theory

Novak-Aitken pointed out that analysis of data collected through ethnographic methods can be completed through a variety of techniques, such as the matrix development (Miles and Huberman, 1994). Miles and Huberman explained that matrices define rows and columns where the data entries are multiform which can consist of short blocks of text, quotes, phrases, ratings, abbreviations, and so on. The display format and shape of the entries will depend on the subject matter: a general situation, detailed chronologies, the behaviour of people in different roles, or the interplay of conceptual variables. Novak-Aitken noted that besides the generation of theories or hypotheses, data analysis can focus on the understanding of specific incidents through the identification of common patterns or trends that appear in the data.

LeCompte and Schensul (1999) indicated that ethnographic research uses inductive, interactive, and recursive processes to build theories to explain the behaviour and beliefs under study. The researchers start with both the research question and a series of initial hypotheses and models. These hypotheses are investigated in initial interviews and observations. They are then elaborated

and retested through continued collection of data using the same or different methods. The process continues until new information confirms a stable pattern, and the model appears to be complete. LeCompte and Schensul noted that Glaser and Strauss (1967) refer to this process as grounded theory. Like Heshusius' (1981) study, this study used a grounded theory methodology to facilitate the analysis of data. Charmaz (1996) said that grounded theory analysis starts with data and remains close to the data. Grounded theory works are empirical studies, whether their data sources are autobiographies, published accounts, public records, novels, intensive interviews, case-studies, participant observer field notes or personal journals.

> Grounded theorists evaluate the fit between their initial research interests and their emerging data. They do not force preconceived ideas and theories directly upon their data. Rather, they follow the leads that they define in the data, or design another way of collecting data to try to follow their initial interests (pp. 32-33).

Charmaz also pointed out distinguishing characteristics of grounded theory methods which include: 1) simultaneous involvement in data collection and analysis phases of research; 2) creation of analytic codes and categories developed from data; 3) the development of middle-range theories to explain behaviour and processes; 4) memo-writing, writing analytic notes to fill out categories; 5) theoretical sampling, sampling for theory construction; and 6) delay of the literature review. She suggested that grounded theory methods are suitable for studying social psychological topics such as motivation and personal experiences.

According to Charmaz, perhaps the most important basic rule for a grounded theorist is: study the emerging data. She suggested that qualitative grounded theory coding means creating the codes as the researcher studies his or

her data. Focused coding uses initial codes that reappear frequently to sort large amounts of data and it allows the researcher to create and to try out categories for capturing his or her data. A category is part of the researcher's developing analytic framework and categories often subsume several codes. The data gathered in grounded theory become increasingly more focused because the researcher engages in data analysis while collecting data. The data analysis drives subsequent data collection. The simultaneous involvement in data gathering and analysis is aimed towards developing theory. She also suggested making comparisons of the categories, with different people, data from the same individuals, and comparing categories in the data with other categories. Memo writing is the intermediate step between coding and the first draft of the completed analysis and it leads the researcher to explore his or her codes and connect categories and define how the data fit into larger processes. Charmaz (2000) said that theoretical sampling helps researchers define the properties and fills gaps in their data and holes in their theories. Researchers can sample people, scenes, events or documents, depending on the study and where the theory leads them. They may return to the same settings or individuals to gain further information.

Charmaz (2000) depicted her description of grounded theory strategies as constructivist version of the grounded theory, which seeks meanings from respondents and the researcher. A constructivist approach necessitates a relationship with respondents, listening to their stories with openness to feeling and experience. Coding and categorising processes sharpen the researcher's ability to ask questions about the data. Posing new questions to the data results in new analytic points where the researcher can go back and forth to ask specific questions around the new category. She proposed taking the reader into a story

and imparting its mood through narrative exposition in a constructivist grounded theory approach. Simple language and straightforward ideas make theory readable. Questions help tie main ideas together or redirect the reader. Immediacy draws the reader into the story. A mix of concrete detail with analytic categories connects the familiar with the unfamiliar. The researcher should try to portray respondents' worlds and views.

7.22 Feasibility of Ethnographic Research in a Classroom

Wolcott (1997) warned researchers about doing ethnography versus borrowing ethnographic techniques. First, simply using observation in the field does not guarantee that the results will be ethnographic. Second, there is no magic formula for combining the methods. Anthropologists conduct their inquiries into human social behaviour by observing and asking, and ordinarily attend to broad cultural contexts. Educational researchers, focused on particular problems, intent not only to address those problems but to remedy them as well, are better advised to exhibit some reserve in noting how they may at times avail themselves of several techniques for getting their information, how their approach may be influenced by the characteristic long-term thoroughness of the anthropologists, or how their perspective may be informed by relevant prior work in anthropology. It is not the techniques employed that make a study ethnographic. The critical element is the perspective through which one interprets what one has seen. Just simply looking at repeated viewings of particular behaviour in a classroom does not make the study ethnographic. Ethnography is well suited to answer the question, "What is going on here?" That is, first a question of behaviour and events, and, second, a question of meanings. Genuine ethnographic inquiry proceeds best under conditions where

there will be time to find out what is going on, and where there is a reason to believe that knowing what things mean to those involved could conceivably make a difference.

The researcher began this study as a case study ethnographer, trying to study the culture of the Portuguese students learning Mandarin in Macao. She wanted to address beliefs, attitudes and motivation of these participants towards Mandarin learning with the CD-ROM. However she encountered several problems that made her changed the focus from an ethnographic approach to a general case study approach and they are time spent in the field, role as an observer, and use of a key informant.

First, Crowl (1993) pointed out that there is mounting concern that a growing number of researchers applying ethnographic techniques in educational settings have little or no training as anthropologists, resulting in fundamental errors, such as spending far too little time making observations. Spindler and Spindler (1992) suggested at least 3 months, which spread over an entire school year, to be spent in a classroom. Wolcott (1997) said that his ideal ethnographer should remain in the field at least one year, preferably longer. Because the Portuguese participants in this study only studied Mandarin out of their own interest and that it was not a regular class, their attendance was unpredictable. They only attended a total of 7 hours of in-class observation over three months. Therefore, the researcher had no choice but only worked with 7 hours of their time. Initially, she thought this was acceptable because Antón (1996) and Novak-Aitken (1993) only spent 2 months and 3 months respectively in a classroom doing an ethnographic research. But with Crowl, Spindler et al. and Wolcott's advice, there was too little time spent with the students in this study to make this research ethnographic. Spindler et al. said that the validity in

ethnographic studies largely depends on an adequate period of study. Besides, the researcher did not have much chance to interact with the students outside of the classroom. She only spent two occasions with them socially.

Second, Wolcott's impression that most of what is casually passed off as participant observation research is decidedly nonparticipatory. More frequently, researchers are required to assure those in charge that their presence will cause no interruption. Most researchers in schools are privileged observers rather than active participants. Because ethnography implies involvement, the extent of genuine participation on the part of researchers is simply assumed by readers to be greater than it was. He thought that ethnography can play a more important role by encouraging educational researchers to slow their efforts and widen their gaze, simply to do less more thoroughly. Spindler et al. noted that it is particularly difficult to use participant observation in classrooms. Novak-Aitken also noted that it is impossible for the researcher to become a true participant of the classrooms under investigation due to the nature of classroom environments. Even though participant observation is suggested to be used in an ethnographic study, the researcher could only use marginal participation. She found that it was not easy to participate as a member because she is not Portuguese and she could not speak the Portuguese language. She was expected from the Mandarin teacher and her school to help out the students when they had problems and try not to interfere with the teaching. She was worrying that too little involvement might affect the observation study and too much involvement might interfere with normal class activity.

Finally, Wolcott said that there are unique problems to be faced in doing ethnographic research in settings already familiar. Most researchers feel so well versed about what goes on in schools that they become their own key informant

in school research, which he referred to as "ethnography-minus-one" research. A key informant is an individual with whom one spends a disproportionate amount of research time because that individual appears to be particularly well-informed, articulate, approachable, or available. The phrase ethnography-minus-one serves notice that in school-related studies it is too often the researcher who is telling the story said how things should be rather than trying to grasp the native's point of view. The researcher did not really use a key informant in this study because of two reasons. The reason was that most of the participants were very busy and not willing to spend any time talking about what was going on. So she used informants instead and she only spoke to them during the interviews. The second reason was the researcher's own fault. She thought she was already familiar with the environment so she did not insist on using a key informant.

After doing this research, the researcher found that the feasibility of ethnography in a classroom depends on whether enough time is spent in the observation, whether all the students are required to come to class, whether she can mingle with the students both inside and outside of the classroom, and whether she can speak their language and use a key informant.

While an ethnographic stance might have been preferred, under the circumstances of only spending 7 hours with the Portuguese students, the researcher of this study did what she could in reality and the research is more in line with a case study. However, she continued to use a range of qualitative techniques for data collection, most may be construed as from an ethnographic perspective and some of which are part of a grounded theory approach.

7.3 Research Instruments

Wolcott (1997) said that the ethnographer is the research instrument. Besides the researcher, the instruments used in this research were interviews, focus groups, in-class observations, logs and journals and questionnaires. According to Schensul, LeCompte and Hess et al. (1999), in-depth interviewing is a more systemic approach to data collections, typically conducted with gathering detailed information about specific topics across a sample. Interviewees are selected purposefully or at random to represent a particular population. Focus groups are a variation of interviews designed for the purpose of gathering data about a specific topic from a group of individuals. Just like with interviews, the focus group participants are selected purposefully or at random to represent certain populations. Observations are conducted in real-life contexts for the purpose of recording natural occurrences relevant to the specific intervention. They can range from participant to fully structured and non-participant observation. Observations may be recorded via field notes or with the use of videotape recorders. Logs and journals are techniques that involve the recording of data by participants. Logs provide a written record of activities. Journals are the personal recordings of individuals' experiences to those activities. A questionnaire is simply a set of questions and its purpose is to collect information.

7.31 Interviews

Robson (1993) explained the different types of interviews, which are commonly based on the degree of structured or formality of the interview. At one extreme, there is the fully structured interview, with predetermined set questions asked, and the responses recorded on a standardised schedule. In the middle range, there is the semi-structured interview, where the interviewer has

worked out a set of questions in advance, but is free to modify their order based upon his or her perception of what seems most appropriate in the context of the conversation, can change the way they are worded, give explanations, leave out particular questions or include additional ones. At the other extreme, there is the unstructured interview, where the interviewer has a general idea of interest and concern, but lets the conversation develop within this area. The researcher used semi-structured interviews in this study.

Smith (1996) said that in general, researchers use semi-structured interviews in order to gain a detailed picture of a respondent's beliefs or perceptions about a particular topic. The advantages of using the semi-structured interview can be summarised as follows. It facilitates rapport/empathy, allows a greater flexibility of coverage and enables the interview to enter novel areas, and it tends to produce richer data. On the costs side, this form of interviewing reduces the control the investigator has over the situation, takes longer to carry out, and is harder to analyse (p. 12).

Kvale (1996) said that the virtue of qualitative interviews is their openness. No standard techniques or rules exist for an interview investigation. There are, however, standard choices of methods at the different stages of an interview investigation. They include questions such as: How many interviews will be needed? Should the interviews be taped, and should they be transcribed? How should the interviews be analysed? Should the interpretation be given to the interviewee (p. 84)?

Smith recommended taping an interview because a tape-recording allows a much fuller record than notes taken during the interview. The interviewer can concentrate on how the interview is proceeding and where to go next rather than laboriously writing down what the respondent is saying. Tape-recording does

have its disadvantages. The respondent may not feel happy being taped and may even not agree to the interview if it is recorded. Transcription of tapes takes a long time. However, Smith noted 'I think the benefits of tape-recording so outweigh the disadvantages that I would never consider doing this sort of interviewing without taping it' (p.18).

The researcher of this study started on her semi-structured interviews from February to July in 1999. Notes as well as tape recordings were used during the interviews. There were actually three separate batches of students she had to interview. The first batch was her pilot group. The second batch was her main study group, and the last batch was her follow-up study group. All of the interviewees are or had once been a student studying the Mandarin language. Before her first interview, her supervisor sat down with her to discuss how many students she should interview, and he advised her that the interview should be taped and transcribed later on. The researcher's supervisor said that it might take some convincing to do the taping. Fortunately, the researcher was able to tape all, but one. To help her verify her data transcription, she asked her supervisor to listen to some of the English interviews. To help her verify the translation of the data transcription, she asked her colleague, who is an English teacher at the Macao Polytechnic Institute, to listen to some of the Chinese interviews.

During the interviews, the researcher found the following problems. First, Being Chinese herself, she found that Chinese people tend to be more polite and reserved, she wondered how open and candid were her participants in their interviews. Second, most of the interviews took place during office hours, she suspected that some participants might worry about how what they say might affect their jobs and try not to offend anybody. Those interviewees who were

not part of her school might be more candid. Finally, language used was a problem with the Portuguese participants. The researcher thought that if only she could speak Portuguese, she would be able to elicit more personal and candid responses from the Portuguese participants.

7.32 Observations

Cunningham (1993) indicated that the use of observations provides an opportunity to gain other data including feelings and experience; however it can be more time consuming than questionnaires and interviews. The observer is asked to experience the problem personally or he or she can take on the role of an onlooker. The observation can be structured with explicit guidelines or no guideline.

Robson (1993) highlighted the two important dimensions of different approaches to observation: formal or informal information gathering and the role adopted by the observer. Informal approaches are less structured and allow the observer considerable freedom in what information is gathered and how it is recorded. They would include note-taking, diary-keeping and generally gathering information from participants. The role of the observer can be classified as complete participant, participant as observer, observer as participant, marginal participant and complete observer. The complete participant and the complete observer carry with them very different methodological and philosophical views about the nature and the purposes of observation, echoing the general discussion about qualitative and quantitative approaches. The complete participant role involves the observer concealing that she is an observer, acting as naturally as possible and seeking to become a full member of the group. The researcher who takes the role of a participant as observer is made clear to the group from the start that he or she is doing the research and then tries to establish

close relationships with members of the group. The observer as participant researcher identifies himself or herself straight off as a researcher, but makes no pretence of actually being a member of the group. The marginal participant researcher adopts the role of a largely passive, though completely accepted participant. The complete observer researcher observes the activities of a group without in any way becoming a participant and whose role is not known to the group.

This study took the approach of no guideline, with informal information gathering. The researcher was the data collection instrument and took the role of a marginal participant because she wanted to assure those in charge that her presence would cause no interruption. Conclusions and interpretations from these initial observations and recordings provided the groundwork for the development of the indicators to be used in the data gathering.

Cunningham (1993) suggested that in the early stages of an observation, interviews can help the observer locate key interactions, people, or expected events. Interviews can indicate where and when to observe, as well as a perception of the key events that might be occurring. They continually verify what is happening and why it is happening. Observations and recordings, when combined with interviews, provide a two-facet approach to understanding (p. 145). Interviews were also used with observations in this study.

The typical note taking provides a sketch of the interaction, why it occurred, and who else was involved. When and how should notes be made? According to Cunningham, the best method to follow is to jot down a key few words during the observation. These can be summarised in detail soon after the observation. He also suggested that the most useful way to increase the accuracy of the data collection method is by using multiple observers of the same event. However,

this may be too costly to implement. Therefore there was only one researcher in this study.

The researcher conducted the in-class observation study from March 4 to June 3 in 1999. She jotted down a few words during the observations and filled out the log journal immediately afterward. Interviews were used before the observation study to locate common problems faced by the Portuguese students and interviews were also used towards the end of the observation study to verify data collected.

Cunningham maintained that observations have their problems. It is not easy to record events simultaneously with their occurrence. Observer effects are probably inevitable in any study. The researcher of this study encountered the following problems. First, since the students were not required to attend the class, the number of students attending the class and how long they were supposed to use the CD-ROM was not predictable. It was difficult to collect data and detect a pattern in their group activity. Second, because the students and the teacher were actually doing the researcher a favour by using the CD-ROM in class, the researcher had to assist in any way to make sure the class ran successfully. That included helping out the students when they had problems. In fact, whenever students needed help with regard to the usage of the computer, the researcher had to help out and the Mandarin teacher also expected it. The researcher thought that might have interfered with the observation. Third, because of the way the equipment was set up at that time, the CD-ROM had to be reinstalled every time they were used. If the computers were not set up for the students and the teacher, the researcher felt that they would not be willing to use it. Convenience and accessibility became a very important issue. Fourth, the researcher was not able to video the sessions

because she did not have the accessibility to the equipment and manpower to help out. If classes were videotaped, then the researcher could have gone back and review what was going on in class. Fifth, just like what Cunningham's (1993) findings, it was difficult to record data simultaneously while other things like helping out the students. Having another researcher in the classroom would be quite helpful. Finally, observer effects and novelty effects were found in the beginning of this study. Initially the students were very polite and showed enthusiasm about the use of the CD-ROM when the researcher was there. Once they got over the politeness and the excitement of the CD-ROM, the students spent less and less time with the CD-ROM.

7.33 Focus Group Interviews

Schensul, LeCompte and Nastasi et al. (1999) said that the purpose of focus group research is to identify important issues, domains for further investigation, and opinions on a set of topics. A group interview may be formal or informal and are interactive where members are encouraged to express their opinions. It elicits extensive information from a broadly representative number of people in a relatively shorter period of time.

According to them, a formal focus group interview involves from 5 to 15 individuals from representative groups of people. Under the direction of a group leader or facilitator, these individuals are asked to respond to a previously determined set of questions on a specific topic over a period of not more than about 90 minutes. Participants may receive an incentive to compensate them for time and information. Focus group interviewing uses a quota sampling procedure. They suggested that ethnographers must conduct at least two focus groups for each variable of concern to ensure that they capture most aspects related to the subject of the inquiry. Telephone invitations, followed by letters

describing the purpose, content, structure, location, and sponsors of the focus groups, are important ways to legitimise the focus group sessions for prospective participants.

Vaughn, Schumm and Sinagub (1996) noted that the interactive group format of focus groups offers distinctive advantages for the collection of rich, in-depth data. First, focus group interviews encourage interaction not only between the facilitator and the participants but also between the participants themselves. Second, the group format offers support for individual participants and encourages greater openness in their responses. Third, focus group interviews allow and encourage individuals to form opinions about the designated topic through interaction with others.

Two focus group interviews were conducted in this study, one for the user-interface focus group in November of 1998 and the other for the teacher focus group in April of 1999. Seven people participated in the user-interface focus group that lasted about 90 minutes while eleven teachers participated in the teacher focus group that lasted for about 60 minutes. The two focus groups ensured that the changes suggested by the participants were worthwhile. Since the user-interface focus group was conducted with co-workers within the school, no written invitation was necessary. However, written letters were sent out to individual schools to invite the teachers for the teacher focus group interview. Questionnaires were used to capture data from the focus group interviews.

During the user-interface focus group discussion, the participants were very candid about the problems they found. However, the Portuguese participants were more verbal and spoke more freely. Just like problems with interviews with Chinese people, the Chinese participants were more polite and reserved and rather filled out the questionnaires. The researcher found that a truly relaxed,

candid, and open atmosphere is very difficult to have in a focus group interview when it is conducted in a work environment. The participants might not want to say something that would affect their jobs.

During the teacher focus group discussion, the teachers were speaking among themselves, forming their opinions. Though Vaughn et al. said that this is an advantage, the researcher wondered if that would influence each other's opinions. Since the teachers represented their own schools, they might be careful about what to say, not to offend anybody and not to shame their schools. All of this group of teachers consisted Chinese participants; they tended to be very polite and did not like to be critical. Worrying that what they say might affect their jobs, having peer's influence, being too polite, and not being offensive and critical were some of problems encountered during the focus interviews of this study.

7.4 The Research Model

According to Schensul, Schensul and LeCompte (1999), the initial steps that are required to conduct ethnographic research are to select a paradigm and build a formative research model. Schensul et al. said that constructive or interpretive viewpoint is one paradigm in the ethnographic research. The paradigm represents the viewpoint of the world held by the researcher. Interpretive and constructivist approaches are inherently participatory because meaning can be created only through interaction and is socially constructed. Interpretive approaches do not necessarily begin with, nor are they expected to produce, results that commit to action. Applied ethnographic research benefits greatly from an interpretive or constructivist viewpoint with its emphasis on its recognition of the importance of local context and cultures in human behaviours

and beliefs. A constructive or interpretive paradigm was adopted for this study.

Schensul et al. noted that a formative research model is a diagram that represents the initial relationships among elements or concepts with regard to the topic one wants to study and it is subject to modification, refinement, and improvement at any point throughout the life of the study. The ability to develop, use, and modify such a representational model is an important first step in conceptualising essential data collection.

According to Schensul et al., the first step in establishing a research design using a research model is to generate a statement of research purpose. The next step is to develop a series of research objectives directed towards clarifying the relationship between the independent and dependent domains. The dependent domain refers to the problem or phenomenon of the study, and it changes in response to variations of the independent domains whereas independent domains precede dependent domains in terms of presumed causality.

The construction of a research model at the domain level starts with delineation of the dependent domain. The selection of the dependent domain determines the study's research topic. The selection of the dependent and the independent domains underpins the study's formative theory and guides the process of exploratory data collection. The formative theory is referred to as the middle-range theory that starts with a problem or question to be addressed in a localised population.

The search for independent domains is the strength of the ethnographic approach. The objective of this first stage of modelling is to identify as many independent domains as the researcher can hypothesise to be directly or indirectly related to the dependent domain. Schensul et al. emphasised that the number of independent domains in a study should be between two and five.

The purpose of this research was to find out what influences students to use the CD-ROM in their Mandarin learning. Initially, as shown in the human factors that affect Mandarin learning with the CD-ROM in Figure 14, it was found that perceptions and preferences of multimedia, motivation and amount of invested mental efforts would influence students when using the CD-ROM in their learning. These human factors formed the independent and dependent domains in this research. Then the next step was to construct a series of hypotheses, which form the formative research model in Figure 36. The hypotheses are:

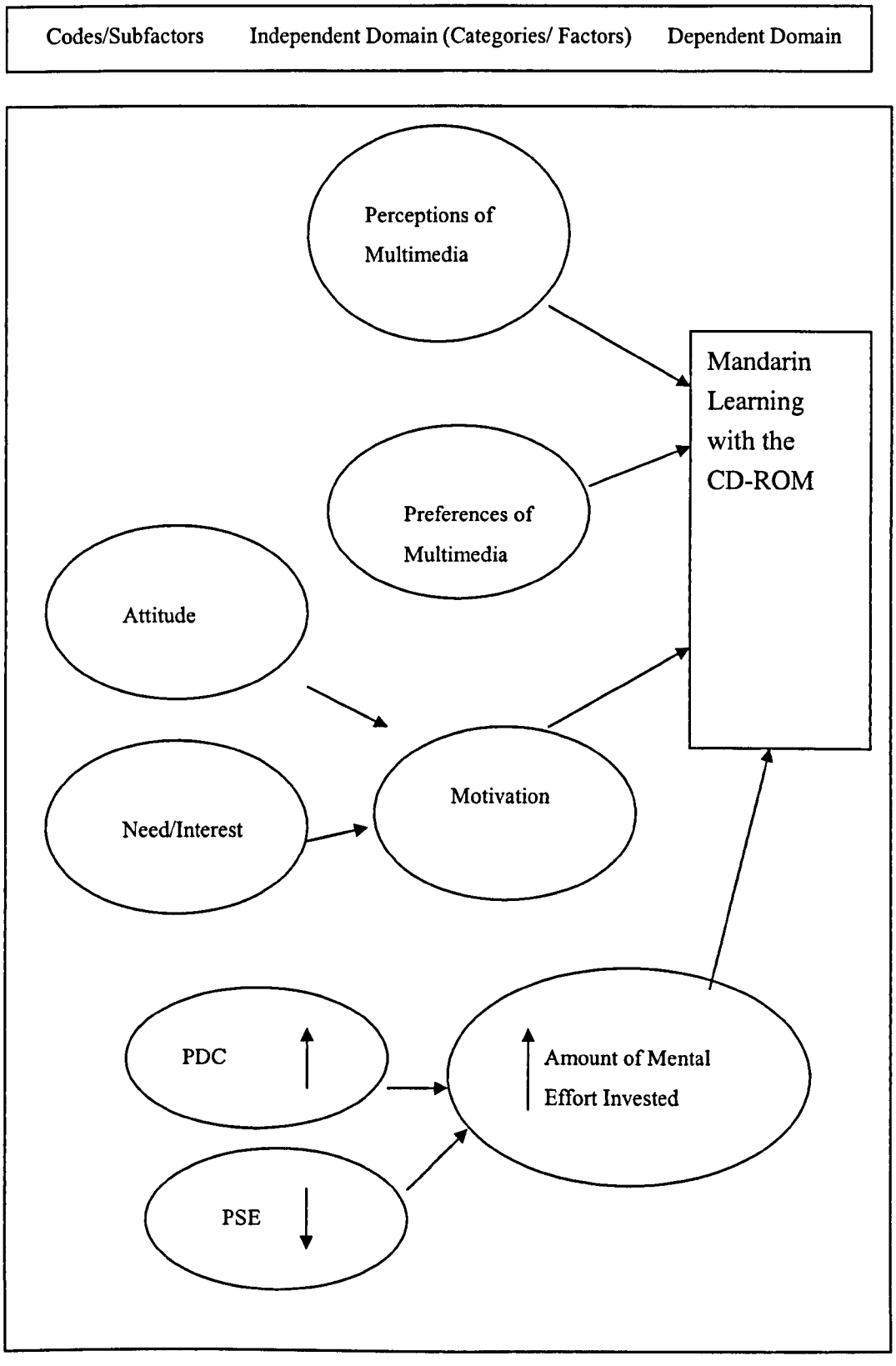
1. Students' perceptions of multimedia components influence Mandarin learning with the CD-ROM (Figure 10)

2. Students' preferences of multimedia components influence Mandarin learning with the CD-ROM (Figure 11)

3. Students' motivation influences their Mandarin learning with the CD-ROM (Figure 4)

4. Students' perceived demand characteristics have a positive influence and their perceived self-efficacy has a negative influence on their Mandarin learning or Mandarin learning with the CD-ROM (Figure 13)

Figure 36: Formative Research Model for Mandarin Learning with the CD-ROM



The challenge of constructing a research model is to move from abstract concepts to valid and reliable operations for data collection. Schensul et al. (1999) used domain, factors, subfactors and variables to describe movement from abstract to operational levels in ethnographic research. Sub-factors are subset of factors and factors are subset of a domain. Charmaz (2000) used codes and categories to define patterns found in data in grounded theory. Codes can then be grouped into categories. The researcher adopted the terminology used by Schensul et al. and Charmaz in this research.

In Figure 36, there are basically four independent domains that were found: perceptions, preferences, motivation and amount of mental effort invested, and they would be referred to as categories in the grounded theory analysis and also referred to as factors in the ethnographic research. The codes that influence motivation are attitude and need/interest and the codes that influence the amount of mental effort invested are perceived demand characteristics (PDC) and perceived self-efficacy (PSE).

After doing more literature review and analysis of the data, motivation becomes the central theme/category of this study. With Mandarin learning with the CD-ROM being the dependent domain, motivation is the independent domain that affects the dependent domain. The relationships between codes/subfactors and categories/factors are defined in the tree diagram in Figure 37.

Figure 37: Tree Diagram with Motivation effect on Mandarin Learning with the CD-ROM

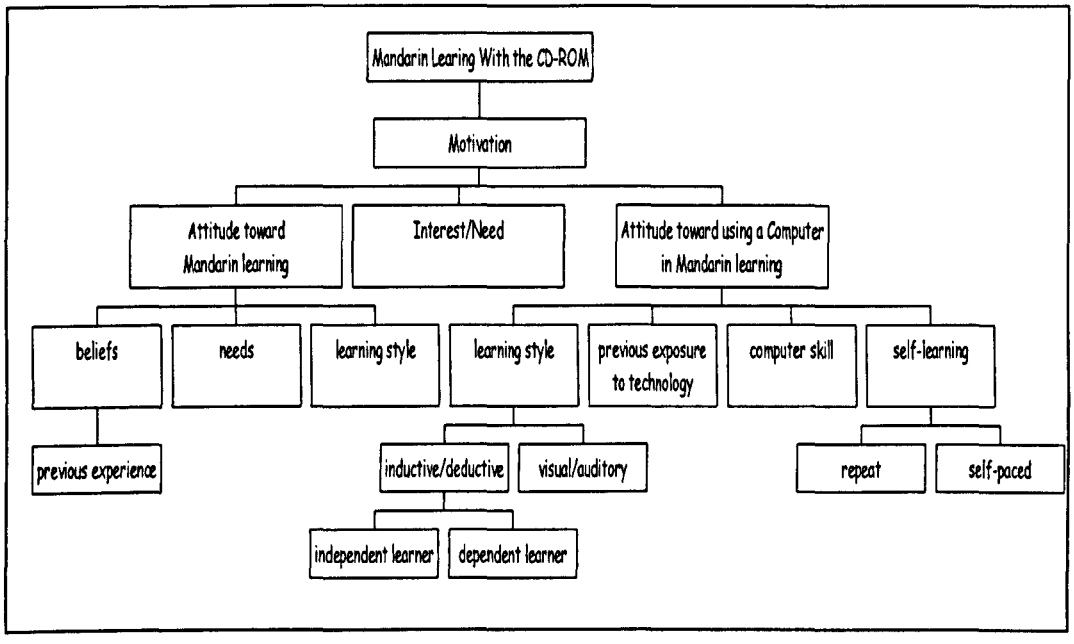


Figure 37 describes the objective of this research on the top level, which is the use of the multimedia CD-ROM to learn Mandarin, and it is derived from Figure 20 depicting the relationship of Dunn and Dunn learning styles model and Mandarin learning with the CD-ROM. Motivation is the independent domain that affects the use of the CD-ROM in students' learning. The attitude towards Mandarin learning, interest/need, and the attitude towards using a computer in Mandarin learning are factors that affect motivation. Finally, the variables beliefs, needs, and learning style affect the attitude towards Mandarin learning and the variables learning style, previous exposure to technology, computer skill, and self-learning affect the attitude towards using a computer in Mandarin learning. The researcher aims to investigate students' attitudes through interviews and observations.

7.41 Research Questions

Ethnographic research often begins with a question (Schensul, Schensul, and LeCompte, 1999). The researcher began this research with an interest of multimedia and its influence on learning. So when her school asked her to produce the multimedia Mandarin CD-ROMs, she was wondering about the effectiveness of multimedia in Mandarin learning. Before embarking on this issue, her supervisor thought that 'appropriateness' was probably better to explore than 'effectiveness'. So the researcher started with two questions initially: What are the benefits and limitations of using multimedia in Mandarin learning? How appropriate it is to use multimedia in Mandarin learning? Only through the initial literature review did she find out that multimedia can be used in different categories of language learning skills: vocabulary, listening and reading and for different types of students: visual/auditory, independent/dependent, knowledgeable/low prior knowledge, home exposure/non-home exposure, and Chinese/Macanese/Portuguese.

The researcher hopes to be able to answer the following two questions:

1. What are the benefits and limitations of using Multimedia in Mandarin learning?

2. How appropriate it is to use Multimedia in Mandarin learning?
   - Different categories of language learning skills
     Vocabulary
     Listening
     Reading
   - Different types of students.
     Visual/auditory
     Independent/dependent
     Knowledgeable/low prior knowledge
     Home Exposure/Non-Home Exposure
     Chinese/Macanese/Portuguese

7.5 Design of the Study

The design of this study used ethnography to develop and evaluate instructional materials with the Knirk and Gustafson instructional model. In Table 46, there are two major parts in the table, divided by a double vertical line. To the right of the double vertical line, the stages of the Knirk-Gustafson instructional development model, problem determination, design, and development are listed horizontally. To the left of the double vertical line is the research study schedule from the initial literature review to the follow-up study.

Table 46: Application of the Ethnographic Method in the Stages of Instructional Development Model

<table>
<tr><td></td><td></td><td></td><td></td><td colspan="6">Knirk-Gustafson Instructional Development Model</td></tr>
<tr><td></td><td>Ethnographic Techniques</td><td>Instrument/ equipment</td><td>Data</td><td>Problem Determination</td><td>Design</td><td colspan="4">Development</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td>Develop</td><td>Analyse</td><td>Revise</td><td>Implement</td></tr>
<tr><td>Literature Review/ Analysis of existing media</td><td></td><td></td><td>Research Question, Formation of theory</td><td>Needs Assessment Existing material analysis</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="3">Pilot Study</td><td>User-Interface Focus group</td><td>Questionnaire</td><td>Survey data</td><td>Existing material analysis</td><td></td><td></td><td>Prototype</td><td>Prototype</td><td></td></tr>
<tr><td>Pilot Interview</td><td>Tape recorder</td><td>Transcription</td><td rowspan="2">Needs Assessment, Learner's entering skills, Community's characteristic, Content analysis</td><td rowspan="2">Learner's entering knowledge, background, attitude, learning style</td><td rowspan="2">CD-ROM I is being developed</td><td rowspan="2">Second Literature Review</td><td rowspan="2"></td><td rowspan="2"></td></tr>
<tr><td>Second Literature Review</td><td>Existing journals</td><td>Comparison of data</td></tr>
<tr><td colspan="10">Click! Mandarin CD-ROM I</td></tr>
<tr><td rowspan="3">Main Study</td><td>Teacher focus group</td><td>Questionnaire</td><td>Survey data</td><td></td><td></td><td rowspan="3">Develop CD-ROM II</td><td rowspan="3">CD-ROM I</td><td></td><td></td></tr>
<tr><td>In-class observations</td><td>Log sheet, Journal</td><td>Observation data</td><td></td><td rowspan="2">Learner's entering knowledge, attitude, learning style</td><td></td><td>CD-ROM I is used in class</td></tr>
<tr><td>Main Interview</td><td>Tape recorder</td><td>Transcription</td><td></td><td></td><td></td></tr>
<tr><td colspan="10">Click! Mandarin CD-ROM II</td></tr>
<tr><td>Follow-up Study</td><td>Follow-up Interview</td><td>Tape recorder</td><td>Transcription</td><td></td><td></td><td>Develop CD-ROM III</td><td>CD-ROM I</td><td></td><td></td></tr>
<tr><td colspan="10">Click! Mandarin CD-ROM III</td></tr>
</table>

Table 46 describes how the ethnographic techniques are used in this research and correspond to the different stages of the instructional development process. The pilot study, which included a user-interface focus group and a pilot interview, was conducted initially to identify the problem, analyse the learner's entering skills, content/curriculum, existing materials and community's characteristic. They could be also be used to study a learner's attitude, learning style to help establish instructional objectives and strategies. The first volume of the 'Click!' CD-ROM series was developed after the analysis of this set of data, which constituted the problem determination and design stages of the model. The pilot study then moved into the development stage. Only volume I of the 'Click!' CD-ROM series was evaluated.

The development stage of the instructional model is an iterative process. First, a main study was conducted to evaluate and revise the first volume of the 'Click!' CD-ROM series. The main study included conducting a teacher focus group, in-class observations and in-depth interviews. Notes from the observations and interviews provided valuable data to revise the first volume and to produce the second volume of the 'Click' CD-ROM series. Then a follow-up study was carried out to evaluate and revise the first volume of the CD-ROM series again to ensure reliability and validity of the data. The third volume of the CD-ROM series was developed at the end of this research study.

7.51 Sampling

Sampling (Schensul, Schensul and LeCompte (1999)) is the process of identifying from a large population a smaller group which not only shares the same characteristics but is more manageable to study. There are three types of students studying Mandarin in Macao: Cantonese, Macanese and Portuguese. Since the researcher cannot study the entire population, she used nonprobability

sampling, where the probability of selecting a single individual is not known, to choose her participants. The researcher used quota sampling for the pilot interview and convenience sampling for the rest of the study.

Schensul, Schensul and LeCompte (1999) indicated that quota sampling selects representatives from all known categories within a population. It requires that the major characteristics of the population are salient to the research questions to be identified. Researchers then select a certain number of quotas of individuals representing each of these characteristics in the study. They noted that 'quota sampling is particularly useful in the early stages of research because it can help researchers identify the full range of behaviour, attitudes, and opinions within a population' (p. 246). Though quota sampling is not a very accurate way to represent the percentages of demographic or attitudinal characteristics of a group, it is a very important strategy for capturing the range of cultural variation. The researcher of this study used quota sampling in the pilot interview of the pilot study. She found this kind of sampling especially useful where she could "pick and choose" with regard to whom she wanted to talk to, 'about what and to extent to probe, without violating the principles of naturalistic methodology' (Heshusius, 1981, p. 22). The researcher selected a quota representing each of the characteristics for her study. The participants must be an adult learner, must be either a Chinese (Cantonese or Macanese) or Portuguese, studying or have studied Mandarin in the past. Since the total number of students studying or have previously studied Mandarin are not calculated and the probability of selecting a single individual is not known, the use of quota sampling is appropriate. In this study, based on the types of students in Macao, the researcher interviewed 3 Cantonese students, 3 Macanese students, 2 Portuguese students, and one teacher from each student category for

the pilot interview, a total of 8 students and 3 teachers.

Schensul, Schensul and LeCompte (1999) also indicated that many researchers use convenience samples because these are the samples that are available to them. They advised that this kind of sampling can only be used 'when the research is exploratory or when specific variations in the population have little effect on the phenomenon under study' (p. 233). In this study, since choosing one participant versus another would not have that much effect on the study and because of the limited resources, the researcher used convenience sampling throughout the rest of the study. Though, focus group interviewing uses a quota sampling procedure, the researcher used convenience sampling for the focus group interviews in this study instead. For the user-interface focus group, she could only ask those who were working in the school, in the designing department and the multimedia department, who were convenient, to help out. For the teacher focus group, she sent out invitations to many secondary schools in Macao and she could only talk to those teachers, who were willing to show up for the discussion. There were a total of 7 participants and 11 participants in the user-interface focus group and teacher focus group, respectively. For the in-class observation study and the main interview, she was assigned a group of 10 Portuguese students by her school, but one of them dropped out after the first class. The students, nine of them, were easily accessible and convenient to her to conduct the in-class observation study and the main interview. In the follow-up study, she simply picked those four students, who were convenient to her.

7.52 Design of Questions for the Interviews

Questions for the interviews were drawn up in accordance with the aims of the study. The researcher depended on guidelines provided by Kvale (1996)

and Schensul, Schensul and LeCompte (1999). The researcher also relied on the expertise of her supervisor. The questions for the students were mainly derived from Table 8, the Initial Research Questions for the Students. There were three sets of questions, one for the pilot study, one for the main study, and one for the follow-up study. Questions were created for both the teachers and the students in the pilot study and the main study. For the follow-up study, questions were only created for the students.

7.521 Questions for the Pilot Study

The questions for both the teachers and students in the pilot group were used to find out about learner's entering skill, learner's attitude and learning style, content/curriculum, existing materials and community's characteristic. Initially, the researcher was more interested in how students viewed Mandarin learning in the pilot interview, the CD-ROM was only mentioned towards the end of the interview.

The following were the first set of research questions for the students:

1. Why are you studying Mandarin? Do you have much chance to use Mandarin outside of class?
2. What do you enjoy the most?
3. What do you enjoy the least?
4. What do you find the easiest?
5. What do you find the most difficult?
6. How might using the computer CD-ROM help your learning?
7. How might your learning not be improved by the CD-ROM?
8. Have you used a CD-ROM before? If no, would you like to use one?

The following were the first set of research questions for the teachers:

1. What kind of problems do you have in teaching Mandarin?
2. What do you see as the easiest for Portuguese/Macanese/Cantonese-speaking students in learning Mandarin?
3. What do you see as the most difficult for Portuguese/Macanese/Cantonese-speaking students in Mandarin?
4. How might using computer CD-ROM help their learning?
5. How might their learning not be improved by CD-ROM?

The second part of the first question for the student, "Do you have much chance to use Mandarin outside of class?", was added in on the third interview, after the researcher interviewed the first student and the first teacher. The researcher realised then that she might want to add extra questions for the interviewees as the interview process continued.

7.522 Questions for the Main Study

The researcher basically used the same set of questions from the pilot study but included questions for the CD-ROM, which is represented in the underlined portion. She wanted to find out about the students' attitudes towards the CD-ROM.

Questions for the students:

1. Why are you studying Mandarin? Do you have much chance to use Mandarin outside of class?
2. What do you enjoy the most about learning Mandarin? What do you enjoy the most about using the CD-ROM?
3. What do you enjoy the least about learning Mandarin? What do you enjoy the least about using the CD-ROM?
4. What do you find easiest about learning Mandarin? What do you find easiest about using the CD-ROM?
5. What do you find the most difficult about learning Mandarin? What do you find the most difficult about using the CD-ROM?

6. How might using computer CD-ROM help your learning?
7. How might your learning not be improved by CD-ROM?
8. Have you used a CD-ROM before? How do you compare about what you use now with the previous experience?
9. How to improve the CD-ROM?
10. Which option do you like think classes ought to be conducted (teacher, teacher plus CD-ROM, CD-ROM plus teacher)?
11. Do you prefer to have the teacher teach the material first, or to use the CD-ROM first?

After interviewing the first student, three new questions emerged, so the researcher included them in as questions 9, 10 and 11. They were ways to improve the CD-ROM, how should class be conducted and whether teacher should explain the materials first.

Questions for the teacher:

1. What kind of problems do you have in teaching Mandarin?
2. What do you see as the easiest for Portuguese students in learning Mandarin?
3. What do you see as the most difficult for Portuguese students in learning Mandarin?
4. How might using computer CD-ROM help their learning?
5. How might their learning not be improved by CD-ROM?
6. Do you find using a CD-ROM helpful for you? How?

The questions for the teacher in the main interview were the same as those in the pilot study, except for question 6, which was added to elicit information from the teacher about how he felt about the CD-ROM.

7.523 Questions for the Follow-up Study

The researcher designed the following research questions based on those questions from the pilot study and the main study. The first eight questions were designed during the discussion she had with her supervisor. They decided to take

out everything relating to the Mandarin language but yet they didn't want the interviewees to think that the interview was only about the CD-ROM. So they moved the 6th and 7th questions from the pilot study and main study to the beginning of this question set. That way the researcher could introduce the topic of the interview as how the CD-ROM can help the learning of a language.

Questions for the students:

1. How might using computer CD-ROM help your learning of a language?
2. How might your learning of a language not be improved by CD-ROM?
3. What do you enjoy the most about the CD-ROM?
4. What do you enjoy the least about using the CD-ROM?
5. What do you find easiest about using the CD-ROM?
6. What do you find the most difficult about using the CD-ROM?
7. Have you used a CD-ROM before? How do you compare about what you use now with the previous experience?
8. How do you suggest we do to improve the CD-ROM?
9. To what extent does the CD-ROM alter the role of the teacher?
10. How much time should class be conducted using the CD-ROM?
11. How much time class should be conducted with the teacher?
12. Should the teacher explain the materials first before using the CD-ROM?

Smith (1996) said that it is likely that a successful interview will include questions and answers at both general and more specific levels. The researcher has included some general as well specific questions in this interview. Questions 10 to 12 are more specific questions while the others are more general. The specific questions came from the newly emerged questions from the main interview. For question 9, which she originally had "Can the CD-ROM replace the teacher?" to "To what extent does the CD-ROM alter the role of the teacher?". Her supervisor thought that her original question was too specific, it may not be able to bring out answer from the students. Even though she knew she shouldn't give yes-or-no answer type question, it was so easy to still fall into the trap. So it is always good to have someone to consult about the research questions.

7.53 The Pilot Study

The pilot study included a user-interface focus group and a pilot interview. As mentioned before, a prototype was developed before the beginning of this study. The user-interface focus group evaluated this prototype. The students in the pilot interview were questioned only based on their own experience without the CD-ROM. Information gathered from the user-interface focus group and the pilot interview contributed to the problem determination and design stages of the Knirk and Gufstason model.

7.531 The User-Interface Focus group

Three graphics designers, one administrative staff and three web-designers of the Macao Polytechnic Institute attended the user-interface focus group discussion on November 11, 1998. Four participants were Portuguese and three participants were Chinese. During the demonstration, the researcher went through each part of the initial design of the prototype to evaluate the general layout, navigation, graphics, sound and wording of the interface. Immediately after the demonstration, the participants were asked about the discussed items in the user-interface questionnaire (see Appendix 6). Questionnaires were used as a mean of capturing and recording participants' opinions during the discussion. Out of the seven questionnaires distributed, only three were returned. Most of the feedback was given verbally.

7.532 The Pilot Interview

The students were classified into three groups by their nationalities: Portuguese, Macanese, and Cantonese. The researcher interviewed a total of 8 students and 3 teachers and designed the questions to investigate the issues

on-hand such as learner's entering skill, learner's attitude and learning style, content/curriculum, existing materials and community's characteristic. This semi-structured interview served as an exploratory interview, trying to find out interesting behaviours and attitudes of the students towards Mandarin learning using a multimedia CD-ROM. During the interview, the researcher tried to follow up on the student's answers and seek new information on the topic. The pilot group interview lasted from February 11 to March 22, 1999, which took about 40 days to finish. All the interviews were taped and transcribed at a later time.

7.54 The Main Study

As mentioned before, the first volume of the 'Click!' CD-ROM series was developed after the pilot study. So the researcher decided to conduct the main study to evaluate the CD-ROM. The main study consisted of three parts: teacher focus group, in-class observations and in-depth interviews. Data gathered from the observations and interviews not only able to be used in the development stage of the Knirk and Gufstason model, but it can also be used to determine learner's entering knowledge, attitude, and learning style. Since the development stage is an iterative process, after analysis and revision of the data, the second volume of the 'Click!' CD-ROM series was implemented.

7.541 The Teacher Focus Group

The researcher sent out invitations to all of the secondary schools in Macao, hoping that the teachers who were teaching Mandarin or Computer would come for this evaluation. Only 11 teachers from 7 secondary schools showed up on April 21, 1999. One was a computer teacher and the rest were all Mandarin

teachers. Again, questionnaires were used as a mean of capturing and recording participants' opinions during the discussion.

After the twenty-minute demonstration of the CD-ROM, the researcher questioned the teachers based on the questions on the questionnaires (see Appendix 7) that were handed to them at the end of demonstration. Questions from the questionnaire were similar to the ones for the user-interface focus group, except they were written in both English and Chinese to make sure that the teachers could understand the questions, to evaluate the general layout, navigation, graphics, sound and wording of the interface. Thirteen questionnaires were collected, including two from two teachers from the Macao Polytechnic Institute.

7.542 The In-Class Observation Study

The Mandarin class assigned to the researcher consisted of a group of ten Portuguese students. With the help of a Mandarin teacher, the researcher was able to conduct the in-class observation study from March 4 to June 3 in 1999. At the time when the researcher began the in-class observations with the students, the students had already started their Mandarin class for about 3 weeks. These ten Portuguese students were teachers as well as staff from the school. The class ran from 1:15 to 2:45 in the afternoon, on Tuesday and Thursday. The agreement was that they would only be learning the Chinese pronunciation symbol, pinyin, and no Chinese character. Because of the way the computers were set up with protection cards, the researcher had to reinstall the software in the computers for the students before the beginning of every lesson. She conducted the in-class observations only in the computer room. Journals and logs were used to collect data from the in-class observations.

7.543 The Main Interview

The researcher basically used the same set of questions from the pilot interview but included questions for the CD-ROM. Due to the special circumstances in 1999[5], interviews were conducted before the end of the in-class observation study, from April 20 to June 16, 1999, which lasted for 58 days. The researcher wanted to find out the students' attitudes towards the CD-ROM. She could only interview nine students because one student dropped out of class after the first day with the computer. Interviews were taped and transcribed at a later time.

7.55 The Follow-up Study

As mentioned before, the second volume of the Mandarin CD-ROM series was developed after the main study. To ensure reliability and validity of the data, the researcher decided to conduct a follow-up study. Information gathered from the follow-up interview also contributed to the development stage of the Knirk and Gufstason model. After analysis and revision of the data, the third volume of the 'Click!' CD-ROM series was implemented.

7.551 The Follow-up Interview

The researcher gave the first volume of the CD-ROM series to four students, three students out of the pilot study and one student whom she has never interviewed before. After allowing the students to freely explore the CD-ROM at their own time, the researcher conducted an interview with them after two months. Out of the pilot study group, she particularly chose one Portuguese, one Macanese, and one Cantonese to complete the follow-up study. She wanted to include an

[5] At the time of the study, the sovereignty of Macao was about to be handed back to China. The hand-over date was December 20, 1999.

outsider, someone whom she has never interviewed before, to see if this student had similar viewpoints or not. The researcher wanted the data to be as reliable and valid as possible. She designed the follow-up interview questions based on those questions from the pilot interview and main interview. Interviews were also taped and transcribed at a later time.

In this chapter, educational research and qualitative research were discussed as an introduction. Then ethnographic research and feasibility of ethnography in a classroom were presented. Finally, research instruments, the research model, research questions, and design of the study were discussed. The researcher tried to use an ethnographic research method within the constructive/interpretive paradigm to explore the benefits, the limitations, and the appropriate use of multimedia in Mandarin learning. She used interviews, observations, and focus group interviews extensively throughout her study. The purpose of this research was to find out what influences students to use the CD-ROM in their Mandarin learning. Hypotheses were created to answer the two research questions: What are the benefits and limitations of using multimedia in Mandarin learning? How appropriate it is to use multimedia in Mandarin learning? Now that the reader has a better understanding of the research methodology used in this study, the researcher will discuss the analysis of the data in the next chapter.

Chapter 8: Analysis of Data

Analysis of data is discussed in this chapter. As stated earlier, due to special circumstances that Macao was going to be handed back to China at the end of 1999 and the Portuguese participants would have been long gone if the researcher did not collect the data, the order of this research started with an initial literature review, a pilot study, further literature review, a main study, a follow-up study, and ended with a further literature review.

8.1 Middle-range theories from the Initial Literature Review

By studying the literature on multimedia, the researcher expanded the initial categories/hypotheses, which formed the formative research model in Figure 36, into the following assumptions:

1. Students' perceptions of multimedia components influence Mandarin learning with the CD-ROM (Figure 10)
   1.1 Students believe that audio is helpful in their Mandarin learning with the CD-ROM.

2. Students' preferences of multimedia components influence Mandarin learning with the CD-ROM (Figure 11)
   2.1 Students prefer hearing narration while reading text in their Mandarin learning with the CD-ROM.

3. Students' motivation influences their Mandarin learning with the CD-ROM (Figure 4)
   3.1 Students are motivated to learn Mandarin with the CD-ROM.

4. Students' perceived demand characteristics have a positive influence and their perceived self-efficacy has a negative influence on their Mandarin learning or Mandarin learning with the CD-ROM (Figure 13)
   4.1 Students find that there is a need or interest to learn Mandarin in Macao.
   4.2 Students find that Mandarin learning is easy for them.
   4.3 Students find that Mandarin learning with the CD-ROM is easy for them.

Based on the assumptions learned in the initial literature review, the researcher formulated the following formative, middle range theories.

1. Students who believe that audio is helpful are more likely to be motivated to learn Mandarin with the CD-ROM.
2. Students who have a need or an interest to learn Mandarin are more likely to be motivated to learn Mandarin with the CD-ROM.
3. Students who find Mandarin learning easy and CD-ROM usage easy are more likely to invest less mental effort in using the CD-ROM in their Mandarin learning.

Ethnography does not test these theories to determine if they are right or wrong. Instead, Schensul, Schensul and LeCompte (1999) claimed that it should match the expected results derived from the formative theory with the observed results that accrue from the data collection. The data collected from various points of this study were used to compare with these theories.

8.2 The Pilot Study

The pilot study included the user-interface focus group and the pilot interview. From Table 6 and Figure 8 in the second chapter, the researcher determined the initial codes in this research: screen design, learner control and navigation, feedback, interactivity, video and audio, reduced instruction time, self-paced learning, self-directed learning, flexibility, motivational effects, information chunking, having rich content, better-organised instructional material, and novelty. While the pilot study was taking place, more literature reviewing was being undertaken.

8.21 The User-Interface Focus Group

The initial Mandarin prototype system created in 1998 was used in this group discussion. After a demonstration of the program, the seven participants were free to comment on the user-interface or fill out a questionnaire. The questions on the

questionnaire form were rated in four categories: very good, good, fair and poor. From the three user-interface questionnaires collected, the data are summarised in Table 47. Some questions were not answered on the form. The first respondent did not answer the question "Displays are uncluttered". The second respondent did not answer the question "The terminology". The third respondent did not answer two questions, "The instructions on navigation through the course", and "The animated graphics/effects in the course". The researcher has some doubts about whether or not the participants understood the English word or whether or not the question was applicable to the discussion.

Table 47: User-Interface Focus Group Questionnaire Result

(Out of 3 responses)	Very Good	Good	Fair	Poor
The general structure (layout) of the course		67%	33%	
The instructions on navigation through the course (one did not answer)		67%		
The animated graphics/effects in the course (one did not answer)	33%		33%	
Graphics and sound (if used) are appropriate		33%	67%	
The screen layout and appearance			100%	
Displays are uncluttered (one did not answer)		33%		
The appropriateness of the use of different colours			100%	
Menu items are understandable and descriptive		67%	33%	
The terminology (one did not answer)			33%	33%
The understandability of the English/Portuguese used		33%	67%	

In Table 47, most the comments were only good or fair and only one person said that the animated graphics/effects were very good. The common criticism was that the general layout was not consistent and that the scroll bar should have been on the right-hand side. Most of the other feedback was given verbally. They complained about the colour, the font, the position of scroll bar and the general layout of the prototype. After the user-interface focus group discussion, the entire user-interface of the 'Click!' CD-ROMs was changed.

8.22 The Pilot Interview

The researcher interviewed eight students and three teachers in the pilot interview. She was hoping that the interview could bring out interesting behaviours about students' Mandarin learning with the CD-ROM. As stated earlier, the pilot group interview lasted from February 11 to March 22, 1999. The researcher was worried about whether or not she had influenced the interviewee, or whether or not she was able to understand and interpret everything the interviewee said. Though she had the interviews all taped, she still needed to jot down some notes just in case that the tape recorder failed on her.

She was also worried about how to build rapport with the interviewee. So she realised that the first question, "Why are you studying Mandarin?", served as an opening statement for the student interviewee. But when she asked the teachers the first question, "What kind of problems do you have in teaching Mandarin?", she noticed two out of three of the teacher interviewees felt the question was offensive. Their first response was why should they have any problems. They both spoke about problems of their students.

The researcher realised more and more how time-consuming it was as time went on. One difficulty was that she had to conduct the interview in English, Mandarin, or Cantonese, making the data more subjective because she had to do the translation herself. During that time, the researcher had mixed feelings about the interview process. Sometimes she found that it was very interesting to hear certain things, but sometimes she was bored listening to the same thing over and over again. Knowing this, she then realised she had made some progress and that the time and effort were not wasted. The data set became more and more reliable as she heard more of the same opinion repeated.

As the researcher was doing the transcription of the first two interviews with Lurdes and Phyon, she began to appreciate the very essence of the interview process. She was able to draw out some insights, and compare it to the literature review she had done so far. After analsing all the pilot interviews the following points arose:

1) The main reason for studying Mandarin was because it is the official language of China and Macao.
2) Visuals and sound are the attractive features of CD-ROM providing interactive learning.
3) Drill and practice are features needed by students.
4) Learning pronunciation is most important for student learning a foreign language.
5) Feedback or feedback of pronunciation is extremely important.
6) Students can jump to different part of the book, start and stop wherever they want to.

These points form the focused coding in the grounded theory analysis. The emerging codes for why students study Mandarin or use the Mandarin CD-ROM are needs, visuals and sound, interactive learning, drill and practice, pronunciation, feedback, the branching and navigation capability, and the pause and go capability.

After transcribing the pilot interview data, the researcher classified each student's and each teacher's response in terms of each question, doing the line-by-line coding of the data. Table 48 displays why each student studied Mandarin and what each student enjoyed or did not enjoy about Mandarin learning.

Table 48: Line-by line Coding in Regard to Students' Learning Purpose and Likes and Dislikes of Mandarin in the Pilot Study

	Lurdes	Phyon	Jose	Antonio	Fanny	Seng	Anita	Rui
Type of students	Macanese -Learned Cantonese before	Cantonese	Macanese - Learned Cantonese before	Portuguese	Cantonese -Study 3 months in Beijing	Cantonese, who has proofread Click! for two weeks	Macanese -Learned Cantonese before -Study 10 months in Beijing	Portuguese, who also participated in the user-interface group
Why study Mandarin	-A need to learn -Useful -Interested because of the sound of Mandarin is beautiful	-Useful	-Useful because people will be speaking more Mandarin in the future	-Just for the purpose of learning -Speak to his friend -Read Chinese poems	-Her boss sent her to Beijing -She didn't think she needed to learn	- Wanted to learn the language	-Mandarin is necessary/useful in the future	-Useful to know for his job and to do business in China in the future
Use Mandarin outside of class		No, when she is chit-chatting, likes to speak in Cantonese	-Not any more -Only had chance when he first started Mandarin	-Yes, but only on a social level -Cannot use it in his work	-Yes, there are people visiting our school who speak Mandarin	-Yes, with teachers in our school, tourists on the street	-Not much, only when she is travelling to China or Taiwan or talking to tourist in Macao	-No

Enjoy most in Learning Mandarin	-Pronunciation	-When the teacher praises her pronunciation -From unknown to knowing -Brave enough to speak to strangers	-To speak with others -Understand Mandarin TV and Mandarin songs or recognise what he had studied before -Listen to tape in class	-Searching for the real meaning of the character and sentence	-Enjoyed her student life in Beijing -Watching literature videotape -Enjoyed analysing and discussing the videotape afterwards	-Communicate with teachers and classmates	-Study by herself, having better concentration -Be able to communicate with her mother in written language -Knowing how to read	-Writing of Chinese characters
Enjoy least in Learning Mandarin	-Words with the same sound -Same word pronounced differently at different places	-Reading the text in class because it is too monotonous	-Reading the text at home -Reading aloud and telling jokes in class when he has not been taught or not been prepared -Writing because he is lazy	-Dialect and slang for different region	-Teaching method, like copying from the board -Teacher didn't care about her level of pinyin	-When he makes mistakes, he would be disappointed -4 tones	-Recitation -Teaching method, memorizing a lot things -Writing of Chinese character	-Intonation -ch, zh sound

In Table 48, the researcher found that needs as well as usefulness of Mandarin were the driving forces of Mandarin learning for the students in the pilot study. What they enjoyed the most about learning Mandarin was when they could pronounce correctly and be able to socialise with people. They also enjoyed watching TV and video and listening to tapes. Writing of Chinese characters, reading, speaking, and listening were the language skills enjoyed by some students. What they enjoyed the least was probably something that they were having problem with, like intonation for the Portuguese, or words with the same sound, reading and writing of Chinese character for the Macanese, and reading and 4 tones for the Cantonese. They disliked the teaching method, like copying from the board, memorising things, or when the teacher did not care about their pinyin level. Most students did not have much chance to use Mandarin outside of class.

Fifty percent of the students have used a CD-ROM before and it was mainly an English dictionary. Seven out of eight students were willing to use a CD-ROM. It was interesting to find that one student said that she wouldn't use any CD-ROM and that she preferred to study with a teacher. This opinion supports the role of a teacher in a classroom. From the data the researcher can conclude that sound is an important feature of the CD-ROM for Mandarin learning. Based on Charmaz's (1996) suggestion about comparing different people, the matrix comparing both the students' and teachers' opinions is shown in Table 49. Table 49 displays the opinion of the students and teachers in terms of what they found the easiest and the most difficult in Mandarin learning, and how the CD-ROM can or cannot be helpful in Mandarin learning.

Table 49: Comparison of Students' and Teachers' Responses for the Pilot Interview

	Group (students)	Group (teachers)
Easiest in Learning Mandarin	<u>Portuguese</u> -Writing of Chinese character -Verb tenses -First two lessons of the textbook <u>Macanese</u> -Pronunciation -Meaning of words -Grammar -Everything if he studies -Writing of pinyin <u>Cantonese</u> -Meaning of vocabulary -Dialogue related to daily conversation -Discussion question -To write (character) -To be able to understand	<u>Portuguese</u> -Accent, Phonetics, Initials and Finals, Syllable -4 tones -Portuguese people are good in music <u>Macanese</u> -Writing of pinyin <u>Cantonese</u> -Writing of pinyin -Listening skill and able to understand -Can basically read, only make mistakes on individual words -Greetings and some simple daily conversation

	Group (students)	Group (teachers)
Most Difficult in Learning Mandarin	<u>Portuguese</u> -To find someone to talk to him in Mandarin -Intonation -Memorising -To speak -To write <u>Macanese</u> -Words with the same sound -Same word pronounced differently at different places -Chinese character writing -Lazy -Forgets the Mandarin sound because he knows the Cantonese sound -In the beginning, pinyin and 4th tone, now it is character writing and culture information <u>Cantonese</u> -Pronunciation in phrases or sentences -Difficult to memorise the sound -To read from pinyin -Pronunciation -4 tones -Intonation	<u>Portuguese</u> -Lack of perseverance -Didn't realise that Chinese language is more difficult than expected -They don't know how Chinese people think -Learn 20% from teacher <u>Macanese</u> -Intonation, 4 tones -Confused 1st with 4th tone -Learning vocabulary because their Chinese level is low <u>Cantonese</u> -Colloquial words -Pronunciation -To speak without Cantonese accent -Difficult to be precise, accuracy of sound, tone and intonation -To use the tongue movement -Problem with pronunciation with the tip of the tongue -Intonation, 4 tones -Confusion with 1st and 4th -Written language more difficult because not too many opportunities to use it

	Group (students)	Group (teachers)
How CD ROM is helpful	<u>Portuguese</u> -Make it easier to learn -Interactive activities -Listen to sound and tone -Explore meaning of a word -Study at home -Learn any time -Review character writing, sound, tone as much as he likes -Repeat as much as he likes -Easier to repeat and review <u>Macanese</u> -More choices -More active and animated -More visual things -Jump to different part of the CD-ROM -More attractive -More active way of learning -Pronunciation and sound -Learn more about the history and meaning of word -Story-telling -Study at home -Listening to the sound -Sound should be of good quality and standard -Watching movies <u>Cantonese</u> -Pronunciation -Repeat as often as she likes -More attractive interface -See what she is learning on the screen	<u>Portuguese</u> -Visual, image, colour and sound -Movie about culture and history -Listening and seeing the object <u>Macanese</u> -To listen to it outside of class -For listening, visual is important because the students can learn from more than one channel -Just like tape, the student can listen to intonation and short essay -Use videotape to improve students' interest <u>Cantonese</u> -Pronunciation of a single word, recitation, short essay, short sentence -To assist students in their learning at home or in their spare time

	-Easier to search and navigate -Having the high-tech feeling, more willing to try out -Sound is standardised, of the same high-quality -To pause and go easily without rewinding -Increase her learning interest because it is interactive -Be able to look up a word, like a dictionary -Click on the sound as often as he likes -Learn pinyin -Do testing and practice -Listen to sentence or conversation -Learning Speech sound, Initials and Finals, 4 tones -Jump to different lessons	-The capability of the CD-ROM to pause and go, allows students to think and follow and imitate -If the CD-ROM has the capability to tell the students if their pronunciation is wrong or not
	Group (students)	Group (teachers)
How CD-ROM is not helpful	<u>Portuguese</u> -Only complementary to learning -Teacher is always necessary -Need people to communicate -Cannot transmit feeling to the CD-ROM -Need teacher or friend to explain to him -Cannot ask questions to the CD-ROM -Cannot have certain words translated with the CD-ROM <u>Macanese</u> -Not able to know whether she is learning correctly or not -Not able to get feedback about her pronunciation -Doesn't have a computer	<u>Portuguese</u> -If students don't like computers -Students don't have a teacher to give them advice. -No computer can surpass human -Need face-to-face and -human-to-human contact <u>Macanese</u> -Practical usage, they need practice -Doesn't create a language environment -Doesn't have human-to-human contact

	-Cannot ask questions -Learning is only limited to the contents on the CD-ROM -Not able to help her with her recitation, she would need to practise more at home Cantonese -May not be able to use some words in her daily conversation -Cannot get feedback from the computer whether she is pronouncing correctly or not. -The CD-ROM cannot really help her in listening on word or sentence because she could simply use a tape -When the CD-ROM level is not suitable -Only a one-way communication, no interaction and communication -All materials in the CD-ROM are preset. -Correction of exercises will not help her because she can memorise the answer the next time she goes back to the exercise. -Needs a teacher to remind and advise her of her mistakes. -Portuguese translation is not helpful to him. -Cannot ask the CD-ROM questions.	-The computer cannot give correction on their written language. Cantonese -If they don't use it -For those students who have a hard time imitating sound -For those students who have underlying problems in their pronunciation need a teacher to help them

In Table 49, what the students found the easiest in Mandarin learning was verb tenses and writing of Chinese character for the Portuguese, pronunciation, grammar and writing of pinyin for the Macanese, and meaning of the vocabulary, daily conversation and writing for the Cantonese. The teachers agreed that

writing of pinyin was easy for the Macanese and daily conversation and the ability to understand the meaning was easy for the Cantonese.

In Table 49, what the Portuguese students found the most difficult in Mandarin learning was intonation, memorising, speaking and writing. The Macanese students found that words with the same sound, character writing, pinyin, 4th tone and culture information were difficult for them. One Macanese student commented that that fact that he was lazy and that made the language more difficult. The Cantonese students found that pronunciation, reading from pinyin, 4 tones, intonation were difficult for them. The Portuguese teacher said that lack of perseverance and not realising that the Chinese language was more difficult than expected were problems of the students and that students probably only learned 20% from the teacher. Both of the Macanese and Cantonese teachers as well as the students agreed that intonation and the 4th tone were difficult. The Cantonese teacher also added that colloquial words, tongue movement, and not able to be totally fluent were some of the problems with her adult Cantonese students.

According to Newnham (1987), Chinese is famous for its frequent homophones (same sound, different meaning), it is interesting that one student from the pilot study also found this to be her problem. It is also interesting to find that if the Portuguese students cannot find someone to talk to and could only learn 20% from the teacher, then they have very limited Mandarin learning on their own. The researcher found that intonation, memorising, not being able to know the colloquial words, not good with tongue movement, not able to be fluent and being lazy are probably some problems faced by adult Mandarin learners.

In Table 49, the students expressed their opinions about the CD-ROM being helpful when they could listen to sound and tone as much as they like, use it to

increase their interest, study at home, repeat as much as they like, review character writing, branch to different part of the CD-ROM, have more active learning, practise pronunciation, see what they are learning on the screen, watch movies, search and navigate easier, pause and go easily without rewinding, do testing, practise on their own or look up a word. The teachers concurred with the students that the CD-ROM provides visual image and sound effect, increases students' learning. Students can learn outside of class, to learn culture and history information, listen to intonation, practise pronunciation and follow and imitate the CD-ROM with the pause and go capability.

Table 49 also displays how the CD-ROM is not helpful for students, most students said that they cannot get feedback about their pronunciation, cannot express their feeling to the CD-ROM, cannot ask questions, and learning materials are limited in the CD-ROM. Some students felt that there is a need to communicate with people, and that the CD-ROM is only complementary to learning and a teacher is always necessary. When the student does not have a computer or the materials in the CD-ROM cannot be used in her daily conversation, then the CD-ROM is not helpful to her. One student said that she could simply use a tape recorder to listen to the sound. The Portuguese and Macanese teachers agreed that there is a need for face-to-face and human-to-human contact in language learning. The Portuguese teacher said that if the students do not like computers then the CD-ROM would not be helpful to them and that the computer cannot give advice to the students. The Macanese teacher said that students need to practise in a language environment, but the CD-ROM does not provide that environment for them and the computer cannot give corrections. The Cantonese teacher said that the CD-ROM is not helpful for those students who have a hard time imitating sound and other

underlying problems with their pronunciation or they simply do not want to use it.

When the researcher kept hearing words like repeat, listen, sound, pronunciation, writing of Chinese character, not getting feedback, and not able to ask questions, she realised she was getting more reliable data. The updated codes from the pilot interview for the reasons why students study Mandarin are needs and usefulness. The updated codes from the pilot interviews for the benefits and limitations of the multimedia CD-ROM are visuals and sound, interactive learning, more choices, drill and practice, repeat, review, listen, easier to learn, searching and exploring, pronunciation, intonation, attractive interface, not enough feedback from the CD-ROM, cannot ask questions to the CD-ROM, branching and navigation capability, pause and go capability, Chinese character writing, writing of pinyin, no need to rewind, study at home, learn at any time, meaning of words, limited content of the CD-ROM, and no human contact.

To summarise how students and teachers perceived multimedia, the questions were "How might using the computer CD-ROM help your learning?" and "How might your learning not be improved by the CD-ROM?". Table 50 displays the frequency of how students and teachers perceived multimedia in Mandarin learning in the pilot study.

Table 50: Frequency of how Students and Teachers Perceived Multimedia in Mandarin Learning in the Pilot Study

Codes	Students (8)	Teachers (3)	Total
Interactivity	3		
More Animated	1		
More choices	1		
Repeat	2	1	3
Review	1		
Learn at any time	1	1	2

Study at home	2	1	3
Easier to learn	2		
Increase interest	1	1	2
High-tech feeling	1		
Attractive interface	2		
Visuals	2	2	4
Listen to sound	2		
Listen to tone	1	1	2
Listen to sentence	1	1	2
Listen to conversation	1		
Listen and see		1	
Listen to short Essay		2	
Click on sound as much as she likes	1		
Sound	2		
Sound is standardised	1		
Listen to others besides teacher	1		
Listening skill	1	1	2
Testing and Practice	1		
Character writing	1		
Meaning of words	2		
Writing of pinyin	1		
Speech Table	1		
Pronunciation	3	1	4
Intonation-tone	2		
History	1	1	2
Culture		1	
Movies	1	1	2
News	1		
Story-telling	1		
Pause and go	1	1	2
No need to rewind	1		
Branching and navigation	3		
Searching	2		
Exploring the meaning	1		
Not having feedback	1		
Cannot get feedback about pronunciation	2	1	3

Cannot get feedback about how the students are doing	1		
Cannot translate	1		
Cannot give correction	1	1	2
No human contact		2	
Not able to use words in daily life	1		
Need Teacher	3	1	4
Cannot ask questions	4		
Cannot communicate	2		
Cannot transmit feeling	1		
Does not create a language environment		1	
Limited material	2		
Portuguese translation is not helping him	1		
Not the right level	1		
Cannot translate	1		
Cannot help recitation	1		
Cannot help those students who have problem in pronunciation		1	
Cannot help if students don't use it		1	
Cannot help those students who don't have computer	1		
Cannot help those students who don't like computers		1	

For the analysis of the frequency table, the researcher concentrated on those codes that have more than one count. In Table 50, having interactivity, studying at home with the ability to repeat, easier to learn, attractive interface, visuals, listening to sound, meaning of words, learning pronunciation and intonation, having branching, navigation, and searching capabilities were some of the positive feelings that students have towards multimedia in Mandarin learning. Not getting feedback about pronunciation, needing a teacher, cannot ask

questions, cannot communicate and the limited materials in the CD-ROM were some of the negative feelings that the students have towards multimedia in Mandarin learning.

In Table 50, both the students and teachers agreed that the CD-ROM was good when the students could repeat, learn at any time and study at home. They also agreed that the CD-ROM could increase the interest of the learner by providing visual and sound facilities. Listening skill, pronunciation, intonation and learning history from movies were some of the language skills that both the teachers and students agreed that the students can learn from the CD-ROM. In addition, they also agreed that the pause and go capability was good. However, both the students and the teacher thought that the limitations of the CD-ROM were that it cannot provide feedback about pronunciation and cannot give corrections to the learners so that teachers are still needed in class.

To determine what preferences of multimedia students had, the question was "If never used a CD-ROM before, would you like to use one?". Table 51 displays students' preferences of multimedia in the pilot study.

Table 51: Frequency of Students' Preferences of Multimedia in the Pilot Study

Categories	Codes	Students (8)
Preferences	Never Used a CD-ROM	4
	Like to use a CD-ROM	7
	Won't use, prefer the teacher	1

In Table 51, the students in the pilot group liked to use a CD-ROM in their Mandarin learning. To determine if there was any motivation for Mandarin learning, the questions were "Why are you studying Mandarin?", "Do you have much chance to use Mandarin outside of class?", "What do you enjoy the most?"

and "What do you enjoy the least?". To determine if there was any motivation for using a CD-ROM in Mandarin learning, the question was "Would you like to use a CD-ROM?" Table 52 displays students' motivation towards Mandarin learning in the pilot study.

Table 52: Frequency of Students' Motivation towards Mandarin Learning in the Pilot Study

Categories	Codes	Students (8)
Motivation (to learn Mandarin)-reasons	Need	2
	Useful	5
	Interest	1
	Communication	1
	Just learn the language	2
	Read poem	1
	Employer sent her	1
	Chance to use outside	3
Motivation (to learn Mandarin)-enjoyed most	Pronunciation	2
	To speak/communicate	4
	Study by herself	1
	Knowing how to read	1
	Chinese character writing	1
	Exploring/looking up words	1
	Discussion	1
	Watching TV/video	2
	Listening	1
	Student life in Beijing	1
Motivation (to learn Mandarin) -enjoyed least	Word with the same sound	1
	Reading in class	1
	Reading at home	1
	Dialect and Slang	1
	Teaching Method-copying from the board	1

	Teaching method-memorising	1
	Making mistakes	1
	Intonation	2
	Recitation	1
	Chinese character writing	2

Table 52 shows that the need to use Mandarin and the usefulness of Mandarin were reasons that motivated students to learn Mandarin in the pilot study. Those students who enjoyed learning pronunciation, communication with others and watching movies were more likely to be motivated to learn Mandarin. Seven out of eight students in the pilot group were more likely to be motivated to use CD-ROM in their Mandarin learning since they liked to use it.

To determine perceived demand characteristics, the questions were "Why are you studying Mandarin" and "what do you find the most difficult?". Table 53 displays the how the students perceived their demand characteristics in the pilot study.

Table 53: Frequency of Students' Perceived Demand Characteristics in the Pilot Study

Categories	Codes	Students (8)	Teachers (3)	Total
PDC – Why	Need	2		
	Useful	5		
	Interest	1		
	Communication	1		
	Just learn the language	2		
	Read poem	1		
	Employer sent her	1		
	Chance to use outside	3		
PDC – Difficult	Pronunciation	2	2	4
	Words with same sound	1		
	Vocabulary		1	

	Chinese character writing	4		
	To talk	2	1	3
	Read pinyin	1		
	Culture	1		
	Memorising	3		
	Being Lazy	1		
	Lack of perseverance		1	
	Not realising that Mandarin is difficult		1	
	Do not know how Chinese think		1	
	Colloquial words		1	
	Intonation	2	2	4
	Speak without accent		1	
	Written language		1	

In Table 53, the students in the pilot group found that either there was a need or that it was useful to learn Mandarin, therefore their perceived demand characteristics for learning Mandarin were high. Based on what Salomon (1983) said when the perceived demand characteristics (PDC) of a medium were manipulated, such as just for fun or to watch carefully to learn as much from it, the latter condition was assumed to induce greater amount of invested mental effort, the students in the pilot study who found pronunciation, Chinese character writing, speaking to others, intonation and memorising difficult were more likely to invest more mental effort in their Mandarin learning. Both the students and teachers agreed that pronunciation, intonation and communication were difficult.

To determine the perceived self-efficacy, the question was "What do you find the easiest?" and Table 54 displays how students perceived their self-efficacy in the pilot study.

Table 54: Frequency of Students' Perceived Self-Efficacy in the Pilot Study

Categories	Codes	Students (8)	Teachers (3)	Total
PSE - easiest	Pronunciation	1	1	2
	Meaning of words	2		
	Grammar	2		
	Daily conversation	1	1	2
	Chinese character writing	2		
	Discussion question	1		
	To understand	1	1	2
	Writing of pinyin	1	1	2
	First two lessons	1		
	Read		1	
	Listening skill		1	
	Read from pinyin		1	
	Tones		1	

In Table 54, except for meaning of words, grammar, and Chinese character writing, all the other codes have only one count, it is assumed that the students in the pilot group were low in their perceived self-efficacy in Mandarin learning. Based on what Salomon (1983) said about college freshmen exhibiting lower self-efficacy with print and investing more mental effort in processing its material, the students in the pilot study were more likely to invest more mental effort in their Mandarin learning.

8.23 Middle-range Theories from the Second Literature Review

From the literature of multimedia, language learners and their learning styles, multimedia and foreign language learning, and using Figure 20, the researcher added the following assumptions regarding attitude:

1. Students' attitude influences motivation and new experiences such as the use of the Mandarin CD-ROM can change their attitude (Figure 6).

    1.1 The multimedia CD-ROM changes students' attitude and motivation towards Mandarin learning with the CD-ROM.

    (In chapter 4, p. 155, the results of Klassen and Milton's (1999) study demonstrated positive attitudinal changes for the multimedia-enhanced mode of learning.)

2. Students' learning styles have a positive effect on their attitude towards using a computer in Mandarin learning (Figure 3).

    2.1 Students who are independent learners like to use the CD-ROM in their Mandarin learning.

    (In chapter 4, p. 163, one student in Davis's (1997) study suggested that using the computer made him a more independent learner where he didn't have to call on anyone else for help.)

    2.2 Students who are visual learners like to use the CD-ROM in their Mandarin learning.

    (In chapter 4, p. 160, Pawling's (1999) study involved vocabulary acquisition with a multimedia dictionary where one student commented pictures help him remember the word.)

3 Students' previous exposure to technology and computer skills affect their attitude towards using a computer in Mandarin learning (Figure 12).

    3.1 Students who have better computer skills like to use the CD-ROM in their Mandarin learning

    (In chapter 4, p. 166, the participants of New's (1999) study all had previous experience with the software and computers. With regard to the effect of the computer, students thought that it was faster and easier to use. Moreover, the software program made it much easier and faster to look up words.)

4 Students who undertake self-paced learning have positive attitudes towards using the CD-ROM in their Mandarin learning (Figure 12).

4.1 Students who undertake self-paced learning like to use the CD-ROM in their Mandarin learning.

(In chapter 4, p. 160, Pawling's (1999) study involved vocabulary acquisition with a multimedia dictionary where one student commented she could do it at her own pace.

In chapter 4, p. 163, the students in Chun's (2001) study could read at their own pace.)

Based on the assumptions learned in the second literature review, the researcher added the following formative, middle-range theories:

1. Independent or visual learners with better computer skills or who like self-paced learning are more likely to be motivated to learn Mandarin with the CD-ROM.

2. The experience with the multimedia CD-ROM can change students' attitude and motivation towards Mandarin learning with the CD-ROM.

The research model displayed in Figure 36 and the tree diagram of motivation in Figure 37 were built based on Figure 14 and Figure 20. Both attitudes towards Mandarin learning and Mandarin learning with the CD-ROM have to be considered before determining the motivation of the students in using the CD-ROM in their Mandarin learning. Attitudes are affected by learning styles as well as previous experience. The researcher of this study hopes to discover whether or not the use of the multimedia CD-ROM will change students' attitude and motivation towards Mandarin learning with the CD-ROM in Macao.

8.3 The Main Study

At the time when the main study was taking place, between March and June of 1999, the first volume of the 'Click!' CD-ROM series was already published. The main study included the teacher focus group, the in-class observation study, and the main interview. The Click! Interactive Mandarin I was being used for the data collection at this stage.

8.31 The Teacher Focus Group

As stated earlier, only 11 teachers from seven secondary schools showed up on April 21, 1999. One was a computer teacher and the rests were all Mandarin teachers. After the demonstration of the 'Click!' CD-ROM, questionnaires were given to the teachers. The questions on the questionnaire form were rated in five categories: very good, good, fair, poor and NA; and they were similar to ones given to the user-interface focus group questions. Since some questions on the user-interface focus group were not answered, two modifications were made in this questionnaire: NA category was added and questions were written in both English and Chinese. In addition, the question "Displays are uncluttered" was eliminated because one participant from the user-interface focus group did not answer that question. The question "The terminology" was eliminated because again one participant did not answer that question and that it is similar to the question "The understandability of the Portuguese/Chinese/English used". Further more, the order of the question, "The screen layout and appearance" was moved before the question for graphics and sound effects because it gave a more general approach to questioning. The question that was phrased "Graphics and sound (if used) are appropriate" was rephrased to "sound effect" to make it more simple to understand and not to have two items to be evaluated in one question. "Graphics" was moved to the question with "animated graphics" and became this

question, "The graphics or animated graphics effects" to put similar items in one question. Thirteen questionnaires were collected, two from two teachers from the Macao Polytechnic Institute. The data are summarised in Table 55.

Table 55: Teacher Focus Group Questionnaire Result in the Main Study

(Out of 13 responses)	Very Good	Good	Fair	Poor	NA
The general structure (layout) of the course 整個課程結構	23%	69%			8%
The instructions on navigation through the course 課程瀏覽指示	23%	77%			
The screen layout and appearance 屏幕效果	15%	77%	8%		
The graphics or animated graphics/effects 圖像及動畫效果	23%	31%	46%		
Sound effect (one did not answer, still taken out of 13) 聲音效果	31%	54%	8%		
The appropriateness of the use of different colours 顏色的使用	15%	39%	46%		
Menu items are understandable and descriptive 選單清楚, 明白	46%	54%			
The understandability of the Portuguese/Chinese/English used 葡語/中 文/英語 清楚, 明白	15%	62%	23%		

In Table 55, it seems that the complete change of user interface after the user-interface focus group discussion was worthwhile. There were more responses on the very good category than the fair category. Sound effect and descriptive menu have better ratings than the others. The common criticisms were the animated Chinese character writing and the colour[6] of the interface. The animated Chinese character writing at that time was not showing the

[6] The colour could not be changed because the subsequent volumes of the CD-ROM have to be consistent.

direction of the stroke order. The other comments were that it was suitable for home use, but only for Macanese and Portuguese. The animated character writing will be good for young students to learn how to write. The system may not be suitable for primary school students because of the English or Portuguese interface. On the positive side, one teacher commented that she hoped to see more of Mandarin teaching materials to promote the use of Mandarin. As a result of the teacher focus group, the character writing of the second volume of the CD-ROMs was changed to improve the animation and the direction of the stroke order.

8.32 The In-Class Observation Study

There was a total of ten Portuguese teachers who volunteered to study Mandarin with the help of a Mandarin teacher. The background of this particular class was important to this study (Costa, 1999). In 1998, the Language and Translation School, one of the schools of the Macao Polytechnic Institute, started a course in which Portuguese teachers could learn Mandarin from the Mandarin teachers and Mandarin teachers could learn Portuguese from the Portuguese teachers. Their initial efforts were disappointing for the Mandarin teachers teaching the Portuguese students. It seemed like there was not enough motivation for the Portuguese students. Some of the Portuguese students started and quitted. There were two suspected reasons why there was a lack of motivation. The first one being that since they were going back to Portugal[7], there was no need for them to learn Mandarin any more. The second reason was that the language itself was probably difficult to follow. Armed with the characteristics of the class that they were Portuguese students who might not find a need to learn Mandarin and that

[7] At the time of the study, the sovereignty of Macao was about to be handed back to China. The hand-over date was December 20, 1999.

Mandarin itself is probably a difficult language, the researcher at least would not be disappointed if the students stopped coming to class. It was also important to know that the students have no other reason to take the course, but out of interest. They could stop at any time. It was not a regular class. In fact, they did not have to pay any tuition or to be graded.

The researcher personally conducted the in-class observations from March 4 to June 3 in 1999. Her original idea was to conduct the class with traditional teaching on Tuesday and with the CD-ROM on Thursday. In fact, she had scheduled a regular classroom (see Appendix 8) on Tuesday and the computer room on Thursday. For the first week, when the students realised that they didn't have the CD-ROM to use on Tuesday, they were disappointed. They were really enthusiastic about the use of the CD-ROM in the beginning. So starting from March 16 of 1999, the researcher also set up the computer room for them on Tuesday.

On Tuesday, they would first attend a lecture in a regular classroom and move to the computer room to listen to the CD-ROM towards the end of the lesson. On Thursday, they would first attend a lecture for one hour in the computer room and then listen to the CD-ROM afterwards for 30 minutes with the teacher around for questions. The teacher would try to explain the materials to them first before allowing them to venture into the CD-ROM.

The researcher only observed the class in the computer room. During the observation period, she was taking notes/logs about when and how long was the computer session with how many students as shown in Table 56, which students was attending class and the total minutes each student spent with the computer session as shown in Table 57 and their behaviour or action and made her own interpretation of their action as shown in Table 58. Journals were written after

the in-class observations to express the researcher's feeling, in a narrative format as suggested by Charmaz (2000) who proposed taking the reader into a story and imparting its mood through narrative exposition in a constructivist grounded theory approach.

Table 56: Date, Duration and Number of Students of the in-class Observations with the CD-ROM in the Main Study

Dates	Duration	Number of students
1) March 4, 1999	60 minutes	10
2) March 9, 1999	30 minutes	8
3) March 11, 1999	30 minutes	6
4) March 16, 1999	30 minutes	6
5) March 25, 1999	45 minutes	6
6) March 30, 1999	30 minutes	3
7) April 8, 1999	30 minutes	1
8) April 13, 1999	15 minutes	2
9) April 20, 1999 (no class)	0 minute	2
10) April 29, 1999	10 minutes	1
11) May 4, 1999	0 minute	1
12) May 11, 1999	25 minutes	4
13) May 13, 1999	45 minutes	5
14) May 18, 1999	10 minutes	1
15) June 1, 1999	15 minutes	5
16) June 3, 1999	45 minutes	4
Total	420 minutes (7 hours)	

In Table 56, there were a total of 7 hours spent in the computer room with the CD-ROM from March 4 to June 3 in 1999. A total of six lessons were covered from volume I of the 'Click!' CD-ROM series, from lesson 8 to 13. The number of students chronologically showed a very depressing trend, from 10 down to 8, and to 6 in the first five lessons, to less and less students. Time spent from 60 minutes down to 30, 15 or 10 minutes was also not very

encouraging. Maybe the number of students attending the class or the time spent in class was influenced by the novelty effect. Easter holiday ran from March 31 to April 8, 1999. As Easter holiday was approaching, the researcher saw less students coming to class. April 8 was the first day after the Easter holiday and only one student showed up in class. There was not supposed to have been any class on April 20; however, two students showed up. Classes between holidays were difficult to handle. Table 57 displays the pattern of the students' studying habit during the observation period.

Table 57: Students' Attendance during in-class Observations in the Main Study

Lessons / Students/minutes spent	1	2	3	4	5	6	7	8	9 [No class]	10	11	12	13	14	15	16	Total
1. Manuela/355 (85%)	✓	✓	✓	✓	✓	✓						✓	✓		✓	✓	10
2. Monica/270 (64%)	✓	✓	✓	✓	✓	✓							✓				7
3. Conceicao /355 (85%)	✓	✓	✓	✓	✓	✓						✓	✓		✓	✓	10
4. Lisete/310 (74%)	✓	✓	✓	✓	✓				✓			✓	✓			✓	9
5. Iva/230 (55%)	✓	✓		✓			✓			✓	✓		✓	✓	✓		9
6. Sofia/180 (43%)	✓	✓	✓	✓				✓							✓		6
7. Suzanna*/195 (46%)	✓	✓	✓		✓			✓	✓						✓		6
8. Anna/235 (56%)	✓	✓	✓		✓							✓				✓	6
9. Juana/90 (21%)	✓		✓														2
10. Orlanda /60 (14%)	✓																1
Number of students in class	10	8	6	6	6	3	1	2	2	1	1	4	5	1	5	4	

*Suzanna was a pregnant woman

In Table 57, the two students who spent the most time in this study were Manuela and Conceicao with 85% of participation. Next in line were Monica and Lisete with 64% and 74% participation respectively. The 9th lesson was April 20 when there was not supposed to have any class but Lisete and Suzanna still showed up. Suzanna's absence in class towards the end of the study could be due to the fact that she needed more time to rest because of her pregnancy. Iva didn't seem to be bothered by the holiday season because she consistently showed up in class before and after the Easter holiday. Orlanda was not interested in coming to class after the first lesson. Was it because she did not like to the use of computer? Unfortunately, the researcher did not have a chance to find out why. Juana only attended two lessons, the researcher wanted to find out more about her attitude through the main interview at a later time. Table 58 displays students' behaviour/action/suggestion and the researcher's interpretation during in-class observation study. Table 58 is displayed chronologically with the researcher's reaction about the class in a narrative form.

Table 58: Students' Behaviour/Action/Suggestion during in-class Observations in the Main Study (Part 1)

Date : March 4, 1999 (Thursday) (1 hour with computer)

Name of students	IN Class	Behaviour/Action/Suggestion	Interpretation
1) Manuela	Y		
2) Monica	Y	1) Spoke to the researcher - couldn't wait to take the CD-ROM home, felt that she could really learn Mandarin with this CD-ROM.	1) Liked the CD-ROM.
3) Conceicao	Y	1) Suggested to the researcher that there should be a Repeat button in the Tones/Sound Exercise and the test.	1) CD-ROM needed modification, a critical student, good source for suggestion.
4) Lisete	Y	1) Fiddled with headphones	1) Excited and liked the CD-ROM
5) Iva	Y	1) Fiddled with headphones 2) While she was listening to the CD-ROM, ask the researcher to check her pronunciation. 3) Asked the researcher where she could get the CD-ROM 4) Listened to the CD-ROM even when the teacher was speaking.	1) Excited and liked the CD-ROM. 2) Need the CD-ROM to check her pronunciation. 3) Interested in CD-ROM.
6) Sofia	Y	1) Spoke to the researcher, liked the program very much.	1) Liked the CD-ROM
7) Suzanna	Y	1) CD-ROM was great	1) Liked the CD-ROM
8) Anna	Y		
9) Juana	Y		
10) Orlanda	Y		

On March 4, 1999, the researcher was nervous about the beginning of this class. She felt that it was more like a first impression that she would have on the teacher as well as the students. She just met the teacher, Mr. Zhao that day and he had never seen the program before. Mr. Zhao was the Mandarin course coordinator. In fact, she did not know he was the teacher helping out in this class before and had never personally spoken to him about using the CD-ROM for an evaluation. She wasn't sure if he would be willing to use it for his class. She showed him the program for about fifteen minutes before class. While she was setting up the equipment for the class, she noticed that he was still very curious about the program and tried it on his own. The Mandarin teacher and the researcher decided that the researcher ought to introduce the program to the students when class began. Nine students showed up initially. One thing that boosted up the researcher's confidence was that one of the students, Manuela, the director of the Language and Translation School at that time, brought a camera to take pictures of this unprecedented event. So the researcher took pictures of the students and also with herself and with Mr. Zhao. She then gave the nine students a ten-minute briefing on the how to use the program. She noticed that most of the students listened attentively while Lisete and Iva were fiddling with the headphones and wanted to put them on. That also boosted the researcher's confidence a little bit more. One student, Orlanda came in late and the researcher personally gave her a short briefing about the CD-ROM. Mr. Zhao and the researcher let the students practise for about one hour on their own and simply walked around the class. One student, Iva, asked the researcher how she could tell if she was pronouncing correctly or not. The researcher suggested to her that whenever she had a question about the pronunciation, she should ask Mr. Zhao about it. Iva was quite satisfied with the answer. One student,

Conceicao, suggested to the researcher that there should be a 'repeat button' in one of the exercises, Tones/Sound Discrimination. She said it would also be useful to apply the Repeat button to the existing test. Iva later asked the researcher where she could get the CD-ROM, and the researcher said she could only get it from her for time being.

Mr. Zhao went from lesson one to lesson seven in 25 minutes. He let the students view the screen and have each student repeat after him. He also let the students ask and answer each other's questions. The researcher found that Iva and Lisete were having the most problem following him. So she tried to assist Iva with the Mandarin text/dialogue as much as possible because she wanted to eliminate the external factors about Iva not knowing how to use the CD-ROM. Iva listened to the CD-ROM while the teacher was teaching, trying to catch up with the teacher.

Mr. Zhao decided that he would use the same textbook associated with the CD-ROM. Originally he was going to use a different book. He said that he would start from lesson 8 the next time. He could also set up some dialogue for the students to practise in class. He seemed to be quite satisfied with the CD-ROM. He even made a comment about asking SAFP (Public Administration and Civil Services) to use it for all their classes.

There were two things the researcher observed that saved instructional time, the translation and the sound. The teacher no longer had to explain to the Portuguese students the meaning of each word or the whole sentence. They could immediately see the translation as they moved their mouse pointers over that line or that word. The teacher did not have to repeat so much any more. The students could listen to the sound as often as they liked.

After the class, the researcher spoke to two students. Sofia said that she

liked the program very much and she congratulated the researcher. She said she also liked repeating after the teacher. Monica told the researcher that she couldn't wait to take the CD-ROM home to study. She felt that now she could really learn her Mandarin with the aid of this CD-ROM. Without the CD-ROM, she said that she might forget a sound she learned from class. Sofia told the researcher that Suzanna told her that the program was great. The researcher asked the programmer to include the Repeat button in three areas in the first volume of the 'Click!' CD-ROM series. The three areas were: Tones/Sound Discrimination, Initials and Finals, and the Speech Sound table. From Table 58 (Part 1), Conceicao was the student who gave the most suggestion to the researcher. On the first day of the lesson, almost everybody was excited about the use of the CD-ROM in their Mandarin study. Monica felt that she could finally really learn Mandarin with this CD-ROM. Lisete and Iva loved to listen to the CD-ROM.

Table 58: Students' Behaviour/Action/Suggestion during in-class Observations in the Main Study (Part 2)

Date: March 9, 1999 (Tuesday) (traditional classroom 30 minutes)

Name of students	IN Class	Behaviour/Action/Suggestion	Interpretation
1) Manuela	Y		
2) Monica	Y		
3) Conceicao	Y		
4) Lisete	Y	1) Told the researcher how much she really enjoyed the CD-ROM and that it made the class more interesting. 2) Liked to study more by herself	1) liked the CD-ROM 2) CD-ROM used for self-study.
5) Iva	Y	1) Liked to study more by herself	1) CD-ROM good for self-study
6) Sofia	Y		
7) Suzanna	Y		
8) Anna	Y		
9) Juana			

On March 9, 1999, Lisete told the researcher how much she really enjoyed the CD-ROM and that it made the class more interesting. She and Iva wanted to come to study more on their own. After studying in the traditional classroom, the students came in the computer room around 2:15. When 2:45 came, they were still anxious to leave the class. The researcher supposed that any class has only so much attraction. She was worried about the motivation of this class. This was not a regular class. People could come and go as they pleased. In fact, they could end this class at any time they wanted to. There was little incentive to hold them here except their own willingness to come. Only eight students showed up: Iva, Lisete, Manuela, Conceicao, Monica, Sofia, Suzanna, and Anna.

Table 58: Students' Behaviour/Action/Suggestion during in-class Observations in the Main Study (Part 3)

Date : March 11, 1999 (Thursday) (2:00 to 2:30 - 30 minutes)

Name of students	IN class	Behaviour/Action/Suggestion	Interpretation
1) Manuela	Y	1) Asked Conceicao to show her what she was doing.	1) Liked to work with Conceicao or CD-ROM is difficult
2) Monica	Y	1) Tested on the number exercise. 2) Started to talk at the end.	1) Motivated 2) Maybe bored, maybe already learned the material
3) Conceicao	Y	1) Complaining about not having the Play All button in the Text portion for review. 2) Worked on exercise	1) A critical student, good source for suggestion. 2) Liked to practise listening skill.
4) Lisete	Y	1) Put on headphones when she walked in the class 2) Busy copying the translation. 3) Spent the most time with CD-ROM.	1) Still excited 3) CD-ROM good for beginner
5) Iva			
6) Sofia	Y	1) Used the Play All button to listen leisurely 2) Started to talk at the end	1) Let the computer in control or she has already learned everything. 2) Maybe bored, maybe already learned the material
7) Suzanna	Y	1) Started to talk at the end.	1) Maybe bored, maybe already learned the material

8) Anna	Y	1) Told the researcher and the teacher that the CD-ROM was great and liked to have a copy. 2) Liked to click on one word each time to listen to the sound. 3) Spent most time with the CD-ROM.	1) Liked the CD-ROM. 2) Liked to control the computer. 3) CD-ROM good for beginner
9) Juana	Y		

On March 11, 1999, only eight students showed up again: Lisete, Manuela, Conceicao, Monica, Sofia, Suzanna, Anna, and Juana. Iva told Lisete that she wouldn't be able to come to class. At least, they told each other about it. Anna was the first one sitting in the classroom. She told the researcher and the teacher that she felt the CD-ROM was really great and she wondered if she could get a copy of it. The teacher told her that he had already talked to the director, and Manuela agreed that each student should have one.

The researcher noticed that Lisete was the only one who put on the headphones the minute she walked into class. This was her third Mandarin lesson in the computer room. She was even having her headphones on initially when the teacher was lecturing. The researcher wondered if that distracted Lisete or disturbed the teacher.

There was a forty-five minute lecture in the beginning, probably reviewing what they learned from last time, and the teacher started to go over the new vocabulary in lesson 11 while the students were looking at the screen. The students were allowed to freely explore the system from 2:00 to 2:30. The teacher then wrapped up the class in the last 15 minutes going over the Text section and had the students practise with each other.

During the 30 minutes of CD-ROM usage, the researcher noticed that Monica tried the sound exercise herself to test out the numbers. Lisete was

busy copying the Portuguese translation. Sofia used the Play All option leisurely, to leave the computer in control. The researcher tried to show the same feature to Anna. She didn't seem to like it. It seemed to the researcher that Anna preferred to use the individual click to hear one word at a time, so that she was in control. Conceicao was complaining about the Text section not having a Play All button to play the entire conversation for review. The researcher thought she needed to add this in the second volume of the CD-ROM series because the first volume was already published at that time. When Manuela saw that Conceicao was working on the exercise, she wanted Conceicao to show her how to use that exercise. The researcher thought that peers have a lot of influence on students. Towards the end of the computer lesson, she noticed that, Suzanna, Sofia and Monica started to talk. They are more advanced students, and the researcher figured that they were already bored listening to it after they learned the material. She noticed Lisete, and maybe Anna spent the most time with the CD-ROM. She supposed this system is more useful to beginners. She noticed that the teacher also spent about five minutes reviewing how to use the system.

Table 58: Students' Behaviour/Action/Suggestion during in-class Observations in the Main Study (Part 4)

Date : March 16, 1999, (Tuesday) 2:15 -2:45 - 30 minutes

Name of students	IN Class	Behaviour/Action/Suggestion	Interpretation
1) Manuela	Y	1) Eager to put on the headphones 2) Needed Conceicao's guidance	1) Still interested 2) Maybe difficult to use
2) Monica	Y	1) Monica and Conceicao eager to put on the headphones	1) Interested in the CD-ROM
3) Conceicao	Y		
4) Lisete	Y	1) Eager to put on the headphones 2) Enjoyed using the Play All button	1) Still interested 2) Improvement and a good feature to have
5) Iva	Y	1) Eager to put on headphones 2) Busy copying the translation 3) Enjoyed using the Play All button	1) Still interested 2) Use the CD-ROM to find the meaning without the teacher 3) Improvement and a good feature to have
6) Sofia	Y	1) Eager to put on the headphones 2) Probably understood the text and began to construct sentences after listening to it. 3) Used the Play All button all along	1) Still interested 2) More advanced student 3) Independent student - who can work by herself
7) Suzanna			
8) Anna			
9) Juana			

On March 16, only six students showed up. They were Manuela, Conceicao, Monica, Iva, Sofia and Lisete. The researcher began to worry about how long could this in-class observation be going on. It seemed like they were losing their interest. They spent about one hour in another classroom learning the materials before coming into the computer room. They came in the classroom at 2:15. All of them seemed very eager to jump right into the computer with the headphones on. Maybe they were eager to use the CD-ROM or maybe they needed a break from the lesson they just had.

The researcher noticed that Iva was busy copying the translation. Sofia seemed to pick up the most from the text/dialogue, where she began to construct sentences from the existing model, after listening to it. Both Iva and Lisete enjoyed using the Play All button now, they could sit back and relax and leave the computer in control. Sofia knew about the usage of the Play All button from the beginning. Manuela always needed Conceicao's guidance.

On Thursday, March 18, 1999, the students decided to have lunch at the restaurant while they were having class. They seemed to enjoy that kind of environment very much. They learned something about the food they were having. They also learned about colour. Eight students showed up at the restaurant. They were Manuela, Conceicao, Iva, Lisete, Monica, Sofia, Suzanna and Anna. Suzanna told the researcher that she couldn't attend the last lesson because she was sick and she would catch up with the CD-ROM. The researcher suggested to the teacher that the students shouldn't have the CD-ROM next Tuesday and he agreed. He was going to spend the time reviewing over the materials they learned in the restaurant. Conceicao, Manuela, and the teacher were going to Portugal in April. So, the researcher really didn't think this class could last any longer, maybe one or two more lessons.

Table 58: Students' Behaviour/Action/Suggestion during in-class Observations in the Main Study (Part 5)

Date : March 25, 1999 (Thursday) (2:00 - 2:45 - 45 minutes)

Name of students	IN Class	Behaviour/Action/Suggestion	Interpretation
1) Manuela	Y	1) Manuela, Monica and Conceicao couldn't see the teacher was referring to the vocabulary list on the screen.	1) Probably not interested, rather concentrated on the teacher, CD-ROM cannot compete with the teacher.
2) Monica	Y		
3) Conceicao	Y		
4) Lisete	Y	1) Liked to copy the translation	1) Translation -good for foreign student, CD-ROM- good for self-study
5) Iva			
6) Sofia			
7) Suzanna	Y	1) Both Suzanna and Anna couldn't see the teacher was referring to the vocabulary list on the screen. 2)Anna had problem catching up with the materials in class, preferred to have the teacher explaining things to her.	1) Probably not interested, rather concentrated on the teacher, CD-ROM cannot compete with the teacher. 2) The CD-ROM could not compete with teacher or maybe the CD-ROM was for more independent student
8) Anna	Y		
9) Juana			

On March 25, 1999, only six students showed up: Monica, Manuela, Conceicao, Susanna, Anna and Lisete. They spent the first 45 minutes reviewing some words in lesson 13. Most students didn't even realise that the teachers were referring to the vocabulary list on the screen, and they were Monica, Manuela, Conceicao, and Suzanna. They either didn't realise it or they weren't interested. Maybe they were only interested in what the teacher had to say.

The researcher noticed that Lisete liked to copy the translation from the screen. She seemed very patient and interested in terms of going through the CD-ROM on her own. She would simply take her own sweet time. Anna had a problem catching up. She preferred to hear the teacher explaining to her. She either had a problem with Mandarin or she was not interested in learning with the CD-ROM. The researcher had to show her how to use the vocabulary list and Text section again and the researcher could only conclude that more independent students tend to work better with the CD-ROM.

Table 58: Students' Behaviour/Action/Suggestion during in-class Observations in the Main Study (Part 6)

Date : March 30, 1999 (Tuesday) (30 minutes)

Name of students	IN Class	Behaviour/Action/Suggestion	Interpretation
1) Manuela	Y	1) Still interest in using the CD-ROM.	
2) Monica	Y	1) Losing her interest in learning Mandarin or with the CD-ROM	1) novelty effect
3) Conceicao	Y	1) Still interest in using the CD-ROM.	
4) Lisete			
5) Iva			
6) Sofia			
7) Suzanna			
8) Anna			
9) Juana			

March 30, 1999 was the last day before the Easter holiday. Only three students showed up: Monica, Conceicao, and Manuela. They spent most of the time listening to the teacher in the classroom. They then spent about 30 minutes in the computer room. Conceicao and Manuela seemed more interested. Monica said that she was hungry towards the end of class. The researcher noticed that Monica might be losing her interest in Mandarin learning or using the CD-ROM. The researcher thought that maybe what Monica was showing was the wearing off of the novelty effect.

Table 58: Students' Behaviour/Action/Suggestion during in-class Observations in the Main Study (Part 7)

Date : April 8, 1999 (Thursday) (30 minutes)

Name of students	IN Class	Behaviour/Action/Suggestion	Interpretation
1) Manuela			
2) Monica			
3) Conceicao			
4) Lisete			
5) Iva	Y	1) Spent 20 minutes copying translation from the CD-ROM	1) Translation was good for foreign student so that she could later on study at home.
6) Sofia			
7) Suzanna			
8) Anna			
9) Juana			

April 8, 1999 was the first day after the Easter holiday. Only one student showed up. Iva spent 20 minutes copying the translation from the CD-ROM. The researcher told Iva that the CD-ROM was now available for sale and she said she would buy one. After the researcher showed her the installation of the CD-ROM, she left at about 1:45. During the weekend, the researcher told Lisete that the CD-ROM was out for sale. She said she was going to buy one, too.

Table 58: Students' Behaviour/Action/Suggestion during in-class Observations in the Main Study (Part 8)

Date : April 13, 1999, (Tuesday) (spent 15 minutes with computer)

Name of students	IN Class	Behaviour/Action/Suggestion	Interpretation
1) Manuela			
2) Monica			
3) Conceicao			
4) Lisete			
5) Iva			
6) Sofia	Y	1) Anxious to listen to the CD-ROM 2) Reviewed with the CD-ROM on what the teacher went over the past hour.	1) Still interested 2) Good for review
7) Suzanna	Y	1) Anxious to listen to the CD-ROM 2) Liked to explore new chapters	1) Still interested 2) Good for exploring
8) Anna			
9) Juana			

On April 13, 1999, only two students showed up today: Sofia and Suzanna. Conceicao was in Portugal. Monica was in India. Manuela was getting ready to go to Portugal the following day. Sofia and Suzanna spent 1 hour and 15 minutes in the classroom, going over what they have missed from the last lesson. They spent only 15 minutes with the CD-ROM. They both were very anxious to listen to the recording. Sofia spent more time with the materials taught in class, but Suzanna liked to explore into other chapters to guess what was going

on.

There would be one more class this Thursday, and the teacher was also going to Portugal. The teacher told the researcher that class would resume on the 29th of April. The researcher really had her doubts about the willingness and motivation of the students after stopping for two weeks. There were less and less students coming to class.

Table 58: Students' Behaviour/Action/Suggestion during in-class Observations in the Main Study (Part 9)

Date : April 20, 1999 (No class today, Teacher still in Portugal)

Name of students	IN Class	Behaviour/Action/Suggestion	Interpretation
1) Manuela			
2) Monica			
3) Conceicao			
4) Lisete	Y	1) Didn't know there was no class 2) Researcher told her to study with CD-ROM, but she declined.	1) Still interested in learning Mandarin 2) Preferred the teacher
5) Iva			
6) Sofia			
7) Suzanna	Y	1) Didn't know there was no class 2) Researcher told her to study with the CD-ROM, she said "No way, I prefer to study with the teacher".	1) Still interested in learning Mandarin 2) Preferred the teacher
8) Anna			
9) Juana			

There wasn't supposed to be any class on April 20, 1999; however two students, Lisete and Suzanna, forgot and showed up. The researcher suggested to Lisete and Suzanna to study with the CD-ROM and both of them declined the idea. Suzanna said, "No way, I prefer to study with the teacher". The researcher took the opportunity to interview Lisete that day.

Table 58: Students' Behaviour/Action/Suggestion during in-class Observations in the Main Study (Part 10)

Date : April 29, 1999 (Thursday) left at 2:00 p.m. -10 minutes with CD-ROM

Name of students	IN Class	Behaviour/Action/Suggestion	Interpretation
1) Manuela			
2) Monica			
3) Conceicao			
4) Lisete			
5) Iva	Y	1) Showed no interest in class	1) Interest was declining, maybe the novelty effect or too many classes were interrupted in between.
6) Sofia			
7) Suzanna			
8) Anna			
9) Juana			

The session on April 29, 1999 was even more depressing. Only one student showed up. Neither the teacher nor the student had any interest in class. The student, Iva asked a few questions and listened to the CD-ROM for a while. Both the teacher and the student left around 2:00 p.m. They only had 45 minutes of class. Iva only used the computer for about 10 minutes. They were more interested in talking about the teacher's trip to Portugal. Interest was definitely declining.

Table 58: Students' Behaviour/Action/Suggestion during in-class Observations in the Main Study (Part 11)

Date : May 4, 1999 (Tuesday) 45 minutes of traditional classroom lesson - no CD-ROM today

Name of students	IN Class	Behaviour/Action/Suggestion	Interpretation
1) Manuela			
2) Monica			
3) Conceicao			
4) Lisete			
5) Iva	Y	1) Didn't listen to the CD-ROM	1) Interest was declining
6) Sofia			
7) Suzanna			
8) Anna			
9) Juana			

On May 4, 1999, only one student showed up, Iva. She only had 45 minutes of class. She didn't listen to the CD-ROM at the end. Class was cancelled on May 6 because they all had to attend a conference.

Table 58: Students' Behaviour/Action/Suggestion during in-class Observations in the Main Study (Part 12)

Date : May 11, 1999 (Tuesday) computer lesson from 2:20 to 2:45-25 minutes

Name of students	IN Class	Behaviour/Action/Suggestion	Interpretation
1) Manuela	Y	1) Did exactly what the teacher said, reading the vocabulary first	1) Followed everything the teacher said
2) Monica			
3) Conceicao	Y	1) Preferred to read the text first before reading the vocabulary list	1) More independent and adventurous
4) Lisete	Y	1) Liked to copy the translation 2) Did exactly what the teacher said, reading the vocabulary first	1) Self-study 2) Followed everything the teacher said
5) Iva			
6) Sofia			
7) Suzanna			
8) Anna	Y	1) Did exactly what the teacher said, reading the vocabulary first	1) Followed everything the teacher said
9) Juana			

On May 11, 1999, only four students showed up: Manuela, Conceicao, Anna, and Lisete. They sat through traditional classroom teaching for one hour and 20 minutes, and they only came into the computer room around 2:20 p.m. The researcher saw that they were listening to lesson 15 attentively. Lisete, as usual, liked to copy down the translation. While the teacher was lecturing the lesson, the researcher switched everybody's screen to the Text section so that they could see what was discussed by the teacher. When the teacher told the students that

they should start by studying the vocabulary list first. Anna, Lisete, and Manuela immediately switched to the vocabulary list, but Conceicao said she preferred reading the conversation first, liked to view the whole picture first. Conceicao was more independent and more adventurous in her learning.

Table 58: Students' Behaviour/Action/Suggestion during in-class Observations in the Main Study (Part 13)

Date : May 13, 1999 (Thursay) Conceicao's birthday - 1:15 - 2:30 - 45 mintues with computer

Name of students	IN Class	Behaviour/Action/Suggestion	Interpretation
1) Manuela	Y		
2) Monica	Y		
3) Conceicao	Y		
4) Lisete	Y		
5) Iva	Y		
6) Sofia			
7) Suzanna			
8) Anna			
9) Juana			

On May 13, 1999, Conceicao, Manuela, Monica, Lisete and Iva showed up in class. They left 15 minutes earlier because they wanted to celebrate Conceicao's birthday.

Table 58: Students' Behaviour/Action/Suggestion during in-class Observations in the Main Study (Part 14)

Date : May 18 1999 (Tuesday) came in at 2:15 - 10 minutes with computer

Name of students	IN Class	Behaviour/Action/Suggestion	Interpretation
1) Manuela			
2) Monica			
3) Conceicao			
4) Lisete			
5) Iva	Y	1) Used CD-ROM for ten minutes	1) Just use it for the sake of it.
6) Sofia			
7) Suzanna			
8) Anna			
9) Juana			

On May 18, 1999, only Iva showed up in class. She had to leave early, so she only used the CD-ROM for about ten minutes after having lesson in the traditional classroom.

Between May 18 and June 1 in 1999, there were no records of what was going on in class. The researcher was not available for three lessons and she had her assistant help out for two lessons. On May 20, only one student showed up. On May 25, nobody showed up, not even the teacher. So the researcher decided to cancel the CD-ROM session on May 27 because of lack of interest.

Table 58: Students' Behaviour/Action/Suggestion during in-class Observations in the Main Study (Part 15)

Date : June 1, 1999 (Tuesday) in computer room from 2:15 to 2:30 - 15 minutes

Name of students	IN Class	Behaviour/Action/Suggestion	Interpretation
1) Manuela	Y	1) Everybody left earlier	1) Interest was declining, they just needed an excuse to leave early.
2) Monica			
3) Conceicao	Y	1) Had to go to a meeting	
4) Lisete			
5) Iva	Y		
6) Sofia	Y		
7) Suzanna	Y		
8) Anna			
9) Juana			

On June 1, 1999, Suzanna, Conceicao, Manuela, Sofia, and Iva showed up. They left 15 minutes earlier because Conceicao had to go to a meeting. The researcher found out later that they still went to their regular meeting place at the coffee stand to have coffee. So the researcher figured that they just wanted to leave early. Since they had an excuse, and that was perfect for them.

Table 58: Students' Behaviour/Action/Suggestion during in-class Observations in the Main Study (Part 16)

Date : June 3, 1999 (Thursday) - 45 minutes

Name of students	IN Class	Behaviour/Action/Suggestion	Interpretation
1) Manuela	Y	1) Announced that this was the last class	1) No more interest in this Mandarin learning or the CD-ROM.
2) Monica			
3) Conceicao	Y		
4) Lisete	Y		
5) Iva			
6) Sofia			
7) Suzanna			
8) Anna	Y		
9) Juana			

On June 3, 1999, as usual, only four students showed up: Manuela, Conceicao, Lisete, and Anna. Manuela (the director of the Language and Translation School at that time) announced to the researcher that this was the last class. Both the teacher and the researcher didn't know it until that day.

After the in-class observation study, on June 8, 1999, the students took the teacher and the researcher to lunch again. The researcher didn't know if it was the weather or their mood, it was so different from the last time when they had lunch. Nobody was willing to talk. The researcher was hoping that at least

they could review some vocabulary they learned or something about the food they were eating. The researcher really thought that their interest died out and thought that it is very difficult to stimulate students' interesting when they have no reason for studying.

The researcher learned the following issues from the students' behaviours in class:

1) Some students like to have control over the computer, by clicking one word at a time when they please
2) Some students like to have the computer take control, by pressing the Play All button.
3) Most of the students feel that they can study and review at home when they have the CD-ROM.
4) Students who miss lessons feel that they can catch up with the CD-ROM.
5) Students still prefer the teacher being there, so that they can ask questions.
6) Students like to listen to recordings in the CD-ROM.
7) Students still enjoy practising conversation with their fellow classmates.
8) Fellow classmates have influence on each other.
9) The teacher is willing to use the CD-ROM for teaching when everything is set up for him.
10) The role of the teacher is still very important
11) Instructional time was definitely saved because of the sound and the translation.
12) The novelty effect affects the learning attitude.

8.33 The Main Interview

During the time of the in-class observation study, the researcher saw less and less students attending the class and she and her supervisor decided to start the interview process as early as possible. The interview process lasted from April 20 to June 16, 1999, which coincided with the in-class observation study, which ran from March 4 to June 3, 1999. The researcher interviewed nine students and the Mandarin teacher. Since Orlanda only showed up for one lesson, the researcher decided not to interview her. It was good that the researcher started the interview process early; otherwise she wouldn't able to interview everybody. In fact, when she had to go back to ask questions to the students later on, Anna had already returned back to Portugal.

The researcher basically used the same set of questions from the pilot study but included questions for the CD-ROM. This batch of interviews was again time-consuming. She was feeling bored during the interview process because she wasn't sure if she could use the data and that she began to hear similar comments from everybody. The morale of the class was getting lower as time went on and her interview mood was also getting lower. The task of the transcription was getting her down as well. It was when she completed the matrix of the students' and teacher's response that she realised she could compare and draw some conclusion. She learned what the students enjoyed doing the most in class was talking with each other. She also kept hearing words like repeat, listen, sound, pronunciation, writing of Chinese character, not getting feedback, and not able to ask questions. With the results similar to what she had found in the pilot study, she felt more confidence about the interview process again. The researcher could generalise that the students generally like the idea that they can listen and repeat as often as they like with the CD-ROM.

In summary, the researcher found that fun, pleasure and curiosity were the driving forces of learning Mandarin for the students in the main study group. What they enjoyed the most about Mandarin learning were having dialogue with others, the sound of the language, be able to understand TV and news, knowing the structure and construction of the sentences, learning a different way of writing and saying things, and learning a different culture. What the students enjoyed the least about Mandarin learning were not being able to memorise the vocabulary, and not being able to write down what the teacher said. They disliked the class schedule during lunch time, disliked learning the sound without knowing the meaning, when they could not understand the teacher and were frustrated when they could not learn as much as they liked. Students preferred to learn the written character than pinyin, though it was agreed that character writing was not going to be taught in class. Table 59 compares how the students felt in the pilot study and in the main study about what they enjoyed the most and the least about Mandarin learning.

Table 59: Comparison of Students' Likes and Dislikes about Mandarin Learning in the Pilot Study and the Main Study

	Students in the Pilot Study	Students in the Main Study
Enjoyed the most in Mandarin Learning	<u>Portuguese</u> -Searching for the real meaning of the character or the sentence -Writing of Chinese characters <u>Macanese</u> -Pronunciation -To speak with others -Understand Mandarin TV or Mandarin song -Listening to tape in class -Be able to communicate with her mom in the written language -Knowing how to read -Enjoy her student life in Beijing <u>Cantonese</u> -When the teacher praises her pronunciation -From unknown to knowing the language -Brave enough to speak to strangers -Enjoy her student life in Beijing -Watching video and discussion afterwards in Beijing -Be able to communicate with teachers and classmates	• Having dialogue with others • Sound of the language • Understand TV and news • Fun • Knowing the structure and construction of the sentences • Learning a different way of writing, saying things • Learning a different culture

Enjoyed the least in Mandarin Learning	<u>Portuguese</u> -Dialect and slang for different region -Intonation <u>Macanese</u> -Words with the same sound -Same word pronounced differently at different places -Reading the text at home -Reading aloud in class when he has not been taught -Writing of Chinese character -Recitation -Teaching method, memorising things <u>Cantonese</u> -Reading the text in class -Teaching method, copying from the board -Teacher didn't care about her pinyin level -When he made mistakes, he would feel disappointed -4 tones	• Not able to memorise the vocabulary • Not able to write down what the teacher says • Disliked the class schedule during lunch time • Preferred to learn the written character than the pinyin • Disliked learning the sound without knowing the meaning • Couldn't understand the teacher • Frustrating because not learning as much as she liked

In Table 59, it seems that to be able to communicate with others in Mandarin was what the students in the pilot study and the main study have in common. The Portuguese students in the pilot study enjoyed Chinese character writing and the Portuguese students in the main study disliked the fact that they were not learning any Chinese characters even though they originally agreed not to learn it from the beginning. So the Portuguese in Macao must enjoy Chinese character writing very much. What the students enjoyed the least were the way the teacher conducted the class, the Macanese students in the pilot group disliked the teaching method of memorising things, the Cantonese students in the pilot group disliked the teaching method of copying from the board, and the Portuguese students in the main study disliked not be able to memorise the vocabulary, not able to write down what the teacher said when they could not understand the teacher. So the researcher of this study at this point suggests that teachers of foreign language should pay particular attention to how teaching can be enhanced so that students will enjoy more of what they are learning.

In the main study, new questions arose as to how students felt about the use of the multimedia CD-ROM in their Mandarin learning, Table 60 displays what they enjoyed the most and the least, whether they found the CD-ROM usage easy or difficult, and how they would compare the experience with the multimedia CD-ROM in this study with those they had before.

Table 60: Students' Responses about the CD-ROM for the Main Interview

	Group
Enjoyed most in using CD-ROM	• Listen and repeat • Self-study • In control of her study • Interactivity of the CD-ROM • Good for learning and fulfilment

Enjoyed Least in using CD-ROM	• Not learning the Chinese character • Doesn't like the graphics layout of the interface • Prefers a more human interface, something more intuitive • When she is using the CD-ROM alone, she feels it is boring and not entertaining
Easiest in using CD-ROM	• To go to different part of the program by just clicking • To repeat the sound after the CD-ROM • Everything is easy • The navigation bar on the left-hand side is very clear, never get lost in the program • Very practical • Easy to go to different area on the CD-ROM • Organisation of the CD-ROM, all items related to one topic are grouped together • Interactivity • Well-structured • Having the translation
Most difficult in using CD-ROM	• No difficulty
Used other CD-ROM before, and compare the experience	• 4 students never used other CD-ROMs before • 5 students have used other CD-ROMs before • They have seen encyclopaedia, software training, photography, dictionary, grammar, Encarta • The Mandarin CD-ROM is more interactive, having dialogue • The other CD-ROMs have better design

In Table 60, what the students enjoyed the most in using the CD-ROM were the interactivity of the CD-ROM, that they could listen and repeat after it, for self-study, to control their own studies, and for learning and fulfilment. What the students enjoyed the least in using the CD-ROM were not being able to learn the Chinese character. They disliked the graphics layout of the user interface, feeling bored and not entertained when using it alone, and preferred a more

human interface. The students found no difficulty in using the CD-ROM. What they found the easiest in using the CD-ROM were that they could navigate to different part of the program by just clicking and repeating the sound after the CD-ROM. They liked the fact that the CD-ROM was interactive, well structured, well organised, practical, and having translation. Some students thought that everything was easy with the use of the CD-ROM. Four students out of the nine students had never used other CD-ROMs before. For those who used other CD-ROMs before, they had seen encyclopaedia, software training, photography, dictionary, and grammar software. They thought that the Mandarin CD-ROM was more interactive, having dialogue, but the other CD-ROMs have better design. Table 61 displays the opinions of the students and the Mandarin teacher in terms of the reason of studying Mandarin, whether Mandarin learning was easy or difficult, whether or not the CD-ROM was helpful in Mandarin learning.

Table 61: Comparison of Students and Teacher's Responses for the Main Interview

	Group	Teacher
Why study Mandarin	• Fun • Curious • Communicate with people (in China) • Learn the language • Useful • Find out the difficulty in learning a foreign language • Learn a new culture	• Their purpose of learning is different from regular students. • They are not interested in being fluent in the language. • They want to be able to bring some conveniences into their lives. • They want to be able to communicate with others. • They have different expectations.

Easiest in Learning Mandarin	• Grammar • Sentence structure • Numbers • Time • Repeat what the teacher says • 4 tones	• Dialogue • It is easy for them to pick up, it is easy to forget too.
Most Difficult in Learning Mandarin	• Sound • Vocabulary • Tone • Pronunciation • Construction of sentences	• Easy to forget the dialogue • Chinese character writing • Tone and pronunciation of a phrase and a sentence
How CD-ROM is helpful	• Listen and repeat as often as she likes • Review and practise • Interactivity is helpful • Good for studying at home or for self-study • She can control the stage of her learning • She can control the time of her learning • The CD-ROM stimulates her learning • The CD-ROM motivates her learning	• The CD-ROM is very important for students who are in the elementary level. • The CD-ROM can help students with the sound for the vocabulary and sentences. The students can follow the CD-ROM and repeat after it. • The students can learn the writing of Chinese characters • The students can study at home • The students can practise as much as they like. • The students can learn at their own pace. • The students can learn according to their own requirement. • The students can study only what they don't know.

How CD-ROM is not helpful	• The CD-ROM cannot tell her if she is wrong • The CD-ROM cannot make correction of sound or writing for her • The CD-ROM can only be useful if she studies • The CD-ROM cannot replace classroom teaching, and classroom interaction • She cannot talk to the CD-ROM • She cannot ask questions to the CD-ROM. • She cannot interact with her classmates or teacher • Her learning is limited to the contents of the CD-ROM	• The CD-ROM cannot bring about expansion of words, sentences. • The CD-ROM may not be able to help students with their imagination • The CD-ROM cannot correct students' writing • Students' learning is only restricted to the contents of the CD-ROM. • Classroom teaching is more flexible and the students can explore more variations of words, phrases, and sentences.

In Table 61, both the students and the teacher thought that to be able to communicate was the main reason why these students wanted to study Mandarin in the main study group. The students found that repeating after the teacher was easy, however, the teacher said that it might be easy for them to pick up what he said but it was also easy to forget too. Both the students and the teacher agreed that tone and pronunciation were the most difficult for the students.

In Table 61, as far as how helpful the CD-ROM was, both the students and

the teacher agreed that the CD-ROM was good for listening and repeating after it and for practising and studying at home. The students could learn at their own pace, where they could control the stage and time of their learning. As far as how the CD-ROM was not helpful, both the students and teacher felt that the CD-ROM couldn't make corrections of their pronunciation and their writing and that students' learning was restricted to the contents of the CD-ROM. The students said that the CD-ROM could not replace classroom teaching and classroom interaction while the teacher said that classroom teaching was more flexible and the students could explore more variations of words, phrases and sentences. What it really translates to is that traditional classroom teaching with the teacher is not replaceable.

Three new questions emerged and they were ways to improve the CD-ROM, mode of learning, and preference of source of learning. Because of the new questions, the researcher had to ask the students questions again. She couldn't contact one student, Anna, regarding the percentage of time spent with the teacher and whether the teacher should explain the material first because she had already left Macao. She included the new categories in Table 62.

Table 62: Comparisons of Students' and Teacher' s Opinions on the Three Emerged Questions from the Main Interview

	Group	Teacher
Ways to improve CD-ROM	• Correction of sound • Make graphics more attractive • Chinese characters should be written by showing how the stroke is written, from left to right, or from top to down • Create more exercises, having Portuguese	• To put more exercises on there 1. Questions related the text. 2. Given a picture, have a conversation with the student regarding the picture. • To develop a new CD-ROM while writing a

	sentences where the students would translate them into Chinese • Create an independent CD-ROM without following the contents of the existing textbook.	new textbook, so that there will be more appropriate teaching materials.
Mode of Learning (Teacher, Teacher + CD-ROM, CD-ROM + Teacher)	• One student prefers CD-ROM plus the teacher [use CD-ROM before the teacher lectures] • One student suggests using just the CD-ROM for studying • Others all prefer teacher plus the CD-ROM [teacher lectures before use of the CD-ROM] • % time spent with teacher – from 50% to 70%, only 6 students commented on it • 50-50% - 1 • 70%-30% - 1 • 60%-40% - 4	• The CD-ROM cannot replace classroom teaching, and Classroom teaching cannot rely on the CD-ROM • He suggested two ways: 1. To have classroom teaching first, then the students can listen to the CD-ROM. 2. Have the students listen to the CD-ROM first, then have them come into classroom learning to find out what they don't understand. • He suggests an experiment to see which is better.
Source of preference of learning- Teacher explains material first, or use the CD-ROM first?	• Everybody agrees with the teacher first, especially when the subject is new • In situation where the subject matter is not new or for studying, some suggested using the CD-ROM first.	

In Table 62, in ways to improve the CD-ROM, both the students and the teacher agreed that more exercises should be created and that a new CD-ROM should be developed. They wanted to have materials that are more appropriate for the Portuguese students. As far as mode of learning is concerned, both the students and the teacher agreed that the CD-ROM could not replace classroom teaching and classroom teaching could not rely on the CD-ROM. The students preferred to spend from 50% to 70% of the class time with the teacher. As far as preference of source of learning is concerned, all the students agreed that teacher should explain the materials first, especially when the subject is new. In the situation where the subject matter is not new or for reviewing, some students suggested that the CD-ROM could be used before the teacher lectures.

To summarise how students and teachers perceived multimedia, the questions were "How might using the computer CD-ROM help your learning?" and "How might your learning not be improved by the CD-ROM?". Table 63 displays the frequency of how students and teachers thought multimedia was helpful or not helpful in Mandarin learning in the main study.

Table 63: Frequency of how Students and Teacher Perceived Multimedia in Mandarin Learning in the Main Study

Codes	Students (9)	Teachers (1)	Total
Interactivity	1		
Self-autonomy	2		
Repeat	3	1	4
Review	3		
Practise	2	1	3
Self-paced	1	1	2
Study at home	4	1	5
Study according to his own requirement		1	

Study what he doesn't know		1	
More attentive	1		
Motivating	1		
Stimulating	1		
Read and listen to sound	2		
Visual	1		
Listen to sound	3		
Listening	1		
Sound	2		
Compare Sound	1		
Sound of vocabulary		1	
Sound of sentence		1	
Vocabulary	2	1	3
Character writing		1	
Pronunciation	2		
Pause and go	1		
Elementary level		1	
Cannot get feedback about pronunciation	1		
Cannot give correction	3		
Cannot correct written composition	1		
Need Teacher	1		
Cannot ask questions	1		
Cannot communicate	3		
Limited material	1		
Cannot help if students don't study	1		
Cannot replace classroom teaching	1		

For the analysis of the frequency table, the researcher concentrated on those codes that have more than one count. In Table 63, having self-autonomy, studying at home with the ability to review, repeating and practicing, reading and listening to sound at the same time, having visual and sound effect, being able to

learn vocabulary and pronunciation were some of the positive feelings that students have towards multimedia in Mandarin learning. Not able to get corrections from the CD-ROM and couldn't communicate with the CD-ROM were some of the negative feelings that the students have towards multimedia in Mandarin learning.

In Table 63, both the students and teachers agreed that the CD-ROM was good when the students could study at home at their own pace, repeating or practising with it. They also agreed that the students could listen to the sound and learn vocabulary from the CD-ROM.

To determine what preferences of multimedia students had, the questions were "What do you enjoy the most about the CD-ROM?" and "What do you enjoy the least about the CD-ROM?". Table 64 displays students' preferences of multimedia in the main study.

Table 64: Frequency of Students' Preferences of Multimedia in the Main Study

Categories	Codes	Students (9)
Preferences – enjoyed the most	Likes to learn with computer	1
	Repeat	4
	Self-autonomy	1
	Doesn't have to stop the teacher	1
	Listen to the sound	7
	Visual element	1
	Study at home	1
	Review	1
	Listen to text	1
	Listen to the vocabulary	1
	Speech Table	1
	Self-practise	1
	Interactivity	1

	Easy to use	1
	Having Portuguese translation	1
	Good for learning	1
	Enjoyed everything	1
Preferences-enjoyed the least	Not learning the Chinese character (original agreement not to learn character)	3
	Graphics layout	1
	Using it alone, boring and not entertaining	1
	Speech Table	1
	Doesn't know	1
	None	5

In Table 64, the students enjoyed repeating and listening to the sound in the Mandarin CD-ROM. Those students who enjoyed repeating or listening to sound in the main study group were probably more motivated to use the CD-ROM in their Mandarin learning. When using the CD-ROM alone, one student found that it could be boring and not entertaining. The graphics design of the CD-ROM could also make the software boring and not entertaining, therefore the researcher suggested to the designer and producer of educational software to consider the use of a better graphics design to motivate students in their learning.

To determine if there was any motivation for Mandarin learning, the questions were "Why are you studying Mandarin?", "Do you have much chance to use Mandarin outside of class?", What do you enjoy the most?", and "What do you enjoy the least?". To determine if there was any motivation for using the CD-ROM in Mandarin learning, the question was "What do you enjoy the most

about the CD-ROM?" Table 65 displays students' motivation towards Mandarin learning and Mandarin learning with the CD-ROM in the main study.

Table 65: Frequency of Students' Motivation towards Mandarin Learning and Mandarin Learning with the CD-ROM in the Main Study

Categories	Codes	Students (9)
Motivation (to learn Mandarin) –reasons	Fun	2
	Pleasure	1
	Useful	2
	Maybe important in the future	1
	Curiosity	3
	Communication	3
	Learn new things	1
	Learn the language	5
	Learn the culture	1
	Find out the difficulty in a foreign language	1
	Help her teach Portuguese better	1
	Studied Mandarin before	2
Motivation (to learn Mandarin)-enjoyed the most	Communication	6
	Understand TV and news	1
	Fun	2
	Sound of Mandarin	2
	Knowing the sentence structure	2
	Different Culture	1
	Chinese character writing	1
Motivation (to learn Mandarin)-enjoyed the least	Not able to memorise	1
	Not able to write down what the teacher says	1
	Dislike the schedule during lunch time	1

	Pinyin	1
	Vocabulary	1
	Speech Table	1
	Learning the sound without the meaning	1
	When she couldn't understand the teacher	1
	Not learning as much as she likes	1
	Only knows a few words	1
	Doesn't know	1
	None	1
Motivation (to use the CD-ROM) –enjoyed the most	Likes to learn with computer	1
	Repeat	4
	Self-autonomy	1
	Doesn't have to stop the teacher	1
	Listen to the sound	7
	Visual element	1
	Study at home	1
	Review	1
	Listen to text	1
	Listen to the vocabulary	1
	Speech Table	1
	Self-practise	1
	Interactivity	1
	Easy to use	1
	Having Portuguese translation	1
	Good for learning	1
	Enjoyed everything	1

In Table 65, fun, usefulness, curiosity, and communication were the major reasons why the Portuguese students in the main study studied Mandarin. It seems that for those students who enjoyed communicating with others in Mandarin, liked the sound of Mandarin, knew the sentence structure, or thought

that Mandarin was fun were more likely to be motivated to learn Mandarin. Those students who liked to repeat and listen to the sound of the CD-ROM were more likely to be motivated to use the CD-ROM in Mandarin learning.

To determine perceived demand characteristics, the questions were "Why are you studying Mandarin", "what do you find the most difficult?" and "What do you find the most difficult about using the CD-ROM. Table 66 displays how the students perceived their demand characteristics in the main study.

Table 66: Frequency of Students' Perceived Demand Characteristics in the Main Study

Categories	Codes	Students (9)	Teacher (1)	Total
PDC – Why	Fun	2		
	Pleasure	1		
	Useful	2		
	Maybe important in the future	1		
	Curiosity	3		
	Communication	3	1	4
	Learn new things	1		
	Learn the language	4		
	Learn the culture	1		
	Find out the difficulty in a foreign language	1		
	Help out teach Portuguese better	1		
	Studied Mandarin before	2		
	Bring some convenience in their lives		1	
PDC – Difficult about Mandarin	Sound	3		
	Vocabulary	1		

	Construction of Sentence	3		
	Construction of Phrases	1		
	Pronunciation	2	1	3
	Intonation-tone	3	1	4
	Difficult to memorise/Easy to forget	1	1	2
	Chinese character writing		1	
PDC – Difficult about the use of the CD-ROM	No difficulty	9		

In Table 66, since some of the students in the main study group were learning Mandarin out of fun, curiosity, and pleasure, their perceived demand characteristics for Mandarin learning were probably not very high. Those students who found sound, pronunciation and intonation and construction of sentences difficult in this group were more likely to invest more mental effort in their Mandarin learning since they found these particular areas more difficult than the others. In addition, since the students perceived no difficulty in using the CD-ROM, they were more likely to invest less effort in using CD-ROM in their Mandarin learning. Both the students and the teacher agreed that to communicate with others were the major reasons why the students in the main study group were learning Mandarin. Both of them also agreed that pronunciation, intonation and memorisation were the difficulties in Mandarin learning.

To determine the perceived self-efficacy, the questions were "What do you find the easiest?" and "What do you find the easiest about using the CD-ROM?". Table 67 displays how students perceived their self-efficacy in the main study.

Table 67: Frequency of Students' Perceived Self-Efficacy in the Main Study

Categories	Codes	Students (9)
PSE - easiest	Repeat after the teacher	1
	Intonation-4 tones	1
	Numbers	2
	Grammar	3
	Structure of sentence	2
	Time	1
	Doesn't know	1
PSE – easiest in using the CD-ROM	Repeat after the CD-ROM	1
	Everything is easy	2
	Just click	2
	Navigation	3
	Very practical	1
	Easy to use	3
	Organisation	2
	Interactivity	1
	Well-structured	1
	Having translation	1

In Table 67, the students in the main study group thought that numbers, grammar, and structure of the sentence were easy and their self-efficacy in those areas was rather high and therefore they were more likely to invest less mental effort in their Mandarin learning. Maybe those students who thought intonation and the time were difficult might invest more mental effort in their Mandarin learning. The students in this group thought that everything was easy, just within a click and navigate to different part of the program. Since their perceived self-efficacy in using the CD-ROM in Mandarin learning was high, they were more likely to invest less mental effort in using the CD-ROM in their Mandarin learning.

From the main study group, the researcher can compare and contrast with the foregoing points from the pilot study group.

1) The main reason for this group of students studying Mandarin was for fun. Only those who are staying behind in Macao thought that the language is useful and that they can communicate with others.

2) They preferred a more attractive interface, and they liked to listen and repeat after the CD-ROM. The teacher liked the way of the CD-ROM can show the students how to write Chinese characters.

3) Both the students and the teacher felt that the students can review and practise with the CD-ROM as much as they like.

4) By listening and repeating after the CD-ROM, the students can improve on their pronunciation, and that is very important in learning a foreign language.

5) They wanted more feedback from the computer, such as correction of sound and writing. The students would have preferred to have the CD-ROM correct their pronunciation and to have the teacher to assist them. Therefore they really placed much importance in feedback of pronunciation.

6) Both the students and the teacher agreed that the students now can learn at their own pace where they can control the stage and time of their learning. Therefore the capability of the CD-ROM to easily jump from one place to another and starting and stopping whenever is very important.

8.4 The Follow-up Study

At the time when the follow-up study was taking place in July of 1999, the second volume of the 'Click!' CD-ROM series was already published. There were two reasons for this follow-up study, the first reason was to make sure that the data collected from all the studies were consistent and reliable, and the second reason was because of the newly emerged data in the main interview, the

researcher had to conduct theoretical sampling to fills gaps in her data and holes in her theories.

The researcher gave the first volume of the 'Click!' CD-ROM series to four students, one Portuguese, one Macanese and one Cantonese student out of the pilot interview and one student whom she had never interviewed before. She interviewed students from the pilot interview again to find out if they had any different feeling after using the Mandarin CD-ROM and to find out how they felt about these newly emerged categories from the main interview. She wanted to include an outsider to see if this student had similar viewpoints or not.

8.41 Follow-up Interview

During the follow-up interview, the researcher included some specific questions in this interview. Questions like "How much time should the class be conducted using the CD-ROM? How much time should the class be conducted with the teacher? Should the teacher explain the materials first before using the CD-ROM?" were the newly emerging questions from the main interview.

After transcribing the follow-up interview data, the researcher could compare these data with what the students said five months ago. For Lurdes, before and after she used the CD-ROM, she still felt that the CD-ROM was a more animated way of learning and that it has the capability to jump from one place to another. After she studied the CD-ROM, she found that the CD-ROM could actually help her with her pronunciation, and she could listen and repeat as much as she liked. For Phyon, she consistently found that the CD-ROM could help her with her pronunciation, and she could listen as much as she liked. However, after she studied the CD-ROM, she found that the result was not as good as she expected. She still needed a teacher to help her. So she suggested that the researcher should add instructions to help her with her problems: tongue movement, 'er' sound, and

the lighter sound. She said that most of her classmates also had these problems. For Antonio, before and after he used the CD-ROM, he still felt that the CD-ROM was good for listening to the sound and the tone of Mandarin but that the CD-ROM couldn't replace the teacher because communication is important. He thought that the CD-ROM was well structured, useful to learn Chinese character writing, and good for a beginner. For Leslie, he mentioned the most obvious feature of the CD-ROM, the rewinding process. He said that the rewinding process is quicker and more convenient and that searching is much easier. Apart from Fanny in the pilot study who also mentioned that the CD-ROM was helpful because it can pause and go easily without rewinding, he was the second student who referred to this attribute of the media. The other students concentrated more on the contents of the CD-ROM. So as the reader can see here, the attribute of the media also appears to affect students' learning. With a better rewinding process, of course the searching capability is also better. Leslie agreed that the CD-ROM was good for review and studying at home, like most other interviewees.

After using the Mandarin CD-ROM in this study, Lurdes felt that she was now interested in this kind of product and more willing to try it, Phyon felt that though the level did not suit her, she was more willing to try other levels and Antonio felt that the CD-ROM was original and that he could use it to review and study after class. For Leslie, he felt that the sound on the CD-ROM was better than other software he has seen, but it lacked the notepad capability. Table 68 summarises the four participants' responses in the follow-up study.

Table 68: Summary of Students' Responses in Follow-up Study

	Group (students)
How CD-ROM is helpful	• CD-ROM more animated • Helps her with pronunciation • Listen and repeat as much as she likes

	• Able to jump from one place to another • Easier to learn • Interactive activities • Rewinding process is quicker and more convenient • Searching is better • Study at home • Good for review
How CD-ROM is not helpful	• Cannot correct her pronunciation • Questions and answers exercise cannot help her • Contents kind of boring • Only for beginner • Need to talk to teacher • Only one-way communication • Needs advice of teacher • Only assists learning • CD-ROM only gives one model answer • More appropriate for foreigners • Maybe good for children
Enjoy most in using CD-ROM	• Following the Pronunciation in the CD-ROM • Repeat after the CD-ROM • Speech sound table • Listen to vocabulary • Correction in the exercise • Teaching of Chinese character writing
Enjoy Least in using CD-ROM	• Questions/Answer exercise • Doesn't like model answer • Graphics design too boring, should try to have more pictures • Couldn't see the Chinese characters • CD-ROM doesn't remember his last lessons
Easiest in using CD-ROM	• The whole CD-ROM is easy • Easier to search for materials • Things are more centralised in one place, such as text, new word • Operation is quite simple, it has many help functions

Most difficult in using CD-ROM	• No difficulty • Maybe in installation
Used other CD-ROM before and how to compare experience	• Now more interested in this kind of product • More willing to try • Not appropriate for her level, but she is willing to try other levels • More convenient way to study • Feels that our CD-ROM is original • Can use the CD-ROM after class to review and study • The sound of our CD-ROM is more clear, it is more academic • Other products may have notepad capability
Ways to improve CD-ROM	• Should put more flexibility into the exercise, not just one model answer • Add capability to explore meaning of words • Add instruction to help with er and lighter sound • Add instruction to help with tongue movement • Add more Cantonese slang • Add instant translation with sound • Better graphics • Adjust the speed of the recording/sound • Having video showing the conversation • Voice should be more friendly, human, warm. • Capability to go back to previous lesson • Full-installation option, to put everything on hard disk • Add notepad capability
Role of teacher, has it been changed?	• Teacher facilitates learning • Teacher gives pointers about problems or the lessons • Teacher doesn't have to teach everything in the lesson any more • More time to have interaction, to talk and have the teacher make the correction, more discussion

	• CD-ROM cannot replace teacher • CD-ROM doesn't change the role of the teacher • CD-ROM is only a tool • CD-ROM can definitely help both the teacher and the student • CD-ROM cannot do correction of sound • CD-ROM is a one-way communication • CD-ROM is good for reference. • CD-ROM can assist learning • Students can listen and student at home • Human relations are still very important
How much time for teacher, how much time with CD-ROM?	• 50% - 50% • 70% - 30% • 75% - 25% • 80% - 20%
Should the teacher explain the materials first?	• 3 out of 4 prefer teacher explains the materials first • One student prefers to explore the CD-ROM at home first

In Table 68, the students found that the CD-ROM was helpful in terms of being more animated, helping with pronunciation, be able to listen and repeat as much as possible, and be able to jump from one place to another. The CD-ROM made learning easier, provided interactive activities, rewinding was more convenient, and searching was easier. The CD-ROM was good to study at home and for review. The students found that the CD-ROM was not helpful when it couldn't correct pronunciation and when it could only offer one-way communication. The contents of the CD-ROM could be boring and only for beginners or more appropriate for foreigners and good for children. They still needed to talk to teacher for advice.

In Table 68, what the students enjoyed the most in using the CD-ROM were to be able to listen and repeat after the CD-ROM and to learn how to write Chinese characters. What the students enjoyed the least in using the CD-ROM were as follows: the Questions and Answers exercise which provided only one model answer, the boring graphics design, and unable to see the history of where they have been. What the students found the easiest in using the CD-ROM was that searching and accessing information was made easier since everything was organised in one centralised place. The students found no difficulty in using the CD-ROM, or maybe just during the installation of the program.

In Table 68, the students were now more interested in using this kind of CD-ROM in their learning, maybe trying a more appropriate level, and use it after class for review and self-study. The students suggested several ways to improve the CD-ROM by having more than one model answer, adding capability to explore meaning of words, and instruction to help with sound and tongue movement, by adding more Cantonese slang and instant translation with sound. The students wanted better graphics. They wanted to be able to adjust the speed of the recording, having video showing conversation, to go back to previous lesson and to have full-installation option to put everything on the hard disk. The students liked to hear more friendly human voices and to have notepad capability.

In Table 68, the students thought that teachers facilitate learning and the teachers do not have to teach everything and they can have more time to interact with students in class. The CD-ROM cannot replace the teacher and will not change the role of the teacher. It is only a tool that can definitely help both the teacher and the student. It cannot correct sound and only provides one-way communication. It is good for reference where students can listen and study at

home. Human relations are still very important. They suggested spending 50% to 80% with the teacher. Three out of four students preferred that teachers explain the materials first. However, one student preferred to explore the CD-ROM at home first.

The researcher wondered if the students felt the same about using the CD-ROM in their Mandarin learning in both the main study and the follow-up study. Table 69 compares how the students in the main study and the follow-up study felt about using the CD-ROM in their Mandarin study.

Table 69: Comparison of Students' Likes and Dislikes about Mandarin Learning with the CD-ROM in the Main Study and the Follow-up Study

	Students in the Main Study	Students in the Follow-up Study
Enjoy most in using CD-ROM in Mandarin Learning	• Listen and repeat • Self-study • In control of her study • Interactivity of the CD-ROM • Good for learning and fulfilment	• Following the Pronunciation in the CD-ROM • Speech Sound Table • Listen to the vocabulary • Correction of exercises • Repeating after the CD-ROM • Chinese character writing
Enjoy least in using CD-ROM in Mandarin Learning	• Not learning the Chinese character • Doesn't like the graphics layout of the interface • Prefers a more human interface, something more intuitive • When she is using the CD-ROM alone, she feels it is boring and not entertaining	• Questions and Answers exercises • Doesn't like model answer • Graphics design • Should try to display more pictures • Couldn't see Chinese character • The system doesn't remember the last lesson he has seen

Easiest in using CD-ROM in Mandarin Learning	• To go to different part of the program by just clicking • To repeat the sound after the CD-ROM • Everything is easy • The navigation bar on the left-hand side is very clear, never get lost in the program • Very practical • Easy to go to different area on the CD-ROM • Organisation of the CD-ROM, all items related to one topic are grouped together • Interactivity • Well-structured • Having the translation	• The whole CD-ROM is easy • Easier to search for materials • Things are more centralised in one place, such as text, new word • Everything is easy • Can access all information easier • Operation is quite simple, it has many help functions
Most Difficult in using CD-ROM in Mandarin Learning	• No Difficulty	• No Difficulty • Maybe in installation
Used other CD-ROM before and compare experience	• 4 students never used other CD-ROM before • 5 students have used other CD-ROM before • They have seen encyclopaedia, software training, photography, dictionary, grammar, Encarta • The Mandarin CD-ROM is more interactive, having dialogue • The other CD-ROMs have better design	• Now more interested in this kind of product • More willing to try • Not appropriate for her level, but she is willing to try other levels • More convenient way to study • Feels that CD-ROM is original • Can use the CD-ROM after class to review and study

		• The sound of CD-ROM is more clear, it is more academic • Other products may have instant translation and notepad capability

In Table 69, what the students enjoyed the most in using the CD-ROM in both the main study and the follow-up study was listening and repeating after the CD-ROM. What the students enjoyed the least in using the CD-ROM in both the main study and the follow-up study was that they disliked the graphics layout of the interface. The researcher concludes that graphics design is an essential element in the development of any educational program. The students found no difficulty in using the CD-ROM, except maybe in the installation. What they found the easiest in both studies in using the CD-ROM was that the materials in the CD-ROM are organised in such a way that it made navigation and searching much easier. In comparison with their experiences with other CD-ROMs that the students had used before, the students in the main study said that the other CD-ROMs they had tried have better graphics design and the students in the follow-up study said that they were now more willing to try this kind of CD-ROM in the future to review after class.

After the follow-up interview, the researcher concluded that the results from this set of interviews largely confirmed findings from the earlier interviews. The students still preferred more exercises, more explanations, better graphics and more ways for the computer to give them feedback. They all agreed that the role of the teacher doesn't change and that the CD-ROM cannot replace classroom teaching and classroom teaching cannot rely on the CD-ROM. The

CD-ROM is only a tool to assist teaching. Instructional time is saved so that the teacher can better utilise their time in class. The students can review and study as much as they like with the CD-ROM at home.

To summarise how students perceived multimedia, the questions were "How might using the computer CD-ROM help your learning?" and "How might your learning not be improved by the CD-ROM?". Table 70 displays the frequency of how the students thought multimedia was helpful or not helpful in Mandarin learning in the follow-up study.

Table 70: Frequency of how Students Perceived Multimedia in Mandarin Learning in the Follow-up Study

Codes	Students (4)
Having more choices	1
More animated	1
Navigation	1
Repeat	1
Review	1
Study at home	1
Well-structured	1
Easier to learn	1
Good for Portuguese	1
Rewinding is quicker and more convenient	1
Searching is better	1
Translation plus sound	1
Speech Table	1
Listen	1
Listen to sound	2
Listen to Vocabulary	1
Listen to Sentence	1
Listen to lesson	1
Character writing	1
Pronunciation	2
Good for children	1

Elementary level	1
Assist learning	1
Good for Portuguese/foreigner	2
Cannot get feedback about pronunciation	1
Boring	1
Cannot give corrections	1
Need Teacher	2
Questions and Answers Exercises not helping	1
Cannot communicate	1
Teachers can talk more, but CD-ROM is limited in content	1

For the analysis of the frequency table, the researcher concentrated on those codes that have more than one count. In Table 70, the students in the follow-up study felt that the advantages of the multimedia were to be able to listen to the sound and learn pronunciation from the CD-ROM and that this CD-ROM was good for Portuguese/foreigners. The drawback of the CD-ROM was that they still needed a teacher to assist them, meaning that the role of the teacher has not made redundant.

To determine what preferences of multimedia students had, the question was "What do you enjoy the most about the CD-ROM?" and "What do you enjoy the least about the CD-ROM?". Table 71 displays students' preferences of multimedia in the follow-up study.

Table 71: Frequency of Students' Preferences of Multimedia in the Follow-up Study

Categories	Codes	Students (4)
Preferences – enjoyed the most	Following pronunciation in the CD-ROM	1
	Speech Table	1
	Listen to vocabulary	1
	Correction of exercise	1
	Repeat	1
	Chinese character writing	1
Preferences-enjoyed the least	Questions/Answers	1
	Do not like model answer	1
	Graphics Design quite boring, should try to display more picture	1
	Couldn't see Chinese character	1
	No history recorded	1

In Table 71, the students enjoyed learning vocabulary by listening and repeating after the CD-ROM, working on the exercises that provided correction and learning Chinese character writing. However, the students did not enjoy doing the Questions and Answers exercises in the CD-ROM, which only provided one model answer. They disliked the graphic design because it was boring. During the installation of the program, one student found that he could not see the Chinese character. One student complained about not having the history recorded.

To determine if there was any motivation for using the CD-ROM in Mandarin learning, the question was "What do you enjoy the most about the CD-ROM?" Table 72 displays students' motivation towards Mandarin learning and Mandarin learning with the CD-ROM in the follow-up study.

Table 72: Frequency of Students' Motivation towards Mandarin Learning with CD-ROM in the Follow-up Study

Categories	Codes	Students (4)
Motivation (to use the CD-ROM) –enjoyed the most	Following pronunciation in the CD-ROM	1
	Speech Table	1
	Listen to vocabulary	1
	Correction of exercise	1
	Repeat	1
	Chinese character writing	1

In Table 72, it seems that those students who liked to learn vocabulary by listening and repeating after the CD-ROM were more likely to be motivated to use the CD-ROM in their learning.

To determine perceived demand characteristics, the question was "What do you find the most difficult about using the CD-ROM?". Table 73 displays the how the students perceived their demand characteristics in the follow-up study.

Table 73: Frequency of Students' Perceived Demand Characteristics in the Follow-up Study

Categories	Codes	Students (4)
PDC – difficult about the use of the CD-ROM	No difficulty	4

In Table 73, the students found no difficulty using the CD-ROM which meant that their perceived demand characteristics were low, and they were more likely to invest less mental effort in using the CD-ROM in their Mandarin learning.

To determine the perceived self-efficacy, the question was "What do you find the easiest about using the CD-ROM?". Table 74 displays how students perceived their self-efficacy in the follow-up study.

Table 74: Frequency of Students' Perceived Self-Efficacy in the Follow-up Study

Categories	Codes	Students (4)
PSE – easiest in using the CD-ROM	Searching	1
	Everything is easy	2
	More organised	1
	Can access all information easier	1
	Help function	1
	Operation is quite simple	1

In Table 74, it seems that the students found that the CD-ROM usage was relatively easy so that their perceived self-efficacy was high such that they were more likely to invest less mental effort in using the CD-ROM in their Mandarin learning.

From the follow-up study, the researcher came to these conclusions:

1) The CD-ROM can help students with their pronunciation.
2) The students can listen and repeat after the CD-ROM as much as they like.
3) The CD-ROM cannot replace the teacher, therefore the role of the teacher is still very important.
4) The rewinding capability of the multimedia CD-ROM is an important attribute of the media, which makes navigation and searching much easier.

8.5 Summary of Data Analysis

From the pilot interview, the researcher of this study identified the following main points:

1) The main reason for studying Mandarin was because it is the official language of China and Macao.
2) Visuals and sound are the attractive features of CD-ROM providing interactive learning.
3) Drill and practice are features needed by students.
4) Learning pronunciation is most important for student learning a foreign language.
5) Feedback or feedback of pronunciation is extremely important.
6) Students can jump to different part of the book, start and stop wherever they want to.

From the main study group, the researcher compared and contrasted with the foregoing points from the pilot study group.

1) The main reason for this group of students studying Mandarin was for fun. Only those who are staying behind in Macao thought that the language is useful and that they can communicate with others.

2) They preferred a more attractive interface, and they liked to listen and repeat after the CD-ROM. The teacher liked the way of the CD-ROM can show the students how to write Chinese characters.

3) Both the students and the teacher felt that the students can review and practise with the CD-ROM as much as they like.

4) By listening and repeating after the CD-ROM, the students can improve on their pronunciation, and that is very important in learning a foreign language.

5) They wanted more feedback from the computer, such as correction of sound and writing. The students would have preferred to have the CD-ROM correct their pronunciation and to have the teacher to assist them. Therefore they really placed much importance in feedback of pronunciation.

6) Both the students and the teacher agreed that the students now can learn at their own pace where they can control the stage and time of their learning. Therefore the capability of the CD-ROM to easily jump from one place to another and starting and stopping whenever is very important.

From the in-class observation, the researcher identified the following points:

1) Some students like to have control over the computer, by clicking one word at a time when they please.
2) Some students like to have the computer take control, by pressing the play all button.
3) Most of the students feel that they can study and review at home when they have the CD-ROM.
4) Students who miss lessons feel that they can catch up with the CD-ROM.
5) Students still prefer the teacher being there, so that they can ask questions.
6) Students like to listen to recordings in the CD-ROM.
7) Students still enjoy practising conversation with their fellow classmates.
8) Fellow classmates have influence on each other.
9) The teacher is willing to use the CD-ROM for teaching when everything is set up for him.
10) The role of the teacher is still very important.
11) Instructional time was definitely saved because of the sound and the translation.
12) The novelty effect affects the learning attitude.

From the follow-up study, the researcher came to these conclusions:

1) The CD-ROM can help students with their pronunciation.
2) The students can listen and repeat after the CD-ROM as much as they like.
3) The CD-ROM cannot replace the teacher, therefore the role of the teacher is still very important.
4) The rewinding capability of the multimedia CD-ROM is an important attribute of the media, which makes navigation and searching much easier.

In summary, from the pilot interview, the driving force for studying Mandarin was needs. From the main interview, the driving forces for studying Mandarin were fun, pleasure and curiosity. One main issue emerged from the data in the pilot interview, in-class observations, main interview and follow-up interview.

This was that though the students liked to listen and repeat after the CD-ROM, the role of the teacher is still very important. Four issues regarding the students were derived from the observations: perceived demand characteristics, interest, need, and novelty effect.

Analysis of data was discussed in this chapter. The order of this research started with an initial literature review, a pilot study, further literature review, a main study, a follow-up study, and ended with a further literature review. Now that the reader has a better understanding of data found in this study, the researcher will discuss the results in the next chapter.

Chapter 9: Discussion of Results

Discussion of the results is presented in this chapter. First the Portuguese students throughout the interviews and the observations are discussed. From the data collected, common themes were found. First, common characteristics of the Portuguese students are discussed. Second, common issues that were drawn from the data such as how the students perceived the benefits and limitations of the CD-ROM and what kind of language learning skills they could learn from the CD-ROM can help answer the first two research questions. Third, based on the common student types in Macao, an appropriate use of multimedia for different types of students is also suggested. Finally the data found in this study are compared with those found in the third literature review.

9.1 Discussion of the Portuguese Students

Based on the data gathered from the teacher focus group, the Mandarin CD-ROM was more suitable for the Portuguese students and based on the convenience of having the Portuguese students volunteered to participate in the in-class observation study, this study's main emphasis was on Portuguese students. Two Portuguese students were interviewed in the pilot study, ten Portuguese students were involved in the in-class observations and nine were interviewed in the main study, and one Portuguese student from the pilot group was interviewed again in the follow-up study.

Samimy and Lee (1997) said that previous experience affects beliefs, which in turn affects attitude of language learning. To learn about the previous experience of adult Portuguese Mandarin learners, the researcher first launched the pilot interview with two Portuguese students. She wanted to find out students' original beliefs about Mandarin learning or their attitudes towards using any CD-ROM before venturing into the in-class observation study in the main

study. Students' beliefs could be their difficulty in Mandarin learning and how they perceived Mandarin learning using the CD-ROM. From the pilot interview, the two Portuguese students found that the difficulties in Mandarin learning were to find someone to talk to and memorisation. They thought that intonation, speaking and writing were also difficult. They found that the CD-ROM could help them to learn with interactive activities, so that they could listen to sound and tone, explore the meaning of words, and review character writing as much as they liked at home. On the other hand, they thought that the CD-ROM could not help them in transmitting feeling or asking questions, they still needed a teacher. It was suspected that the Portuguese students who volunteered to participate in the main study might have similar beliefs before they went into the in-class observation study.

The important points from the main interview are summarised. The main reason for this group of students studying Mandarin was for fun. Only those who are staying behind in Macao thought that the language was useful and they could communicate with others. They preferred a more attractive interface, and they liked to listen and repeat after the CD-ROM. They felt that they could review and practise with the CD-ROM as much as they liked. By listening and repeating after the CD-ROM, the students could improve on their pronunciation, and that is very important in learning a foreign language. They wanted more feedback from the computer, such as corrections of sound and writing. The students preferred to have the CD-ROM correct their pronunciation and they preferred to have the teacher to assist them. Therefore they really placed much importance in feedback of pronunciation. The students agreed that they could learn at their own pace where they could control the stage and time of their learning. Therefore the capability of the CD-ROM to easily jump from one place to another and start and stop whenever is very important. The data from

the main interview showed that the role of teacher is very important. The students in the main interview had similar beliefs about the benefits and limitations of the CD-ROM, like those students from the pilot interview.

The Portuguese student in the follow-up study, after using the CD-ROM on his own for a while, still thought that having someone to talk to was the most difficult for him, and thought that the CD-ROM was good for the Portuguese and that it was well-structured. He liked to listen to the sound and learn character writing from the CD-ROM. But he realised that the CD-ROM was only good for beginners and that the teacher is still needed. The role of the teacher was also very important to this Portuguese student in the follow-up study.

Four issues regarding the students were derived from the observations: perceived demand characteristics, interest, need, and novelty effect. During the three months of the in-class observation study, less and less students were showing up in class. Was that the wearing off of the novelty effect or the perceived demand characteristics or just simply losing interest or that there was no more need to learn Mandarin? As stated earlier, the students in this class had no need to learn Mandarin, except for the purpose of fun and curiosity. How long can fun and curiosity last?

In the third lesson, three students started to talk after listening to the CD-ROM: Sofia, Suzanna and Monica. Were they already bored with the CD-ROM? Were they just interested in making conversation in Mandarin, to practise what they just learned? Was that the end of the novelty effect?

In the fifth lesson, the students started to show that the novelty effect of the CD-ROM was wearing off, they were more interested in listening to the teacher rather than putting on the headphones to listen to the recording. Anna preferred to listen to the teacher's explanation. In the sixth lesson, only three students showed up in class, that was the last day before the Easter holiday. Was it the

novelty effect or the intervening holiday? In the seventh lesson, only one student showed up after the Easter holiday. In the eighth lesson, only two students showed up because three other students were either on holiday or about to go on to a business trip. The class was set up for the purpose of having fun and not for any serious study, so one can see that the purpose and reason for learning Mandarin was not really serious in this class and that their perceived demand characteristics were very low. In the tenth lesson, with one student, Iva, showing up in class, even the teacher was losing interest. So they spoke about other things besides Mandarin learning. Iva tried to listen to the CD-ROM for ten minutes. In the eleventh lesson, Iva again was the only student showing up, she did not bother to listen to the CD-ROM at all. In the thirteenth lesson, the students found an excuse of leaving early because it was Conceicao's birthday. In the fourteenth lesson, again only Iva showed up in class, she only used the CD-ROM for ten minutes and said that she had to leave early. In the fifteenth lesson, the students again found an excuse to leave early because Conceicao had to go to a meeting.

Between the fourth and the fifth lesson, the whole class went out to have lunch at the Chinese restaurant. The students seemed to enjoy that kind of extracurricular activity. However, when the students went out to lunch again at the end of the study, they did not seem to have as much enthusiasm as before. Was that the end of the novelty effect again? Or they were not interested any more simply because they were about to go back to Portugal.

Juana only attended two lessons, was that the novelty effect again after two lessons? An interview revealed that she very much enjoyed the writing of Chinese characters. Maybe another reason for her not coming after the second lesson could be that she did not get to learn Chinese character in class. So when students' expectation or interest is not served in class, the students become

unmotivated to be there, just as Li (1996) said that if students fall short of expectations in class, they can easily give it up.

Four reasons could possibly explain the behaviours of the students in class. The first reason is the purpose of the learning was just for fun. The second reason is that when students' interests are not met in class, they become unmotivated to attend. Those students who wanted to learn character writing might not come to class. The third reason is the need for learning Mandarin. When the students do not a need to learn the foreign language, they also become unmotivated to come to class. The fourth reason is that novelty effect plays an important role in any new technology. Once the students are familiar with the environment, they are no longer motivated to use it. The perceived demand characteristics, interest, need, and novelty effect affected the learning attitudes in this group of students. Since the purpose of the class was for fun, their perceived demand characteristics were low. Once they were familiar with the CD-ROM environment and that from the data of the main interview, it was found that they had no difficulty in using the CD-ROM, so their perceived self-efficacy was probably very high. With low demand characteristics and high self-efficacy, it is very unlikely they would invest much effort in using the CD-ROM in their Mandarin study.

The data set in this study confirms that

1. Students who believe that audio is helpful are more likely to be motivated to learn Mandarin with the CD-ROM.
2. Students who have a need or an interest to learn Mandarin are more likely to be motivated to learn Mandarin with the CD-ROM.
3. Students who find Mandarin learning easy and CD-ROM usage easy are more likely to invest less mental effort in using the CD-ROM in their Mandarin learning.

9.2 Students' Common Characteristics

From the interviews and the observations, the Portuguese students generally shared some common characteristics. They were self-autonomous learners who liked the manipulation and access capability of the CD-ROM. They were initially motivated and had receptive attitudes towards Mandarin learning with the CD-ROM. However, the feedback they wanted from the CD-ROM, not having a need to learn Mandarin and what they thought of the role of the teacher might have affected their motivation and attitudes towards the end of the study.

This study dealt with adult learners and they wanted more choices. They wanted to be able to regulate how they want and what they want to study. Lisete said that she could control the stage and the time of her learning. She could repeat, and repeat, and would not feel ashamed about it because nobody would know how many times she repeated. Monica said that the CD-ROM could help her study at home when she forgot the pronunciation. Sofia said that she could practice and study with the CD-ROM at home on her own. Iva said that she could study at home, listen to it frequently and repeat as much as she liked. Conceicao said that the CD-ROM could help her with self-practice, giving her more autonomy in her study. Anna said that the CD-ROM could help her to review and study by herself.

The students thought that CD-ROM made it easy to repeat and review the learning materials, and the pause and go capability made interactivity possible. Searching was made easier with the rewinding capability. Iva felt that the CD-ROM was easy to navigate to another place. Suzanna said that the interactivity was great, allowing her to jump from one area to another. She could associate the topics together, as one entity, not separate items because of how things were linked together.

Johnson (2001) said that affective variables related to the feelings and the most commonly studied affective variables are motivation and attitudes. At least initially, the students seemed very motivated to learn Mandarin with the CD-ROM. Monica said that she was actually using the CD-ROM at home when she had nothing else better to do. She was showing it to everyone who came to her house. She felt that the CD-ROM gave her more motivation because it was different than studying from the book. Iva felt that the CD-ROM could stimulate her learning.

The students' attitude, based on Chao's (1998) suggestion, could be classified into two categories: defensive or receptive. One of the students, Orlanda, never showed up again after the first lesson. The researcher could only conclude that Orlanda was not interested in using the computer to learn Mandarin. Based on the first lesson, Orlanda was considered as having a defensive attitude towards Mandarin learning with the CD-ROM. The rest of the students could be grouped as having receptive attitudes towards Mandarin learning with the CD-ROM based on the following evidence. In the first lesson, Lisete and Iva were busy listening to the CD-ROM, trying to copy down the translation, and implying that they were excited about it. After the first lesson, two students spoke to the researcher about how much they liked the CD-ROM. Monica said that she could not wait to take the CD-ROM home to study and felt that she could finally learn her Mandarin with the aid of the CD-ROM. Suzanna told the researcher that she thought the program was great. In the second lesson, Lisete said how much she enjoyed the CD-ROM and that it made the class more interesting. Both Lisete and Iva told the researcher that they liked to study more on their own with the CD-ROM. In the third lesson, Anna told the researcher and the teacher that the CD-ROM was really great. During the third lesson, Lisete still put on the headphones the minute she was in the

room and even had the headphones on when the teacher was lecturing. Even in the fourth lesson, the six students who showed up in class were eager to put the headphones when they got into the computer room. All the students, except for Orlanda, could be considered as motivated students in Mandarin learning with the CD-ROM.

The students thought that the CD-ROM was motivating and stimulating to their study initially. However they hated it when they couldn't communicate to it. Feedback was an important issue in the interviews. Lisete said that the computer could not tell her that her pronunciation was wrong or not. The computer couldn't make correction for her. Anna said that the CD-ROM couldn't tell her everything, only what was available there. Juana said that the CD-ROM could not correct mistakes. It could not tell whether she was correct or not.

The fact that they did not a need to study Mandarin also affected their learning. Only Lisete thought that learning Mandarin was useful because it could help her teach Portuguese. The rest of the students were basically doing it for fun, like Monica and Sofia. Iva was learning for pleasure. Conceicao, Suzanna and Anna were learning out of curiosity. Anna mentioned that she was going back to Portugal, and she did not think that she would be able to use the language nor the CD-ROM.

From the interviews, the students felt that they needed a teacher, to ask question, to communicate with, and to give feedback, and most importantly, to help them. They felt strongly that the use of the CD-ROM could not replace classroom teaching. Iva said that she could not talk with the CD-ROM. She cannot imagine a dialogue with it. She must have another person to talk to. Conceicao said that the CD-ROM could not replace the classroom and the classroom interaction. Anna said that she can always ask the teacher questions,

but she could not do that to a CD-ROM.

From the observations, the role of the teacher was still as strong as ever based on the following evidence. In the ninth lesson, both Lisete and Suzanna showed up in class, not knowing that there was no lesson on that day. It showed that they were interested in Mandarin learning. When they declined the use of the CD-ROM without the teacher, it showed that they still valued the teacher very much.

9.3 Discussion of the Research Questions

The Portuguese students liked to listen and repeat after the CD-ROM and considered the use of the CD-ROM easy and still needed the assistance of a teacher to guide and assist them. This section will answer the following questions:

1. What are the benefits and limitations of using Multimedia in Mandarin learning?

2. How appropriate it is to use Multimedia in Mandarin learning for different categories of language learning skills: vocabulary, listening, and reading?

3. How appropriate it is to use Multimedia in Mandarin learning for different types of students: visual/auditory, independent/dependent, knowledgeable/low prior knowledge, home exposure/non-home exposure, or Chinese/Macanese/Portuguese

9.31 Benefits and Limitations of Multimedia in Mandarin Learning

The data in the interviews and in-class observation showed the benefits and the limitations of the CD-ROM with Mandarin learning, which will probably affect students' willingness to use the CD-ROM in their learning.

9.311 Benefits of the CD-ROM

From the interviews, several benefits of the CD-ROM were found. First the CD-ROM allows the students to have self-autonomy, so that they can study what they want and how and when they want. With the interactivity provided by the CD-ROM, they can repeat and review as much as they like. At least initially, the students found the CD-ROM motivating and stimulating which should have provided some novelty effect for them to use the CD-ROM.

From the in-class observation study, two benefits of using the CD-ROM were found. First instructional time was reduced based on what had been observed in the first lesson, when the teacher did not have to explain to the Portuguese students about the meaning of each word or the whole sentence since translation was provided. The teacher did not have to keep repeating the pronunciation of the new word because the Portuguese students could listen to the recording. Therefore, the translation and the recording definitely saved instructional time in class.

Another benefit of using the CD-ROM was that it is good for home study with the purpose of reviewing and exploring based on the following evidence. In the first lesson, Monica said that she felt that she could really learn her Mandarin with the aid of the CD-ROM. Without the CD-ROM, she said that she might forget a sound she learned from class. In the second lesson, Lisete

and Iva said that they liked to study more on their own. During the luncheon at the Chinese restaurant, Suzanna told the researcher that even though she missed one class, she could catch up with the CD-ROM. In the eighth lesson, Sofia reviewed with the CD-ROM and Suzanna explored new chapters in the CD-ROM.

9.312 Limitations of the CD-ROM

From the interviews, several limitations were found: feedback, limited materials, no human contact and problems with the students. The students complained about not getting feedback about their pronunciation and not able to have correction from the CD-ROM. The materials are limited to what is on the CD-ROM. The CD-ROM is not like a teacher, whom the students could communicate to and ask questions. Finally, the CD-ROM cannot help those who have problems themselves, like if they do not like studying, they do not like computer, or they are too lazy.

The in-class observation study revealed that feedback and gaining answers to questions were very important issues for learners, particularly when they were faced with a new learning task. CD-ROM does not give feedback about pronunciation nor does it answer any questions. In the first lesson, Iva had a question about whether she was pronouncing correctly or not. The researcher suggested to her that if she had any question she could ask the teacher about it.

9.32 The Use of Multimedia for Different Language Skills

The development of the CD-ROM concentrated on vocabulary learning: its pronunciation, meaning, pinyin, and character writing. The researcher wondered how the students in this study perceived the CD-ROM as being helpful in the different language skills. The language skills areas that the students found in the pilot study (Table 50), in the main interview (Table 63) and in the follow-up interview (Table 70) are reflected in Table 75 with those opinions from the students and the teachers. They are classified into the following language skills: listening skill, reading, and vocabulary learning.

Table 75: Students' Perceived Language Skills learned from the Mandarin CD-ROM

Language Skills/Category	Codes	Pilot Study	Main Study	Follow-up Study
Listening Skill	Listen to sound	2	3	2
	Listen to tone	2		
	Listen to vocabulary		1	1
	Listen to sentence	2	1	1
	Listen to short essay	2		
	Listen to lesson			1
	Listening skill	2	3	1
	Listen to other accent	1		
	Sound	2	2	1
	Click on sound as much as she likes	1		
	Compare Sound		1	
	Sound is standardised	1		
Reading	Visual	4	1	
	Read and listen to sound	1	2	
	Translation plus sound			1

Vocabulary Learning	Character writing	1	1	1
	Meaning of Word	2		
	Vocabulary		3	
	Writing of pinyin	1		
	Speech Sound Table	1		1
	Pronunciation	4	2	2
	Intonation	2		
Others	History	2		
	Culture	1		
	Movie	2		
	News	1		
	Story-telling	1		
	Testing and Practice	1		

In Table 75, the codes reflect three language skills: listening skill, reading, and vocabulary learning. It seems that the language skills perceived by the students are in line with the purpose of the 'Click!' CD-ROMs, with its emphasis on vocabulary learning: its pronunciation, meaning, pinyin, and character writing. The students saw that the CD-ROM could be helpful in vocabulary learning, listening skill and reading. Therefore it can be suggested that the multimedia Mandarin CD-ROMs in this study are appropriate for vocabulary learning with its pronunciation, meaning, pinyin and character writing and for developing listening skills and reading comprehension.

It is interesting to note that in the listening skill category, some students liked to listen to just sound and vocabulary while others liked to listen to sentence and short phrases. These may represent two types of students, from the bottom-up processing versus top-down processing, which may refer to inductive and deductive learner respectively.

In comparing the language skills found in this study with that of the Aryes' (2002) study, the language skills found in this study are vocabulary learning,

listening and reading and the language skills found in Aryes' (2002) study were spelling and writing. Writing skill was not mentioned in this study because it was not the aim of this study. In studying Chinese, pinyin and character writing will be similar to spelling in studying English.

9.33 The Use of Multimedia for Different types of Students

From the pilot interview, the researcher was able to classify the students in terms of whether they are Cantonese, Macanese or Portuguese students. The Cantonese students are Phyon, Fanny and Seng, the Macanese students are Lurdes, Jose and Anita, and the Portuguese students are Antonio and Rui. Fanny and Seng have more home exposure experience and Phyon has no home exposure in the Cantonese group (see Table 48).

From the in-class observation study, it was possible to determine the student type in terms of their learning styles. Lisete and Iva were identified as visual students since they liked to take notes and read the text and translation in class and Sofia, Suzanna and Monica were identified as auditory students since they liked to converse with the teacher and with each other in class. Based on what has been observed in class, Conceicao was classified as an independent student with more experience with the computer and Manuela to be a dependent student with less experience with the computer. From the main interview, the researcher found that Juana and Monica were more experienced in the Mandarin language as they had actually studied Mandarin before, and Iva, Anna, Sofia and Suzanna never had any experiences with the Chinese language. Table 76 displays types of students found throughout the whole study.

Table 76: Student Types found in this Study

Types of Students	Name of Students
Cantonese	Phyon, Fanny, Seng
Macanese	Lurdes, Jose, Anita
Portuguese	Antonio, Rui
Home Exposure	Fanny, Seng, Antonio
Non-home exposure	Phyon, Jose, Anita, Rui
Visual	Lisete, Iva
Auditory	Sofia, Suzanna, Monica
Independent	Conceicao

Dependent	Manuela
Computer Experience	Conceicao
Low computer Experience	Manuela
Knowledgeable	Juana, Monica
Low-prior knowledge	Iva, Anna, Sofia, Suzanna

To determine the appropriateness of the use of multimedia for different nationalities, the students are classified into three groups: Cantonese, Macanese, and Portuguese. Based on what they found difficult about Mandarin learning and how the CD-ROM was being helpful to them as shown in Table 49, the following usage for the students with different backgrounds was suggested. As far as the Cantonese students go, since they already understand and read Chinese, it is probably more appropriate for them to listen to pronunciation and intonation of the Mandarin sound and learn pinyin from the CD-ROM. For both the Macanese and the Portuguese students, it is probably more appropriate for them to learn Chinese character writing, pronunciation, and meaning of words. However, for those students who do not have computer, or do not like computers, or do not like to use the CD-ROM or do not like to study are probably not going to use the CD-ROM in their learning. Regardless of which nationality the student is, it seems that pronunciation is needed the most, which is in agreement with Yu and Michael's (1998) study of CyberChinese where non-Asians, non-Chinese Asians, and Chinese students were involved. It was interesting to note that Anita, one of Macanese students in the pilot study, who went to study Mandarin for 10 months in Beijing and who found Mandarin to be useful in the future, still preferred to go to class rather than to use the CD-ROM in her Mandarin learning. It seems like that the CD-ROM can help students of all nationalities with their pronunciation.

To determine the appropriateness of the use of multimedia for the home exposure and the non-exposure group, Fanny, Seng are being discussed from

Table 48. They enjoyed watching videotape, having discussion and communicating with their teachers and classmates. The Cantonese students found that pronunciation was difficult to manage. They all agreed that the CD-ROM could help them with their pinyin and pronunciation since they can listen as much as they like with the pause and go and navigation capability. Bar-Lev (1995) said that whether or not they have any home exposure of the language has an influence on their learning. For English speakers, those students with home exposure will tend to rely on switching to English as a strategy for easier access to a word. They will tend to make less vocabulary errors and seem to be better in Chinese word-order. However they may speak with a less standard Mandarin accent. Based on what Bar-Lev (1995) said, the following may be said about the local students in Macao. In this study, students with home exposure of the Mandarin language include Cantonese and Macanese students who learned Cantonese before. The researcher assumes that the Cantonese or the Macanese students with home exposure may also tend to rely on switching to Cantonese as a strategy for easier access to a word. They may tend to make less vocabulary errors and seem to be better in Chinese word-order. However, they may speak with a less standard Mandarin accent because of their previous experience. Therefore those students with home-exposure experience may use the CD-ROM for pinyin and pronunciation and those students with non home-exposure may learn vocabulary and Chinese word-order from the CD-ROM.

To determine the appropriateness of the use of multimedia for the visual and auditory student, Lisete, Iva and Suzanna are being discussed, from Table 58. Both Lisete and Iva enjoyed the experience of the CD-ROM starting from the first lesson. They liked to put the headphones as soon as they walked into class and they liked to copy down the translation from the screen and took notes in

class. Iva had the headphones on even while the teacher was talking. Suzanna thought that the CD-ROM was great in the first lesson. Lisete and Iva consistently enjoyed their experience up to the fourth lesson. Then Easter holiday was around, it was interesting to see that Iva was the first student who showed up after the holiday in the seventh lesson, but she stayed only for 30 minutes. When the researcher told both Iva and Lisete that the CD-ROM was for sale then, they said they would buy it and use it at home. It was also interesting to see that Lisete and Suzanna showed up in class, not knowing that it was a holiday in the ninth lesson. When the researcher suggested that they ought to use the CD-ROM to study without the teacher, they both declined. They preferred to study with the teacher. For Suzanna, in the third lesson, she already started talking to Sofia and Monica after using the CD-ROM for a while. From their experience, it seems that the CD-ROM is great for self-study but it will never surpass the teacher. The CD-ROM is probably more appropriate for the visual students.

To determine the appropriateness of the use of multimedia for the independent and dependent student, Conceicao and Manuela are being discussed, from Table 58. In the third lesson, Manuela has asked Conceicao to show her what she was doing and she probably liked to work with Conceicao. Manuela asked Conceicao to show her again in the fourth lesson. Since Conceicao is a student with more computer experience and Manuela with less computer experience, this behaviour of Manuela asking for Conceicao's help also demonstrated this fact. Dependent students tend to follow what the teacher said versus independent students like to explore the CD-ROM as shown in the case of the twelfth lesson for Manuela and Conceicao. So the researcher claims that the CD-ROM is probably more appropriate for an independent student and for those who have better computer skills.

To determine the appropriateness of the use of multimedia for knowledgeable and low-prior knowledge student, Monica and Iva are being discussed, from Table 58. Both Monica and Iva were excited about the CD-ROM right from the first lesson. Iva spent the most time with the CD-ROM in class, copying the translation and listening to the recording, showing up even the first day after the holiday, and kept coming on alone in the seventh, the tenth, the eleventh and the fourteenth lesson. She wanted to know where she could buy the CD-ROM in the first lesson and when the researcher told her that it was for sale on the seventh lesson she said she would buy one. Monica was the only student who would prefer to study with the CD-ROM first rather than being with the teacher. She seemed to be excited about the CD-ROM up until the fifth lesson but she was losing interest in the sixth lesson. In the interview, she told the researcher that she disliked the class schedule during lunch time. There are two possible explanations why she mainly showed up before the Easter holiday. The first is because she was knowledgeable in Mandarin and disliked the class schedule. Another explanation is that the holiday might have interrupted her interest in the class and her motivation to learn Mandarin. Therefore the novelty effect might have been affecting knowledgeable students more and also suggested to teachers that holiday season is a time that is crucial in motivating students in their learning. The novelty effect may last longer for those who have low prior-knowledge. The CD-ROM is probably more appropriate for the students with less knowledge in Mandarin.

According to the main interview, Lisete is a visual learner who likes self-paced learning, she likes to stop and repeat as much she likes and be in control of her own learning. She has shown good behaviour in the in-class observations, showing up 74% of the class time, motivated to use the CD-ROM and showing up even though there was no lesson on that day in the ninth lesson.

From the experience with Lisete, students who like self-paced learning are also more likely to be motivated to use the CD-ROM in their Mandarin learning.

In summary, for Cantonese students, they can learn their pronunciation, intonation and pinyin from the CD-ROM. For both the Macanese students and the Portuguese students, they can learn character writing, pronunciation and meaning of the words from the CD-ROM. For those students with home-exposure experience, they can still learn pinyin and pronunciation from the CD-ROM. For those students without home-exposure experience, they can learn word order and vocabulary from the CD-ROM. In short, the CD-ROM is more appropriate for students in all nationalities who want to practise their pinyin and pronunciation. Table 77 displays the language skills learned by students of different nationality and home experience and Table 78 displays the best user group for the CD-ROM usage.

Table 77: Summary of Language Skills learn from the CD-ROM by Nationality and Home Experience

Students Type	Language Skills learned from the CD-ROM
Cantonese	Pronunciation Intonation Pinyin
Macanese	Pronunciation Chinese character writing Meaning of words
Portuguese	Chinese character writing Pronunciation Meaning of words
Home-exposure	Pronunciation Pinyin
Non home-exposure	Vocabulary Word Order

Table 78: Best User Group for the CD-ROM Usage and what Language Skills they can learn from the CD-ROM

Best User Group for CD-ROM	Language Skills
Visual	Chinese character writing Pronunciation Meaning of words Vocabulary Word order
Independent	
Computer Experience	
Low prior-knowledge	
Students who like self-directed and self-paced learning	

In Table 78, it is shown that the CD-ROM is more appropriate for visual student, for independent students and those students with better computer skills, for low-prior knowledge students, or for students who like self-paced and self-directed learning.

On the subject matter whether or not the multimedia CD-ROM can change the attitude and the motivation of the students, there was strong evidence that it did not change the attitude of these students who had no particular reason for studying Mandarin. First of all, there were less and less students showing up in class. Second of all, the Easter holiday interrupted their interest and motivation, there were less students showing up after the holiday. Third of all, in the ninth lesson, both Lisete and Suzanna declined the use of the CD-ROM when they

found out that the teacher was not there. Fourth, starting the tenth lesson, even Iva began to lose her interest as well as the teacher. Iva did not bother to use the CD-ROM in the eleventh lesson when she was the only student showing up in class. Fifth, the students tried to get out of class earlier at the thirteenth lesson when they had an excuse to celebrate Conceicao's birthday. Finally, on June 8, after the last lesson, when they were out to lunch again, the students were not as enthusiastic about Mandarin learning as they were before. All these evidence suggested that the multimedia CD-ROM did not change the attitude and motivation of these students towards Mandarin learning or Mandarin learning with the CD-ROM and that novelty effect was tailing off towards the end of the study.

The data set in this study confirms the fact that

1. Independent or visual learners with better computer skills or who like self-paced learning are more likely to be motivated to learn Mandarin with the CD-ROM.

but disagrees with this theory:

2. The experience with the multimedia CD-ROM can change students' attitude and motivation towards Mandarin learning with the CD-ROM.

Going back to the research model in Figure 36 and the tree diagram in Figure 37, the data confirms the importance of learning style, computer skill, and whether or not the students prefer self-paced learning and that they will eventually affect the attitude the students in using the CD-ROM in their Mandarin learning. However, since the experience of the multimedia CD-ROM cannot change the attitude of these students locally, needs and interest are

probably more important elements in dealing with these students in Macao. In addition, this further confirms the fact that teacher is not replaceable and that the role of the teacher is still very important in the age of advanced technology.

Though students' attitude and motivation towards Mandarin learning or Mandarin learning with the CD-ROM were not altered after the use of the CD-ROM in this study, there was evidence in this study that students do like the use of the CD-ROM and that they can use it for self-study, which is suitable for the adult learners who do not have much time to study with the teacher.

9.4 Discussion of the Third Literature Review

During the analysis of the data, the researcher further reviewed the literature of the relationship between multimedia and Chinese language learning. Based on Chiang's (2002) belief that the learners' perspective on learning Chinese is the best approach to teach beginning level Chinese, this research also took the direction on learners' perspective on learning Chinese as a foreign language. The researcher believed that the effect of teaching is how well learners learn at the end of the given instruction, which will depend on their motivation, their attitude, their belief, their previous experience, and their learning strategies. Both learning style and previous experience affect learning strategies while previous experience affects beliefs, which in turn affects attitude and motivation, both of which will affect the effect of teaching as shown in Figure 33.

In this section, the researcher compared studies reviewed in the third literature review with the data found in this study in terms of Mandarin learning and multimedia. In Mandarin learning, four areas are considered: reasons why Chinese language is studied, motivation, difficulty and learning strategies. Sung and Padilla's (1998) study is compared with reasons why Chinese language is studied. Sung and Padilla's (1998), Wen's (1997), and Samimy and Lee's (1997) studies are compared on motivation towards Chinese language learning. Chiang's (2002), Aryes' (2002) and Samimy and Lee's (1997) studies are compared on difficulty perceived by students in Mandarin learning. Finally Chiang's (2002) and Samimy and Lee's (1997) studies are compared on learning strategies.

In multimedia, several areas of the CD-ROM are considered: research categories, benefits and limitations, language skills, general improvements and usage. Wishart's (2000) study is compared with students' perceptions and motivation in learning with a multimedia CD-ROM, and Aryes' (2002) study is

compared with learners' view of CALL. Ayres' (2002), Wishart's (2000) and Trinder's (2002) studies are used to compare with the benefits and limitations of the CD-ROM. Furthermore, Chinese CALL such as Chen and Cheng's (1976) PLATO System, Yu and Michaels' (1998) CyberChinese, Luk and Ng's (1998) Chinese Idiom, Li's (1996) HyperChinese, Lu's (1997) use of dictionary and Hong's (1997) Business Chinese software are compared in terms of language skills. In addition, Yu and Michaels' (1998) CyberChinese is compared in terms of language skills learned by different nationalities. Then Trinder's (2002) study is used to compare general improvements of CALL. Finally, Wishart's (2000) study is used to compare students and teachers' view of CD-ROM usage. All of these studies are used to compare and contrast with the data found in this study in order to ensure the validity and the reliability of the data that were found in this study.

9.41 Comparisons of Mandarin Learning

In order to prepare better materials for the learners, the researcher suggested evaluating four issues regarding Mandarin learning, and they are why students study Mandarin, their motivation, their perceived difficulty and their learning strategies in Mandarin learning.

9.411 Comparisons of Reasons why Students study Mandarin

Students study foreign languages for different reasons. The reasons for studying Mandarin for the students in the pilot study, the main study and in Sung and Padilla's (1998) study are shown in Table 79.

Table 79: Comparisons of Reasons why Students studied Mandarin

Codes	Pilot Study Students (8) [Table 52]	Main Study Students (9) [Table 65]	Sung and Padilla's (1998) study [Table 28]
Need	X		
Useful	X	X	
Interest	X		X
Communication	X	X	X
Just learn the language	X	X	X
Read poem	X		
Employer sent her	X		
Use Mandarin outside of class	X		
Fun		X	
Pleasure		X	
Maybe important in the future		X	
Curiosity		X	
Learn new things		X	
Learn the culture		X	
Find out the difficulty in a foreign language		X	
Help her teach Portuguese better		X	
Studied Mandarin before		X	
Heritage language			X
Parents encouraged them			X
Heard that language classes are good			X
Heard that the language teacher is good			X

Friends who are studying the language			X
Want to study abroad			X
Travel to countries where the foreign language is spoken			X

The obvious difference between this study and Sung and Padilla's (1998) study is that the present study deals with adult students whereas Sung and Padilla's (1998) study dealt with elementary or secondary students. So the language being useful and that it can be used in communication were the major reasons why students in this study learned Mandarin whereas parental and school influences were the major reasons in Sung and Padilla's (1998) study. However, there are common reasons why students would ever want to study a foreign language, whether or not they are adults or children, that is to communicate or just to learn the language, as shown in Table 79. The grey shading is used to highlight common reasons in all three studies.

9.412 Comparisons of Students' Motivation towards Mandarin Learning

Gardner and MacIntyre (1991) explained two types of motivation: instrumental and integrative. Students' motivation towards Mandarin learning for the students in the pilot interview, the main interview, Sung and Padilla's (1998) Study, Wen's (1997) study, and Samimy and Lee's (1997) study, are shown in Table 80.

Table 80: Comparisons of Instrumental and Integrative Motivation

Instrumental Motivation					
Codes	Pilot Study Students [Table 52]	Main Study Students [Table 65]	Sung and Padilla's (1998) study [Table 27]	Wen's (1997) study [Table 30]	Samimy and Lee's (1997) study [Page 217 of this study]
Need	X				
Useful	X	X			
Chance to use outside	X				
Help her teach Portuguese better		X			
Be a knowledgeable person			X		
Future career			X		
Maybe important in the future		@			
Employer sent her	@				
To get a job			@	@	@
Get respect from others			X		
Travelling to Chinese-speaking country				X	
Use it with Chinese-speaking friends				X	
Important language in the economic development of the world				X	
To learn culture to understand the world better				X	
Communication/ Speak	#	#			
Meet and converse with more people			#	#	
Integrative/intrinsic Motivation					
Codes	Pilot Study Students	Main Study Students	Sung and Padilla's (1998) study	Wen's (1997) study	Samimy and Lee's (1997) study
Speak Chinese well					#
Interest	X				

Just learn the language	X	X			
Read poem	X				
Pronunciation	X				
Study by herself	X				
Knowing how to read	X				
Chinese character writing	X	X			
Exploring/looking up words	X				
Discussion	X				
Watching TV/video	X				
Integrative/intrinsic Motivation (cont.)					
Codes	Pilot Study Students	Main Study Students	Sung and Padilla's (1998) study	Wen's (1997) study	Samimy and Lee's (1997) study
Listening	X				
Student life in Beijing	X				
Fun		X			
Pleasure		X			
Curiosity		X			
Learn new things		X			
Find out the difficulty in a foreign language		X			
Understand TV and news		X			
Sound of Mandarin		X			
Knowing the sentence structure		X			
Learn the culture/Different culture		$			
Participate in culture activities			$		
Better understand and appreciate art and literature of the culture			$	$	
To have Chinese friends					$
To be more at ease with native speakers of the language			X		

Interest in my culture heritage				X	
Enjoy doing all the work				X	
Better understand the problems that Chinese speakers face				X	

In Table 80, it seems that to be able to communicate with others is what the students have in common in all the studies, as shown in the grey shading with the '#' character. As far as instrumental motivation is concerned, Mandarin is important in the future, and job-related is what the students have in common in all the studies, as shown in the grey shading with the '@' character. As far as integrative motivation is concerned, the main interview group, Sung and Padilla's (1998) study, Wen's (1997) study and Samimy and Lee's (1997) study all have one common point, to learn the culture of the language group, participating in culture activities, learning about art and literature and meeting Chinese friends, as shown in the grey shading with the '$' character. It is interesting to note that the students in the pilot group did not mention culture because the majority of the students were either Cantonese or Macanese students, so that culture is not something new to them.

9.413 Comparisons of Students' Perceived Difficulty in Mandarin Learning

The researcher compared students' perceived difficulty in Mandarin learning in this study with those data in Chiang's (2002), Aryes' (2002) and Samimy and Lee's (1997) studies in Table 81. In Aryes' (2002) study, 60% of the students placed themselves in the medium to high levels in the areas of listening, reading and writing, indicating that 40% of the students in Aryes' (2002) study rated listening, reading and writing difficult. Whether or not the students find Mandarin learning difficult will determine their perceived demand

characteristics in Mandarin learning.

Table 81: Comparisons of Students' Perceived Difficulty in Mandarin Learning

Perceived Difficulty	Pilot Study Students (8) [Table 53]	Main Study Students (9) [Table 66]	Chiang's Study Students (25) [Table 31]	Aryes' Study Students (157) [Page 248 of this study]	Samimy and Lee's Study Students (34) [Page 217 of this study]
Pronunciation	25%	22%			
Word with same sound	12.5%				
Sound/Listening	?	33%	16%	40%	
Intonation-tones	25%	33%	20%		
Speaking	25%		20%		
Vocabulary		11%			
Chinese character writing	50%		16%		
Read pinyin/Reading	12.5%		4%	40%	
Culture	12.5%				
Memorising	37.5%	11%	20%		
Being Lazy	12.5%				
Construction of Sentence/Writing		33%		40%	46%
Construction of Phrases		11%			

In Table 81, the students in this study and in Chiang's (2002) study found difficulty in tones, memorising, and pronunciation/speaking when learning Mandarin, as shown in the grey shading. The students in the pilot group did not find any problems in listening unlike those in the main study group, Chiang's (2002) study and Aryes' (2002) study, as shown with the box with the '?' character. The reason behind this was probably because most students in the pilot group were Cantonese and Macanese students who already had some home experience with Mandarin. Character writing was considered the most difficult in the pilot group with 50% of the students, Macanese and Portuguese, commenting about it and 16% of the students in Chiang's (2002) study also

found character writing difficult. Reading of pinyin and general reading were found to be difficult for the students in the pilot group, in Chiang's (2002) study, and in Aryes' (2002) study. Constructions of sentences/phrases or writing were found to be difficult for the students in the main study group, in Aryes' (2002) study, and in Samimy and Lee's (1997) study. In Samimy and Lee's (1997) study, most students and teachers chose writing as the hardest. However, most students and teachers in this study generally agreed that pronunciation and intonation were the most difficult.

9.414 Comparisons of Students' Learning Strategies in Mandarin Learning

Oxford et al. (1993) claimed that students' chosen language learning strategies are often determined by their style preference. The researcher compared students' learning strategies in this study with those found in Chiang's (2002) and Samimy and Lee's (1997) study in Table 82.

Table 82: Comparisons of Students' Learning Strategies in Mandarin Learning

	This Study [Average of Table 89]	Chiang (2002) [Table 32]	Samimy and Lee (1997) [Page 217 of this study]
Pay more attention to pronunciation	23.5%	48%	89%
Pay more attention to character writing		16%	
Practise patterns/grammar more		16%	50%
Establish good study habits		12%	
Learning about radicals and components		8%	
Read more		4%	
Learn more about history and culture		4%	
Vocabulary learning			58%

Since both the students in the pilot study and the main study viewed that pronunciation and intonation were difficult in Table 82, the researcher assumes that they would put effort in these areas and that becomes their learning strategies. The percentage is calculated by taking the average of the pilot study and the main study group. In Chiang's (2002) study, learning characters, pronunciation, and grammar were the predominant learning methods that students responded. Of the 25 students who responded, 48% wished they had paid more attention to tones; 16% wished they had paid more attention to character writing; 16% practised pattern/grammar more. In Samimy and Lee's (1997) study, 58% of the students agreed that the most important part of learning a foreign language was vocabulary learning. Similarly, while 50% of the students felt that grammar was very important, and 89% of the students felt that accurate pronunciation was important for communication in the target language. Pronunciation is what the three studies have in common. When comparing adult beginning students' strategies with the language teaching methods in Table 9, audiolingual or audiovisual teaching method seem to be most appropriate for learning pronunciation.

In this subsection, students learn Mandarin for reasons of communication and they are motivated to learn to communicate with others and to have a better job in the future. However, pronunciation, intonation and speaking were the most difficult for the students in this study. So the researcher suggests that the students can use the multimedia CD-ROM to learn pronunciation and intonation at home and can practise their communication in class. Those students who consider their learning strategies to learn pronunciation, or who have problems in tones, memorising and pronunciation/speaking, are probably more motivated in using the CD-ROM in their Mandarin learning.

9.42 Comparisons of Multimedia

Davey et al. (1995) said that the introduction of sound and vision to language learning materials could transform the learning experience and enhance the motivation of the learner. Therefore the data in this study were compared with other studies in terms of research categories, benefits and limitations, language skills, general improvements of CALL, and usage.

9.421 Comparisons of Research Categories with other Multimedia CD-ROMs

The research categories of perceptions and preferences of multimedia, why students want to use it (motivation), the difficulty they found (perceived demand characteristics), and ease of use of CALL (perceived self-efficacy) in this study are compared with those of Wishart (2000) and Aryes (2002) in Table 83.

Table 83: Comparisons of Research Categories with Other Studies

Research categories		This Study [Table 75]	Wishart (2000)	Aryes (2002) [Table 41]
Perceived CALL	Give control over learning	X		X
	Computers are motivating	X		X
	Relevant to needs			X
	Important to the course			X
	Improve language skill	X		X
	Flexibility	X		X
	Interest	X		X
	Useful/Good information	X		X
	Ease of use	X		X
Preferences	Writing			X
	Spelling			X
	Listening	X		
	Reading	X		
	Vocabulary	X		
		[Table 65]	[Table 38]	

Motivation-why use multimedia CD-ROM	Listen to the sound	X	X	
	Interactivity	X	X	
	Interesting	X	X	
	Quicker and easier to access and use	X	X	
	Assist learning	X	X	
	Fun and exciting	X	X	
	Provides more information		X	
	Having a print facility		X	
	Different and new		X	
			[Table 40]	
Difficulty in using the CD-ROM (PDC)	No difficulty	[Table 78] X	X	
	Too much information		X	
	Not enough depth or detail		X	
	Searching		X	
	Eye strain		X	
	Lack of availability		X	
	Too complex		X	
	Need to learn how to use it		X	
	Time consuming		X	
	Need more help		X	
	Restricted		X	
Easy to use (PSE)	Ease of use	[Table 79] X		[Table 41] X

In Table 83, the data in this study are compared with those in Ayres' (2002) study. The general perception of CALL is that it is easy to use, gives control over learning, and computers are motivating. Furthermore, it improves language skill, gives flexibility and stimulates interest. However, the data in this study did not mention relevance to needs. The students in Aryes' (2002) study rated CALL highly in the area of writing and spelling and the students in this study liked to use the CD-ROM in listening, reading and vocabulary learning.

In Table 83, comparing why students wanted to use the multimedia CD-ROM in this study and in Wishart's (2000) study from Table 38, both studies found that the students liked to listen to the sound of the multimedia CD-ROM, enjoyed the interactivity of the CD-ROM, that it is interesting to use, and that it is quicker and easier to access and use, assists learning, and is fun and exciting. However, the students in this study did not mention about the CD-ROM providing more information or having a print facility.

In Table 83, comparing the difficulty encountered in using the multimedia CD-ROM by students in this study and Wishart's (2000) study from Table 40, 100% of the students in this study found no difficulty in using the CD-ROM whereas 11% of the students in Wishart's (2000) study indicated that they had no difficulty. Furthermore, in Wishart's (2000) study, the students suggested the following reasons that made multimedia more difficult to learn: too much information, not enough depth or detail, difficulty with searching, eye strain, lack of availability, too complex, need to have learned how to use it, time consuming, need more help, and restricted. On the negative side, either the students in this study had not spent enough time on the CD-ROM, or they were not critical enough, or they didn't want to talk about their own difficulty. On the positive side, maybe the CD-ROM in this study was more user-friendly, or the prior experience of the students in this study was helpful so that they did not find any difficulty. The students in Wishart's (2000) study were secondary students who were from 11 to 19 years old so that they were probably too young or inexperience in using the computer, unlike the adult students in this study. Finally, comparing ease of use in this study and in Aryes' (2002) study, all the students said that CALL was easy to use.

9.422 Comparisons of Benefits and Limitations of Multimedia with other Studies

The researcher compared the benefits and the limitations shown in this study and with those in the third literature review in Table 84. Ayres (2002) and Wishart (2000) both discussed the benefits of multimedia while Trinder (2002) discussed both the benefits and limitations of multimedia.

Table 84: Comparisons of Benefits and Limitations of Multimedia with Other Studies

		This study [Table 50 and 63 and 70]	Ayres (2002) [Table 41, page 248 and 249]	Wishart (2000) [Table 39]	Trinder (2002) [Table 37]
Benefits	Flexibility	#	#		#
	Interest	@	@	@	
	Easy to use	@	@	@	
	Give control over learning	#	#		#
	Improve language skills	X	X		
	Motivating	X	X		
	Give good/useful information	X	X		
	Relevant to needs		X		
	Having more choices of topics	X			X
	Control over number of repetitions	X			X
	Good for practicing listening	X			X
	Possibility of listening to different voices and accents	X			X
	Source of authentic language	X			X
	Good for grammar review				X
	Auxiliary tool				X
	Storage medium				X
	Quicker to use	X		X	
	More individualised learning	X		X	

	Advantage of graphics, video and sound	X		X	
	Interactive	X		X	
	Learning to use computers			X	
	Quantity and range of information			X	
	Having the print facility			X	
	Enjoyable and fun			X	
	Relevant information			X	
Limitations	Not able to speak to computer	X			X
	Not able to write to computer	X			X
	No questions can be asked	X			X
	Mistakes are not pointed out by the computer	X			X
	No discussion	X			X
	No contact with peers and teachers	X			X
	No individualised explanation	X			X
	No alternative solutions	X			X
	Does not detect and address individual weakness	X			X
	Not able to practise pronunciation				X
	Less fun				X
	Less motivating				X
	Too much contact with computer				X
	No possibility to learn from peers				X

First, in Aryes' (2002) study, the students said that the benefits of CALL includes flexibility, interest for the learners, ease of use, gives control over learning, improves language skill, computers are motivating, and computers give good/useful information, which were also mentioned in this study. However, the students in this study did not mention relevance to needs.

Next, comparing the benefits of multimedia perceived by the students in this study and Wishart's (2000) study from Table 39, both studies found the benefits in that the CD-ROM is more interesting, easier and quicker to use, provides more individualised and interactive learning, and has the advantage of graphics, video and sound. However, the students in this study did not mention about learning to use computers, quantity and range of information, having the print facility, enjoyable and fun, and relevant information as the benefits in this study.

Next, comparing the benefits of multimedia perceived by the students in this study and in Trinder's (2002) study from Table 37, both studies found the benefits of flexibility concerning time, control over speed and path, having more choices of topics, control over number of repetitions, good for practising listening, possibility of listening to different voices and accents, and source of authentic language input. However, none of the students in this study mentioned about the CD-ROM being good for grammar revision, being a good auxiliary tool and storage medium.

Finally, comparing the limitations of multimedia with Trinder's (2002) study from Table 37, both studies found that the limitations were not able to speak or write to the computer, no questions can be asked, mistakes are not pointed out by the computer, no discussions, no contact with peers and teachers, no individualised explanation why something is wrong, no alternative solutions, and the computer does not detect and address individual weaknesses. However, the students in this study did not mention about not being able to practise pronunciation, being less fun, less motivating, too much contact with computers, and no possibility to learn from peers as the limitations in this study, and the researcher of this study suspected that this might have been caused by the presence of the teacher in class all the time during the in-class observations.

In Table 84, the data found in this study and in Ayres' (2002) and Wishart's

(2000) studies have two benefits in common: interest and ease of use, as shown in the grey shading with the '@' character. The data found in this study and in Ayres' (2002) and Trinder' s (2002) studies also have two benefits in common: flexibility and control over learning, as shown in the grey shading with the '#' character. The limitations in this study and Trinder's (2002) study have the following in common: not able to speak to computer, not able to write to the computer, no questions can be asked, mistakes are not pointed out by the computer, no discussion, no contact with peers and teachers, no individualised explanation, no alternative solution, and does not detect and address individual weaknesses.

9.423 Comparisons of Language Skills with other Chinese CALLs

The language skills found in this study were compared with those in the third literature review. The students in this study perceived listening and reading skills and vocabulary learning as the language skills they learned from the CD-ROM in Table 75. Chen and Cheng's (1976) PLATO System, Yu and Michaels' (1998) CyberChinese, Luk and Ng's (1998) Chinese Idiom, Li's (1996) HyperChinese, Lu's (1997) use of dictionary and Hong's (1997) Business Chinese software are used to compare with data in this study as shown in Table 85.

The PLATO System provided three areas for the student to choose from: vocabulary, grammar, and exercise. It also included pronunciation, intonation and Chinese character writing. CyberChinese consisted of pronunciation, tone, vocabulary, radical, and grammar. Luk and Ng (1998) implemented a program as an aid to learning Chinese idiom in Hong Kong. HyperCharacters facilitated character learning. Lu (1997) said computer dictionaries can be used as an aid in reading Chinese, learning pronunciation and meaning of word as well.

Hong's (1997) software enabled students to use online assistance functions, such as sound, glossary, and English definitions of certain phrases.

Table 85: Comparisons of Language Skills with other Chinese CALLs

	Click! [Table 83]	Chen and Cheng's (1976) Plato System [Page 184 of this study]	Yu and Michaels' (1998) CyberChinese [Page 185]	Luk an Ng's (1998) Chinese Idiom [Page 188]	Li's (1996) HyperChinese [Page 190]	Lu's (1997) use of dictionary [Page 191]	Hong's (1997) Business Chinese software [Page 191]
Listening	X		X				
Meaning of words	X		X	X		X	X
Pronunciation	X	X	X			X	
Intonation-tones	X	X	X				
Vocabulary	X	X	X	X			
Read and listen to sound/Reading	X		X			X	X
Chinese Character writing	X	X	X		X		
Grammar		X	X				

In Table 85, the language skills found in this study were similar to those in CyberChinese software which also offers listening, vocabulary learning and reading skills in addition to grammar. Similarly CyberChinese, in terms of general utility, was perceived to be most helpful to non-Asian students, such as the Portuguese students in this study. The language skills that were found among different nationalities in this study are compared with those with Yu and Michaels' (1998) CyberChinese as shown in Table 86.

Table 86: Comparison of Language Skills Learned by Different Nationalities in this Study and in CyberChinese

	Click! – This study [Table 85]			CyberChinese [page 186 of this study]		
	Cantonese	Macanese	Portuguese	Chinese	non-Chinese Asian	Non-Asian
Pronunciation	X	X	X	X	X	
Intonation	X					
Pinyin	X					
Chinese character writing		X	X			X
Meaning of word		X	X	X	X	
Usage of word						X

In Table 86, pronunciation is generally regarded as the most useful for all nationalities in both studies, even for students who are Chinese who do not speak the dialect. Chinese character writing is especially important for those students who are not familiar with the character format, such as Macanese, Portuguese students in this study and non-Asians in Yu and Michaels' (1998) CyberChinese study.

9.424 Comparison of General Improvements of CALL

The researcher compared students' suggestions of general improvements of CALL in this study with those found in Trinder's (2002) study in Table 87.

Table 87: Comparison of General Improvements of CALL

	This Study [Table 62 and 68]	Trinder's (2002) Study [page 244 of this study]
More interesting video	X	X
Better sound quality/Sound Control	X	X
Clearer user interface/attractive interface	X	X
Easier handling		X
A more comprehensive glossary	X	X
More personalised feedback	X	X
Correct answer on demand	X	X
Printout of completed sessions		X
Note down new vocabulary	X	X
A detailed progress report		X
A function that remembers and reacts to typical recurring/ mistakes		X
Links to explanation, corrections and activities		X
History recorded	X	
Full Installation on hard disk	X	

In Table 87, the students in this study and those in Trinder's (2002) have the following suggestions in common: more interesting video, better sound and control, better user interface, more comprehensive glossary, more personalised feedback, correct answer on demand, and a place to note down new vocabulary. These are probably areas where designers should pay attention.

9.425 Comparison of Students' and Teachers' Usage of CD-ROM

Finally, the researcher compared the views of the students and the teachers in this study and those of Wishart's (2002) study about CD-ROM usage in Table 88.

Table 88: Comparison of Students' and Teachers' view on CD-ROM usage

	This Study		Wishart's (2000) Study	
	Students [Table 49 and 61]	Teachers [Table 49 and 61]	Students [Table 38]	Teachers [Table 42]
Provides information			X	X
Having a print facility			X	
Interesting	X		X	
Quantity and range of information			X	X
Quicker to access and use	X		X	X
Graphics, sound and video	X	X	X	X
Easier to access and use	X	X	X	X
Different and new			X	
Assists learning and work		X	X	
Interactiveness	X		X	
Fun and exciting			X	
Used for teachers' own research				X
Made for more student centred learning	X	X		X
Used for teaching researcher skills				X
Teaching students IT skills				X
Uses as additional resources				X
Motivate students and staff	X			X

In this study, both the students and teachers agreed that the CD-ROM can provide graphics, sound and video, easier to access and use, and that it is made for more student centred learning. However, it is surprising to see that the teachers in this study did not mention that the CD-ROM is quicker to access and use. They probably did not think of the attributes of the media when they were considering the usage of the CD-ROM. Both the students and the teachers in this study and in Wishart's (2000) study agreed that CD-ROM could provide graphics, sound and video

capabilities, easier to access and use and that it is made for more student centred learning, as shown in the grey shading. The researcher interprets quantity of information, speed and ease of use, helps for learning, interactivity, fun and excitement as what is described as student-centred learning in Wishart's (2000) study, as highlighted by the oval shape and the arrow in Table 88.

9.43 Summary of the Third Literature Review

After comparing the data in this study with those that were found in the third literature review, the following items stood out. There is a common reason why students study a foreign language, that is to communicate, which is also a motivating factor in Mandarin learning. Those students who agreed that pronunciation, intonation and memorising were difficult and that they should pay more attention to these areas are more likely to be motivated to use the CD-ROM in their Mandarin learning. The students in this study probably might not have spent enough time or effort in finding out that there were actual difficulties in using the CD-ROM, such as too much information, not enough depth or detail, searching, eye strain, lack of availability, too complex, need to learn how to use it, time consuming, and restricted to the contents of the CD-ROM. The students in this study also did not find the following limitations: not able to practise pronunciation, less fun, less motivating, too much contact with computer, and no possibility to learn from peers. In comparing language skills with other Chinese CALLs, it is most similar to Yu and Michaels' (1998) CyberChinese which also offers listening, vocabulary and reading skills. The 'Click!' CD-ROMs and CyberChinese are most helpful to non-Asian students, such as the Macanese and the Portuguese students in this study. Pronunciation is most useful for all nationalities in this study and in Yu and Michaels' (1998) study and that Chinese character writing is especially important to non-Asians, such as the Macanese

or Portuguese students in this study. In general, designers should add the following when designing educational software: more interesting video, better sound quality and control, better user interface, more comprehensive glossary, more personalised feedback, correct answer on demand, and a place to note down new vocabulary. Students and teachers generally agreed that the CD-ROM provides graphics, sound and video capabilities, easier to access and use and that it is made for more student centred learning.

In this chapter, the Portuguese students throughout the interviews and the observations were discussed. Common characteristics of the Portuguese students were discussed and common issues were drawn from the data to help answer the first two research questions. Based on the common student types in Macao, the appropriate use of multimedia for different types of students was also answered. Finally the data found in this study were compared with those found in the third literature review. Now that the reader has a better understanding of this research, the conclusions and recommendations will be discussed in the next chapter.

Chapter 10: Conclusions and Recommendations

Conclusions and recommendations are presented in this chapter. This study is about beginning adult Mandarin learning using a multimedia CD-ROM. It focuses on three major issues: first the development, from existing textbooks and CD recordings, of the Mandarin CD-ROM 'Click!' series; second the use of an ethnographic research methodology to evaluate the first volume of the CD-ROMs, with the hope that the new experiences might alter the attitude and the motivation of the students; and third provision answers to questions as to the benefits and limitations of the multimedia CD-ROM and its appropriateness in Mandarin learning.

This chapter summarises the research carried out in this study in terms of its findings, limitations and recommendations. Findings include factors affecting Mandarin learning, multimedia and adult Mandarin learners, and multimedia and Chinese language. Limitations include the ethnographic research method, not using computer for the analysis of data, amount of invested effort being self-reported by students, limitations of multimedia in Mandarin learning and the CD-ROM development, evaluation of the 'Click!' CD-ROM, and evaluation of students' learning styles. Recommendations include Chinese CALL design consideration, the 'Click!' CD-ROM usage, assessment of teachers' and students' beliefs in Mandarin learning and Mandarin learning with multimedia, and the teacher's and the student's attitude and beliefs about using multimedia in Mandarin learning.

10.1 Findings

The data set in this study confirms that

1. Students who believe that audio is helpful are more likely to be motivated to learn Mandarin with the CD-ROM.
2. Students who have a need or an interest to learn Mandarin are more likely to be motivated to learn Mandarin with the CD-ROM.
3. Students who find Mandarin learning easy and CD-ROM usage easy are more likely to invest less mental effort in using the CD-ROM in their Mandarin learning.
4. Independent or visual learners with better computer skills or who like self-paced learning are more likely to be motivated to learn Mandarin with CD-ROM.

but disagrees with this theory:

1. The experience with multimedia CD-ROM can change students' attitude and motivation towards Mandarin learning with the CD-ROM.

The findings are discussed in terms of factors that affect Mandarin learning, multimedia and adult Mandarin learners, and multimedia and Chinese.

10.11 Factors affecting Mandarin Learning

Crystal (1997) and Oxford et al. (1993) identified some key factors that affect the learning of a foreign language. These factors are exposure to native users, regular practice, language learning strategies, teaching objectives, gender, course level, previous foreign language experience, language learning style, motivation, attitude and teaching methods. The researcher discusses these factors in terms of Mandarin learning and Mandarin learning with the CD-ROM in this study.

As far as exposure to native users and regular practice are concerned, the CD-ROM provides authentic recordings enabling the students to practise at any time. The students in this study found that the sound provided by the CD-ROM were

standardised with higher quality. However, one teacher said that how much they practise depends on their own perseverance and persistence in learning and one student said that he is too lazy in Mandarin learning. Wipf (1984) suggested that if the listener could identify with the content, then motivation would be enhanced. The researcher suggests that teachers should choose materials that are familiar to students to promote their interest in practice and learning.

As far as gender goes, Aryes (2002) found that there were no statistically significant differences between learners of any particular gender or nationalities when analysed according to perceived usefulness and ease of use. Sung and Padilla (1998) found that female students had higher instrumental/integrative motivation to learn Asian languages. Most of the students in this study were female students, so the researcher claims that they are more motivated to learn Mandarin than their male counterpart.

As far as course level goes, Sung and Padilla (1998) found that students in the advanced classes reported having greater motivation than did beginning level students, in instrumental/integrative motivation, ethnic heritage-motivation, and personal interests-related motivation. Therefore it is not surprising to find that students in this study did not generate enough motivation to carry on the in-class observation study since they were in the beginning level course.

As far as teaching objectives go, the Mandarin teacher who was assigned to teach the Portuguese group made the decision to emphasise communication skills. The teacher preferred the students to practise their speaking skills with him and their listening skills with the Mandarin CD-ROM, whether in class or at home. So listening skill was the objective of the CD-ROM development in the in-class observation study. The teaching method used in this study was a combination of the audiovisual method, with sound and visual effects in the CD-ROM and the direct

method, practising Mandarin conversation in class.

As far as learning strategies go, since both the students in the pilot and the main study viewed that pronunciation, intonation and memorising were difficult in Table 81, the researcher assumes that they would put effort in these areas and that becomes their learning strategies. During the in-class observations, some students liked to copy notes while others liked to look for conversation partners. Crystal (1997) said that students can benefit from being taught to learn techniques of memorisation. The researcher suggests that the students can memorise more if they apply more learning strategies or simply put more effort into their learning.

As far as previous foreign language experience goes, based on the results of Bar-Lev's (1995) study, the researcher concludes that the Cantonese or the Macanese students with home exposure may also tend to rely on switching to Cantonese as a strategy for easier access to a word. They may tend to make less vocabulary errors and seem to be better in Chinese word-order. However, they may speak with a less standard Mandarin accent because of their previous experience.

As far as learning style goes, the researcher proposed the relationship between Dunn and Dunn learning styles model and Mandarin learning with the CD-ROM in Figure 20. She was interested in finding out if the students were inductive/deductive learners, visual/auditory learners, liked to work on their own, with pairs or in group, what were their attitudes and motivation, and how they dealt with the computer environment with the CD-ROM. During the in-class observation study, some students were observed to be visual learners, some were auditory learners, some liked to work in a group. The researcher of this study suggests that collaborative learning may be appropriate for some students.

As far as attitude is concerned, Crystal (1997) said that attitude towards the foreign language is important. If a student perceives a country or culture to be

unpleasant, the negative attitude is likely to influence language learning achievement. Most of the students in this study seemed to have positive attitudes toward Mandarin learning or Mandarin learning with the CD-ROM since they are mostly Chinese and they like the sound of the language and the use of the CD-ROM in Mandarin learning. During the in-class observations, the researcher could group one student as having defensive attitude and the rest of the students as having receptive attitude towards Mandarin learning with the CD-ROM.

As far as motivation is concerned, Wlodkowski (1999) said that when motivation to learn is very low, then potential learning achievement would be diminished. If people are given learning tasks that are beyond their ability, no matter how motivated they are, they will not be able to accomplish them. Nine out of the ten students in the in-class observation study could be considered as motivated students in Mandarin learning with the CD-ROM in the beginning of the study. However, the motivation of the students was getting lower and lower towards the end of the study. Maybe Mandarin learning was really difficult for them or they may be going back to Portugal soon and they won't need to know Mandarin any more.

The experience of the multimedia CD-ROM did not change the attitude and motivation of these students locally. Though students' attitude and motivation towards Mandarin learning or Mandarin learning with the CD-ROM were not altered after the use of the CD-ROM in this study, there was evidence in this study that students do like the use of the CD-ROM and that they can use it for self-study, which is suitable for the adult learners who do not have much time to study with the teacher.

The researcher of this study concludes that interest and needs are the driving forces of attitude, which in turn affects motivation, as shown in Figure 20. Since the students in the in-class observation study had no need to study Mandarin, then interest was the only driving force. The researcher suggests the key to the success of any

teaching materials is to be able to arouse the interest of the learners.

10.12 Multimedia and Adult Mandarin learners

Not all multimedia components are appropriate for all learners. From Table 12, text seems more appropriate for advanced learners, audio or audio with text is more appropriate for weak readers, and pictures or videos are more appropriate for strong students in Mandarin learning with the CD-ROM. Further investigation of audio and video came up with the following conclusion, the best use of video with subtitles is in listening and reading for intermediate and advanced learners and that audio with text is probably beneficial for weak readers.

Najjar (1996) and Bagui (1998) suggested some reasons why multimedia instruction is successful. The reasons are reduced instruction time, interactivity, self-paced learning, self-directed learning, flexibility, motivational effects, information chunking, having rich content, dual coding, better-organised instructional materials and novelty. In the conclusion of the multimedia and foreign language learning chapter, it was found that in the order of appropriateness of success of multimedia instruction, interactivity ranks the top, followed by self-paced learning/self-directed learning/motivational effects, and information chunking/rich content/dual coding. The students in this study found that interactivity, self-paced learning, self-directed learning, motivational effects and dual coding were the benefits of the multimedia CD-ROM. However, the students in this study did not mention information chunking as its benefit and they even identified that limited materials in the CD-ROM as its limitation. Therefore, interactivity, self-paced learning, self-directed learning, motivational effects and dual coding are factors that are more appropriate to Mandarin learning with the CD-ROM with this group of adult students in Macao.

Stemler (1997) discussed five features in educational multimedia that are used for instructional purposes. These five features are screen design, learner control and navigation, use of feedback, student interactivity, and video and audio elements. Effective screen design, learner control and navigation, feedback, the proper use of video and audio create an interactive, stimulating environment for the learners. Because of the interactivity of the CD-ROM, the students in this study found that they can use the Mandarin CD-ROM for self-paced and self-directed learning. They liked to use the CD-ROM to listen to the audio to learn intonation, pronunciation, and vocabulary; and they liked the pause and go, branching and navigation, and searching capabilities. Screen design, learner control and navigation and use of feedback probably made it easier for the students to learn. However, the students in this study preferred a more attractive interface.

Stoney and Oliver (1998) suggested that the factors influencing motivation and engagement of adults are learner attributes of immersion, reflection, play and flow, collaboration, learner control, curiosity, fantasy, and challenge. Immersion was not seen in this study because games were not provided as part of the software and the teacher in the pilot study said that the CD-ROM does not provide a language-learning environment for the students to immerse into learning. A little reflection and play was observed is this study when students were taking the tests during the in-class observation study. Tests provided time for reflection and for play and flow, avoiding boredom and anxiety. Student and student, student and teacher, and student and computer collaboration were observed in class.

The screen design of the program allows learner control and students also perceived learner control as an advantage of the CD-ROM. Stoney and Oliver (1998) said that adults are not as curious as children. To build curiosity into an interactive multimedia program there should be elements of novelty, complexity, surprise, and

incongruity. The students were curious enough to participate in the in-class observation study. But as novelty wore off, curiosity also waned. Rieber (1996) claimed that fantasy is used to encourage learners to imagine that they are completing the activity in a context in which that they are really not present. During the in-class observation study, the students could practise the dialogue in the Text section to pretend that they are having a conversation with a native speaker. However, students in this study were observed to be bored in class. Maybe that was the end of the novelty effect. Rieber (1996) also claimed that people must constantly be able to match challenge with their current skill or ability; otherwise they will be bored. Maybe the CD-ROM was not challenging enough for the students and that they were bored and that did not change their attitude and motivation in Mandarin learning with the CD-ROM. Fun and curiosity were reasons why the students studied Mandarin in the main study, so the question was how long can fun and curiosity last? The interest of those students dwindled as the in-class observation study took place. The Mandarin CD-ROMs in this study can probably provide the most in the area of learner control, reflection, play and flow, and collaboration in influencing motivation and engagement of adults in multimedia learning.

As shown in Table 78, the Mandarin CD-ROMs are more appropriate for visual students, for independent students and those students with better computer skills, for low-prior knowledge students, or for students who like self-paced, self-directed learning to learn Chinese character writing, pronunciation, meaning of words, vocabulary and word-order.

Those students who have a need or an interest to learn Mandarin and liked to listen and repeat the sound after the CD-ROM are more likely to be motivated to use the CD-ROM in their Mandarin learning. The students in the pilot study found that their perceived demand characteristics (PDC) of Mandarin learning were high and the

students in the main study found that their perceived demand characteristics (PDC) of Mandarin learning were low. Regardless whether the perceived demand characteristics (PDC) of Mandarin learning were high or low, since their perceived self-efficacy (PSE) of the use of CD-ROM was high, they are likely to invest less mental effort in using the CD-ROM in their Mandarin learning.

10.13 Multimedia and Chinese language

Newnham (1987) suggested the modern approach for learning Chinese is via sounds alone. Gough, Juel, and Griffith (1992) and Ho and Bryant (1997) both identified problems of the logographic readers. The first is a memory problem. The second problem is the inability to read novel words. Evidence from this study suggested that the CD-ROM can be helpful for those who like to learn with the approach of sound in Mandarin learning and for logographic readers.

Ho and Bryant (1997) said that Chinese tone is simply part of a word's pronunciation, which was a problem faced by many learners in this study. According to Newnham (1987), Chinese is famous for its frequent homophones (same sound, different meaning). One student in this study found this problem. The students in this study generally found that they can learn the tone of the Mandarin language with the help of the CD-ROM.

The language skills that were found in the literature review that are more appropriate to learn from the CD-ROM are listening and reading skills. The language skills that the students in this study found that are appropriate to Mandarin learning are vocabulary learning, listening and reading skills. The data in this study seems to match those that were found in the literature review except for vocabulary learning. The reason that there is a discrepancy is probably because vocabulary learning is more important in the Chinese language learning as stated by Lin (2000)

and Chiang (2002).

The questions from the interviews gathered important information about how the students in this study perceived Mandarin learning and multimedia. It was found that the reason why they studied Mandarin was because it was useful, they could communicate with others in Mandarin, or they simply wanted to learn the language. The students in both the pilot interview and the main interview found difficulties in pronunciation, intonation, and memorising. Most students and teachers in this study generally agreed that pronunciation and intonation were the most difficult. Evidence in this study suggested that the CD-ROM can be helpful for those who have problems with pronunciation, intonation, and memorising.

The students in the follow-up study thought that the teacher facilitates learning and the teachers do not have to teach everything and they can have more time to interact with students in class. The CD-ROM cannot replace the teacher and will not make the role of the teacher redundant. It is only a tool that can definitely help both the teacher and the student. It cannot correct sound and only provides one-way communication. It is good for reference where students can listen and study at home. Human relations are still very important. The students in this study suggested spending 50% to 70% with the teacher. Three out of four students preferred that teachers explain the materials first. However, one student preferred to explore the CD-ROM at home first. Li (1996) suggested that in the process of applying technology, the instructor's role might change but the teacher will always be a significant learning resource and an indispensable guide for leading individual students through the learning process.

10.2 Limitations

In this section, the limitations are discussed in terms of the ethnographic research method, not using computer for the analysis of data, amount of invested effort being self-reported by students, limitations of multimedia in Mandarin learning and the CD-ROM development, evaluation of the 'Click!' CD-ROM, and evaluation of students' learning styles. Novak-Aitken (1993) outlined some limitations for the use of ethnographic methods in technology research as the researcher's subjectivity and bias and difficulty in replicating a study, since it is generally intended as an examination of a specific situation. Charmaz (2000) said that grounded theory can only portray moments in time. The researcher realises that one limitation of this study is that it may be subject to bias and cannot be generalised in a different setting. Observer effects may have been inevitable in this study.

In terms of research methodology, the researcher used the ethnographic research method with the constructive/interpretive paradigm. Charmaz (2000) has reservations about using computer to analyse her data with the reasons that software packages appear more suited for objectivist work than constructivist approaches and that interpretive work cannot be reduced to a set of procedures with the computer software. With the constructive/paradigm approach, the researcher did not use any computer software to assist the analysis of data based on Charmaz's (2000) suggestion. Without the computer to assist, she may have missed out some minor details. However, the researcher still suggests to those who are taking the constructive/interpretive paradigm to refrain from using computer software if possible, to allow more freedom and imagination while interpreting the data. What the students actually say and what they actually mean can be different. For example, the students in this study said that they found no difficulty in using the CD-ROM, did

they mean no difficulty or were they too embarrassed to say that they have problem using it. The computer could not interpret this. During the in-class observations, Orlanda only attended one lesson and Juana only attended two lessons. The researcher interpreted that Orlanda might not like using the computer to learn Mandarin and that Juana did not like not learning Chinese character in class. The computer could not have interpreted these situations.

Wetzel, Radtke, and Stern (1994) suggested that although the direction of the relationship between amount of invested mental effort (AIME) and learning performance appeared to be positive, the weakness with the proposed theory appeared in the predictive links between the various preconceptions and self-reports and their actual effect on learning performance. Salomon (1983) acknowledged the problems associated with perceived demand characteristics and perceived self-efficacy were heavily reliant on self-report by subjects. Therefore the researcher can also say that the self-reports made by the students in this study who claimed that there was no difficulty or that everything was easy may not be totally reliable.

The limitations of multimedia in Mandarin learning found in this study and Trinder's (2002) study have the following in common: not able to speak to the computer, not able to write to the computer, no questions can be asked, mistakes are not pointed out by the computer, no discussion, no contact with peers and teachers, no individualised explanation, no alternative solutions, and the computer does not detect and address individual weaknesses. Because of time and money constraints and lack of existing resources, speech recognition technology, vocabulary building by means of picture based exercises, and listening comprehension development based on video clip were not considered in the CD-ROM development. If the researcher had the time to do it all again with unlimited resources, she would add in speech recognition technology, pictures and movie clips in the CD-ROM development; and she would

probably try to add in more artificial intelligence capability to address the limitations of the CD-ROM.

Pawling (1999) used multimedia dictionary on a CD-ROM for vocabulary acquisition, Leffa (1992) used electronic glossary/dictionary to support the reader with their understanding of vocabulary, and Davis (1997) used computerised marginal glosses for L2 reading. The researcher also developed a glossary and a dictionary in volume II and III of the 'Click!' CD-ROM series to try to assist the students in their vocabulary learning and reading. Because of the time constraints of this study, the researcher regrets to say that she did not include an evaluation of the dictionary and the glossary. If she were to start the research all over again, she would evaluate the usage of the dictionary and glossary of the CD-ROM to find out the true benefits of these tools in Mandarin learning for the local students in Macao.

After the third literature review, the researcher realised that she did not fully evaluate the learning styles, initial language skills and computer skills, perceived demand characteristics, perceived self-efficacy and preferences of the adult Mandarin learners. She found out that some students were visual, auditory or independent students only through the in-class observation study. In fact, she did not really know the computer skills or the language aptitudes of the students other than what was observed. A lot of assumptions have been made. She found out that some students had previous experience with Mandarin learning and that they enjoyed self-paced learning only though the interviews. She had to put together her thoughts and ideas from everywhere, in-class observations and in-depth interviews. If she were to start the research all over again, she would develop further instruments, by putting everything in one place, to help learn more about students' aptitudes, learning situation, learning strategies, perceived demand characteristics, perceived self-efficacy, motivation and attitude.

10.3 Recommendations

The researcher intends to make recommendations in Chinese CALL design consideration, the 'Click!' CD-ROM usage, assessment of teachers' and students' beliefs in Mandarin learning and Mandarin learning with multimedia, and the teacher's and the student's attitude and beliefs in using multimedia in Mandarin learning.

10.31 Chinese CALL Design Consideration

In terms of Chinese CALL design consideration, based on the suggestions given by students in this study and Trinder's (2002) study from Table 87, the researcher suggests to educational designers to consider the following when designing software: more interesting video, better sound quality and control, better user interface, more comprehensive glossary, more personalised feedback, correct answer on demand, and a place to note down new vocabulary. Speech recognition will be very useful to learners.

Reeves (1992) said that individual differences among users with respect to aptitude, knowledge, skills, attitudes, personality characteristics, previous experience, motivation must be accounted when designing or evaluating software and Lin (2000) and Chiang (2002) discussed about beginning Chinese learning with the emphasis on vocabulary learning and from the learners' perspective. The researcher of this study suggests that when designing multimedia CD-ROM learning materials for students, the students' perceived difficulty in that subject must be evaluated first. Once the difficulty is found, then these can be implemented in the CD-ROM with the hope to help them to conquer these difficulties. Then what the students enjoy the least about learning that subject should be determined. Knowing what the students enjoy the least, the designer can try to make the multimedia material as interesting as possible to avoid those problems. Finally motivation and reasons why students study should

be also determined. Knowing the motivation and reasons why students study can determine teaching methods and how to apply technology. It was observed in this study that the use of the CD-ROM saves class instructional time. Knowing that the CD-ROM can save instructional time because of its translation and recording, the teacher should consider using class time more efficiently. Since the CD-ROM can never replace the teacher and that it can never provide any human contact such as being able to answer any question or being be able to communicate, the role of the teacher is still as strong as ever.

10.32 The 'Click!' CD-ROM Usage

When learning Mandarin, Chu (1997) said that emphasis must from the beginning be put, first, on the correctness of pronunciation, and second on the capability in character-recognition and the production of this language. Yu and Michaels (1998) said that the written Chinese language requires the beginning student to learn three written forms of each new vocabulary item: romanisation, traditional Chinese character, and simplified Chinese character. In Table 75, the students in this study perceived that the Mandarin CD-ROMs are appropriate to use in the area of listening skill, reading, and vocabulary learning. In terms of CD-ROM usage, the researcher of this study recommends that the 'Click!' CD-ROMs can be used in Mandarin learning as in Table 89.

Table 89: How to Learn Mandarin with the 'Click!' CD-ROMs

	Sections in the CD-ROM
Romanisation	New Words, Glossary, Dictionary
Pinyin	Speech Sound Table, New Words, Tone/Sound Exercise, Text
Pronunciation	New Words, Tone/Sound Exercise, Text
Simplified and traditional Chinese character	Animated Character, Text

Vocabulary	New Words, Glossary, Dictionary
Listening	Text
Reading	Text

Since some students in this study found that the use of the CD-ROM can be boring and not entertaining when using it alone, the researcher suggested that collaborative learning can be encouraged while using the CD-ROM.

10.33 Assessment of Teachers and Students' Beliefs in Mandarin Learning and Mandarin Learning with Multimedia

Several authors in the literature review used different ways to assess students' learning style. Simonson, Aegerter, Berry, Kloock, and Stone (1987) used the GEFT (Group Embedded Figure Test), to determine whether the students tended to be either Field Dependent (FD) or Field Independent (FI) learners. Dunn and Griggs (1995) suggested using the Dunn, Dunn, and Price Learning Style Inventory to assess students' learning styles. Horwitz (1988) used the Beliefs about Language Learning Inventory (BALLI) to assess students' language learning experience (see Table 10). Gardner and MacIntyre (1993) used the Attitude/Motivation Test Battery (AMTB) to measure attitude and motivation. In order to assess the students' skills for Mandarin learning, based on the results of this study, the researcher suggests evaluating learning styles, initial language skills and computer skills, perceived demand characteristics, perceived self-efficacy, preferences, attitude and motivation of adult Mandarin learners. Based on the format of the BALLI developed by Horwitz (1988), the researcher developed the questionnaire, Beliefs About Mandarin Learning Inventory (BAMLI) in Table 90. The BAMLI consists of the following categories: 1) perceived demand of Mandarin learning; 2) aptitude; 3) the nature of Language learning; 4) learning and communication strategies; 5) motivations and expectations; 6) attitude towards learning situation; 7) learning/teaching situation.

Table 90: Beliefs About Mandarin Learning Inventory (BAMLI)

Questions for the Students	Questions for the Teachers	Purpose
Perceived Demand of Mandarin learning	Perceived Demand of Mandarin learning	
A1. Mandarin is a very difficult language	A1. Mandarin is a very difficult language	Perception of Mandarin learning, PDC
A2. I have a need to learn Mandarin		PDC, Reason
A3. I am learning Mandarin for fun		PDC, Reason
Aptitude		
B1. I have foreign language aptitude		Language skill
B2. I believe that I will ultimately learn to speak Mandarin very well		Language skill
B3. I have studied Mandarin in the past		Past Experience
B4. I am very good with computer		Computer Skill, PSE
B5. I am a very good reader		Language skill, PSE
The Nature of Language Learning	The Nature of Language Learning	
C1. It is necessary to know the foreign culture in order to speak the foreign language.	C1. It is necessary to know the foreign culture in order to speak the foreign language.	Attitude towards the people or interest

C2. It is better to learn a foreign language in the foreign country.	C2. It is better to learn a foreign language in the foreign country.	Inductive learning/direct method
C3. Learning a foreign language is mostly a matter of learning a lot of new vocabulary words.	C3. Learning a foreign language is mostly a matter of learning a lot of new vocabulary words.	Reading method
C4. Learning a foreign language is mostly a matter of learning a lot of grammar rules.	C4. Learning a foreign language is mostly a matter of learning a lot of grammar rules.	Deductive learning/Grammar method
C5. Learning a foreign language is mostly a matter of translation.	C5. Learning a foreign language is mostly a matter of translation.	Deductive learning/Grammar and translation method
Learning Strategies	Learning Strategies	
D1. It is important to repeat and practise a lot.	D1. It is important to repeat and practise a lot.	Preference-use of CD-ROM/ Audiolingual method
D2. It is important to practise in the language laboratory.	D2. It is important to practise in the language laboratory.	Preference-use of CD-ROM/Audiolingual or audiovisual method
D3. I like to copy notes in class		Visual
D4. I like to have speak Mandarin with my classmates in class		Auditory
D5. I like to control the time and the pace of my learning		Self-paced
D6. I like to work in group, with my friends		Dependent students

D7. I prefer learning with the teacher		Preference
Communication Strategies	Communication Strategies	
E1. It is important to speak Mandarin with an excellent accent.	E1. It is important to speak Mandarin with an excellent accent.	Direct method
E2. I feel self-conscious speaking Mandarin in front of other people.		Language use Anxiety
E3. I do not like to read in class.		Classroom anxiety
Motivations and Expectations		
F1. I need to speak Mandarin at work.		Instrumental motivation or need
F2. If I get to speak Mandarin very well, I will have many opportunities to use it.		Instrumental motivation or need
F3. If I learn to speak Mandarin very well, it will help me get a job.		Instrumental motivation or need
F4. I would like to learn Mandarin so that I can get to know its speakers better.		Integrative motivation or interest
F5. I really enjoy learning Mandarin.		Integrative motivation or interest
Attitude towards learning situation		
G1. I like the teaching method.		Attitude towards teacher

G2. I like the teaching hours.		Attitude towards course
G3. I like to use computer		Attitude towards computer
G4. I like Mandarin		Attitude towards the language
G5. I like people who speak Mandarin		Attitude towards the people
Learning Situation	Teaching Situation	
H1. I have a computer to use	H1. I have a computer to use	Computer skill
H2. I like to use the multimedia CD-ROM for self-study	H2. I think students can use multimedia CD-ROM for self-study	Preference/belief
H3. I like to use the multimedia CD-ROM in Mandarin learning	H3. I think students can benefit a lot from multimedia CD-ROM	Preference/belief
H4. I like to learn with computer in class	H4. I like to use computer to teach in class	Preference
H5. I do not have much time to study		Integrative motivation or interest [if the student has the interest, he or she may find the time to study]

Table 90 can be used to determine students' learning styles, initial language skills and computer skills, perceived demand characteristics, perceived self-efficacy, preferences, attitude and motivation of adult Mandarin learners. For learning styles, questions D3 to D6 can be used. For initial language skills and computer skills, questions B1 to B5 and H1 can be used. For perceived demand characteristics, questions A1 to A3 can be used. For perceived self-efficacy, questions B4 and B5 can be used. For preferences, questions H2 to H4 and D7 can be used. For attitude, questions G1 to G5 and C1 can be used. For motivation, questions F1 to F5 and H5 can be used.

Table 90 can also be used to assess the reasons and interest of Mandarin learning and to measure the language and classroom anxiety of a language learner. For reasons of studying Mandarin, questions A2 and A3 can be used. For interest of studying Mandarin, questions F5 and H5 can be used. Finally, to measure language anxiety and classroom anxiety, question E2 and E3 can be used, respectively.

In Table 90, based on the lessons learned, the researcher of this study is simply trying to develop further instruments, by putting everything in one place, to address the limitation addressed in the limitations section about not able to fully evaluate the learning styles, initial language skills and computer skills, perceived demand characteristics, perceived self-efficacy and preferences of adult Mandarin learners in this study.

10.34 A Teacher's and a Student's Attitude and Beliefs in using Multimedia in Mandarin Learning

Finally, from the conclusion drawn in this study, that the multimedia CD-ROM did not change the attitude and the motivation of the students in the main study, therefore, suggestions are made about how to find the difference between a teacher's and a student's attitude and beliefs in using multimedia in Mandarin learning. In

Figure 15, the researcher suggested to teachers to look at the teaching methods along an axis, with induction and deduction on each end. In Figure 34, the researcher put Clark and Kozma's argument along an axis, with no significant difference (NSD) on one end and significant difference (SD) on the other end of the spectrum. Figure 38 is created by putting teaching methods on the horizontal axis and influence of multimedia technology on the vertical axis.

Figure 38: A Teacher's Attitude and Belief Triangle in Using Multimedia in Mandarin Learning

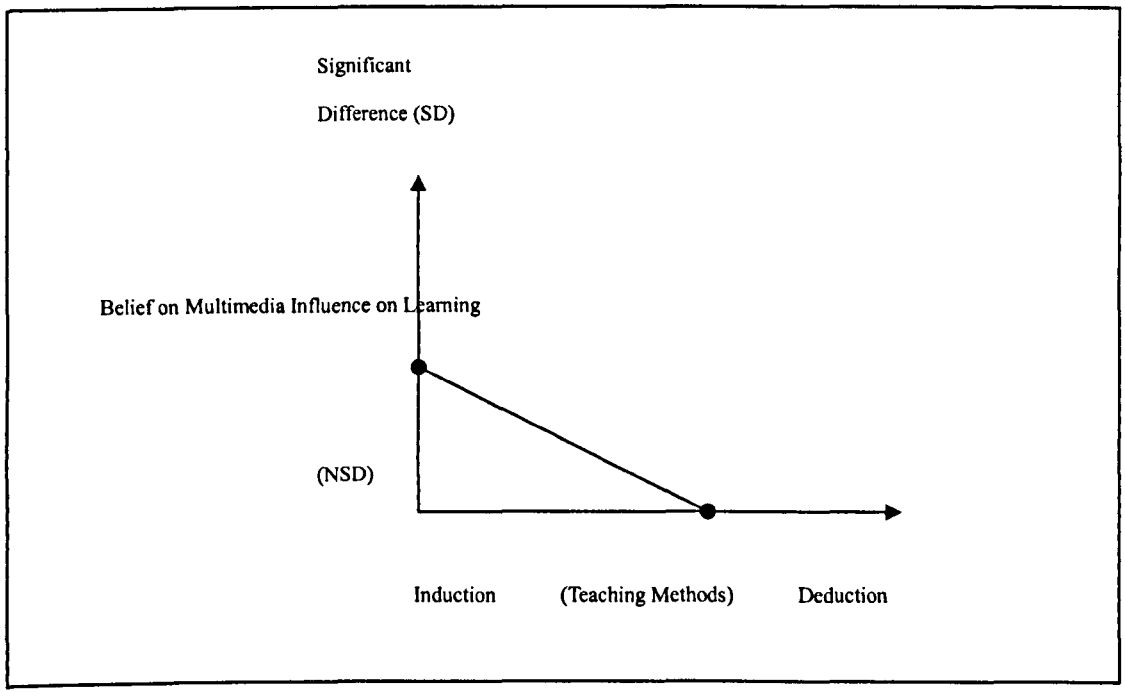


Figure 38 represents the attitude and belief of a teacher for using multimedia technology in a particular language course, and each teacher should have a different triangle. The size of the triangle has no meaning; it is only being used to measure against the attitude and belief of a student. Depending on the objective of the language course, the teaching method being used, whether there should be more inductive or more deductive reasoning, the teacher will place a dot on the induction-deduction horizontal axis. Depending on the belief of the teacher from his or her previous experience, the teacher will place a dot of the SD-NSD vertical axis.

By connecting the two dots to form the triangle, the teacher's attitude triangle is formed.

Felder and Henriques (1995) said that students learn in many ways—by seeing and hearing; reflecting and acting; memorising and visualising; reasoning logically and intuitively and how they reason will affect how they learn. Some students are more comfortable with inductive than deductive reasoning. Whether or not the students are inductive or deductive learners can be placed along the horizontal axis, as shown in Figure 39, to measure the student's reasoning skill. As far as students' attitudes and beliefs go, whether or not they prefer teacher-taught classes or why they want to use multimedia CD-ROM will also determine their willingness to use the CD-ROM, as shown in Trinder's (2002) and Wishart's (2000) studies. A student's willingness in using multimedia will be placed on the vertical axis, assuming that if he or she is willing to use multimedia, at least it will make a difference in his or her learning.

Figure 39: A Student's Attitude and Reasoning Triangle in Using Multimedia in Mandarin Learning

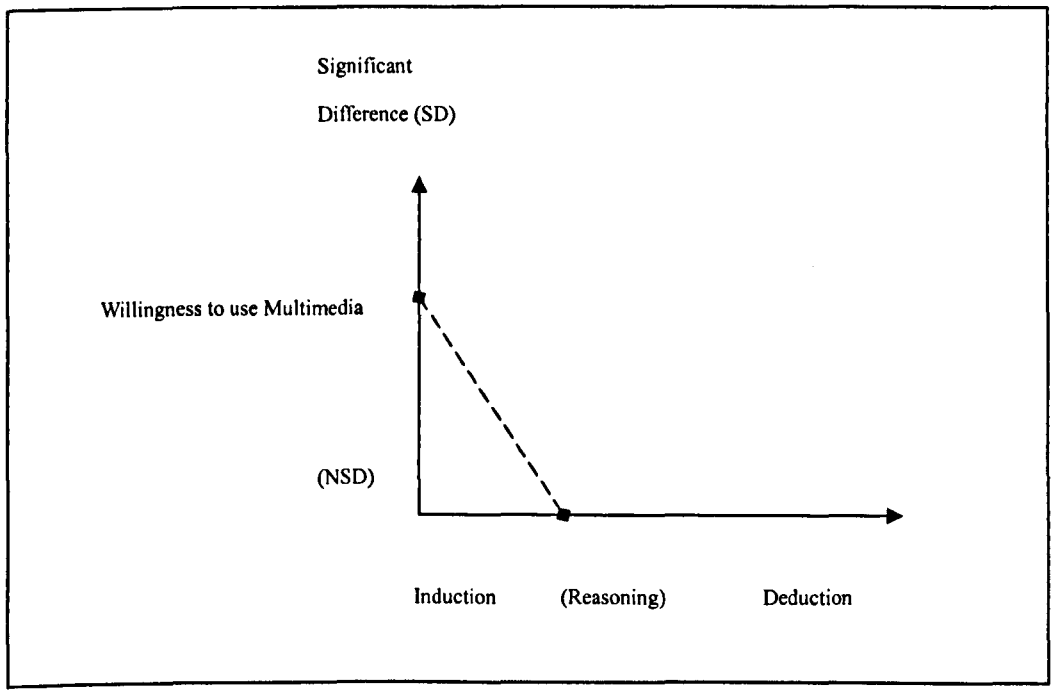
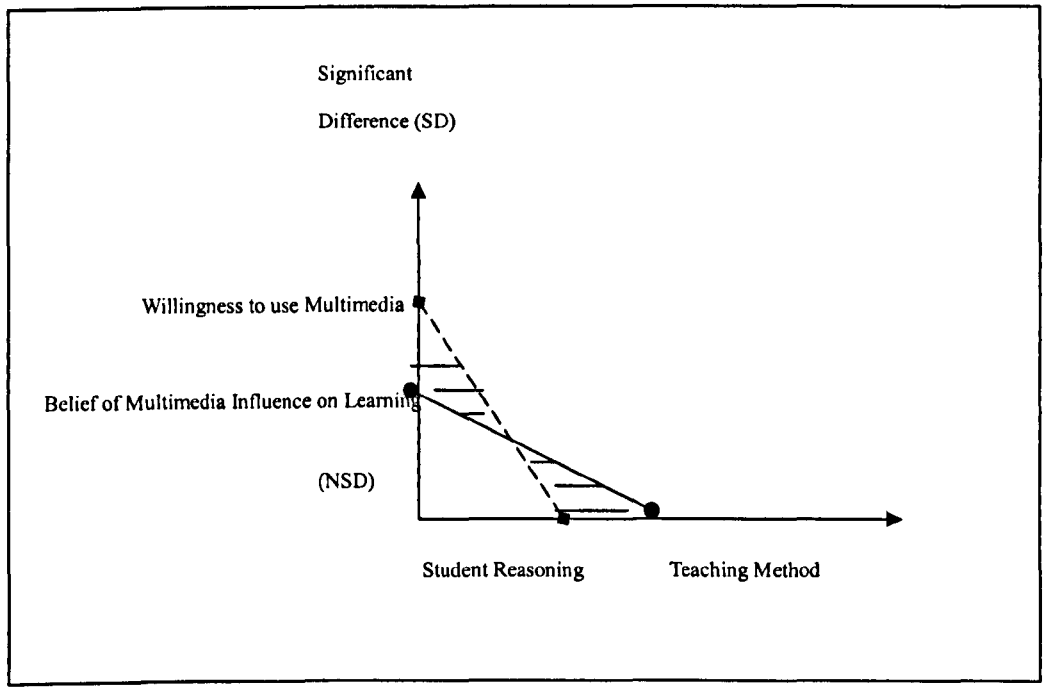


Figure 39 represents a student's attitude triangle in using multimedia in language learning and this could be matched against that of a teacher's point of view. By combining Figure 38 and Figure 39, two overlapped triangles are created as shown in Figure 40.

Figure 40: Difference between a Teacher's and a Student's Attitude and Belief Triangles in using Multimedia in Mandarin Learning



In Figure 40, the difference between a teacher's and a student's attitude and beliefs is shown in the striped area. If there is a difference on the induction-deduction axis, the teacher should try to adjust the teaching method. If there is a difference on the SD-NSD axis, the teacher should try to evaluate his or her own belief, whether or not he or she is using technology enough to assist the student or whether or not the multimedia CD-ROM is able to motivate the student to use technology more. Teachers should not be discouraged by the differences because Kern (1995) suggested the possibility that teacher's beliefs may be influential at the

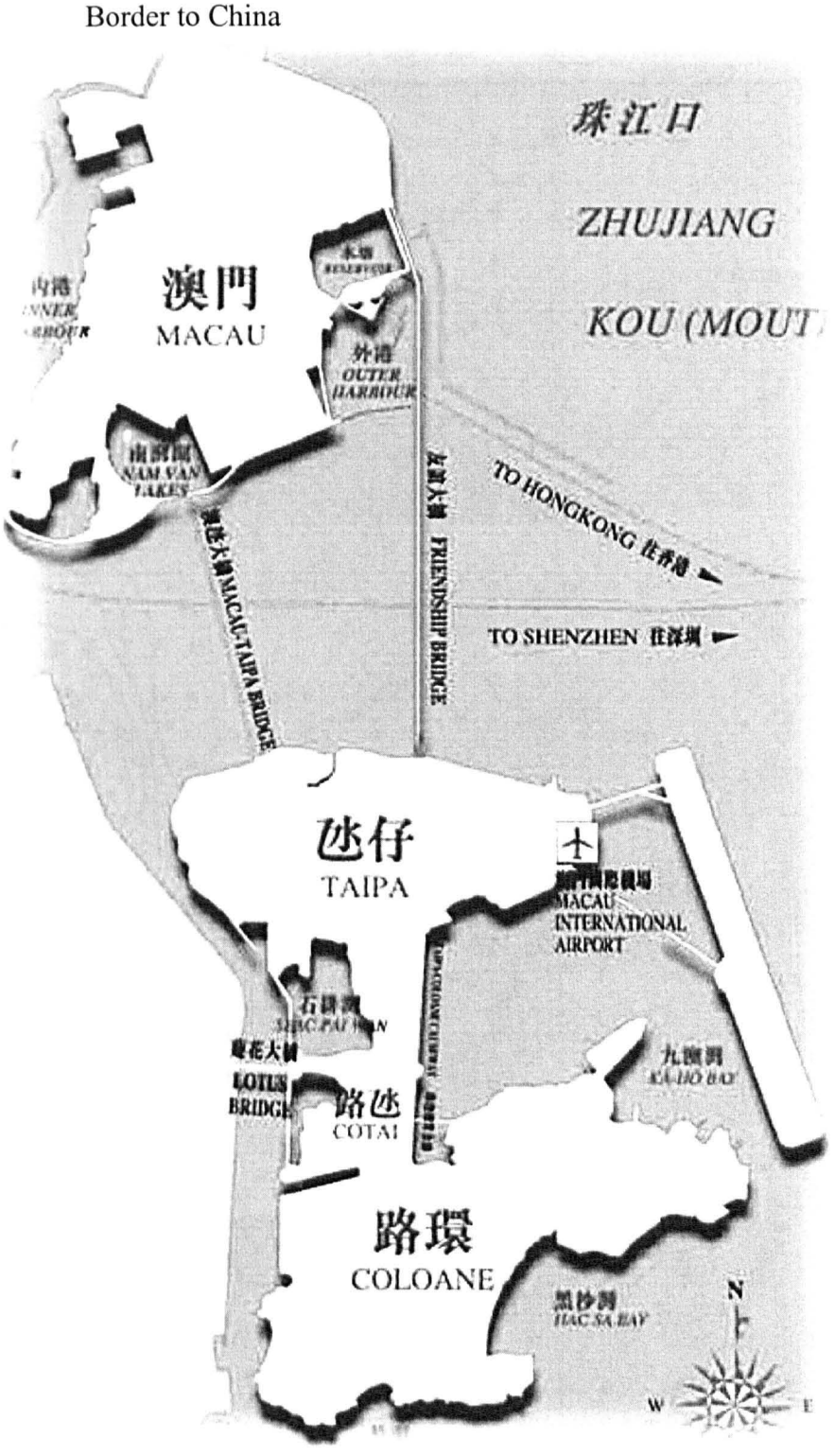
level of the individual. An ideal case of the difference triangle will be two overlapped straight lines.

The teachers can use the BAMLI discussed in Table 90 to determine which teaching methods they prefer to use, their beliefs on use of technology and whether or not it makes any significant differences in Mandarin learning. The students can use the BAMLI to see if they like to use inductive or deductive method of learning and their willingness to use multimedia or computer in their Mandarin learning. Questions C2 to C5, Questions D1 to D2 and Questions E1 can be used to determine teachers' teaching methods and students' learning approaches. Questions H2 and H3 can be used to determine teachers' belief and students' preferences of multimedia usage. These questions can be put on a Likert-scale indicating a response ranging from strongly agree to strongly disagree, from a scale of 1 to 5. The points averaged from questions C2 to C5, D1 to D2 and E1 can be used to plot the horizontal axis and the points averaged from H2 and H3 can be used to plot the vertical axis.

Future researchers can try to make adjustment to the BAMLI questionnaire to suit their needs and test this attitude and belief triangle out with their students and also try to evaluate more ways in assessing students' learning styles, initial language skills and computer skills, perceived demand characteristics, perceived self-efficacy, preferences, attitude and motivation of Mandarin learning with multimedia technology/CD-ROM.

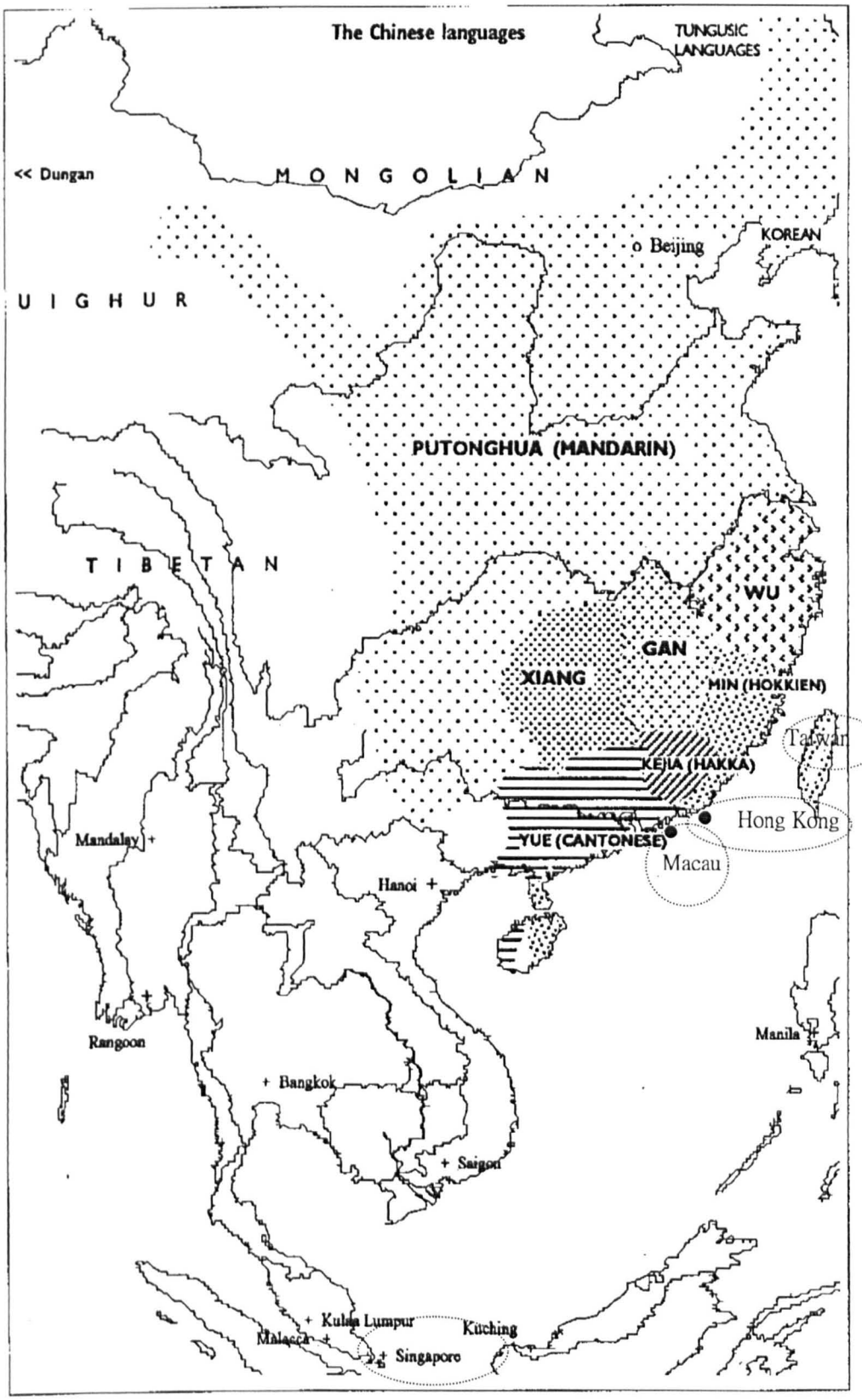
The last word that the researcher of this study likes to leave behind for teachers is that it is imperative to find ways to use technology to do what traditional teaching cannot do. Just as Armstrong and Yetter-Vassot (1994) said, it is how technologies are being used that will eventually affect how students learn.

Appendix 1: Map of Macao

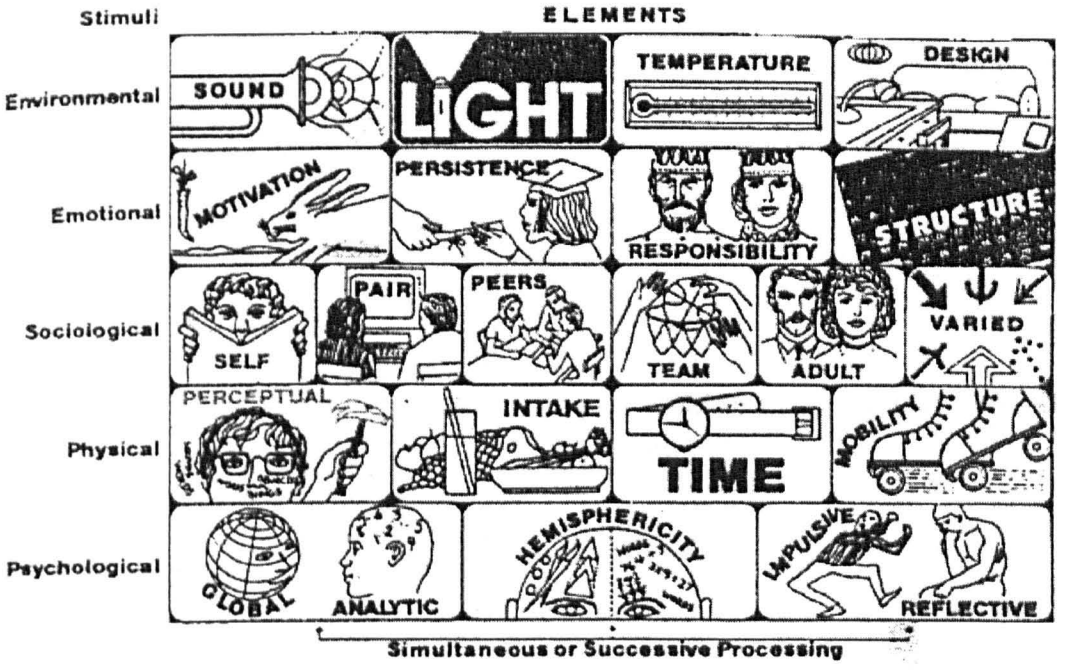


Source: http://www.macautourism.gov.mo/english/map_en.htm

Appendix 2: Dialect Map of China (Dalby, Andrew, 1998, p. 129)

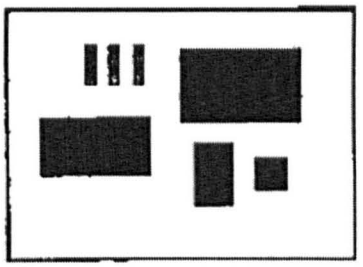
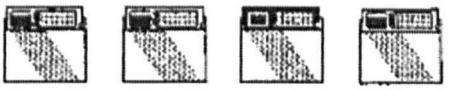
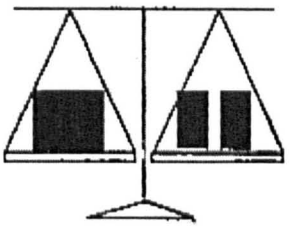
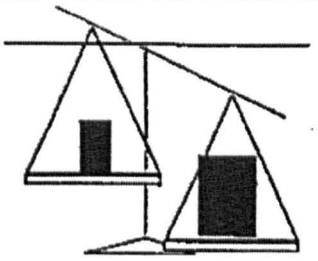


Appendix 3: Dunn and Dunn Learning Styles Model

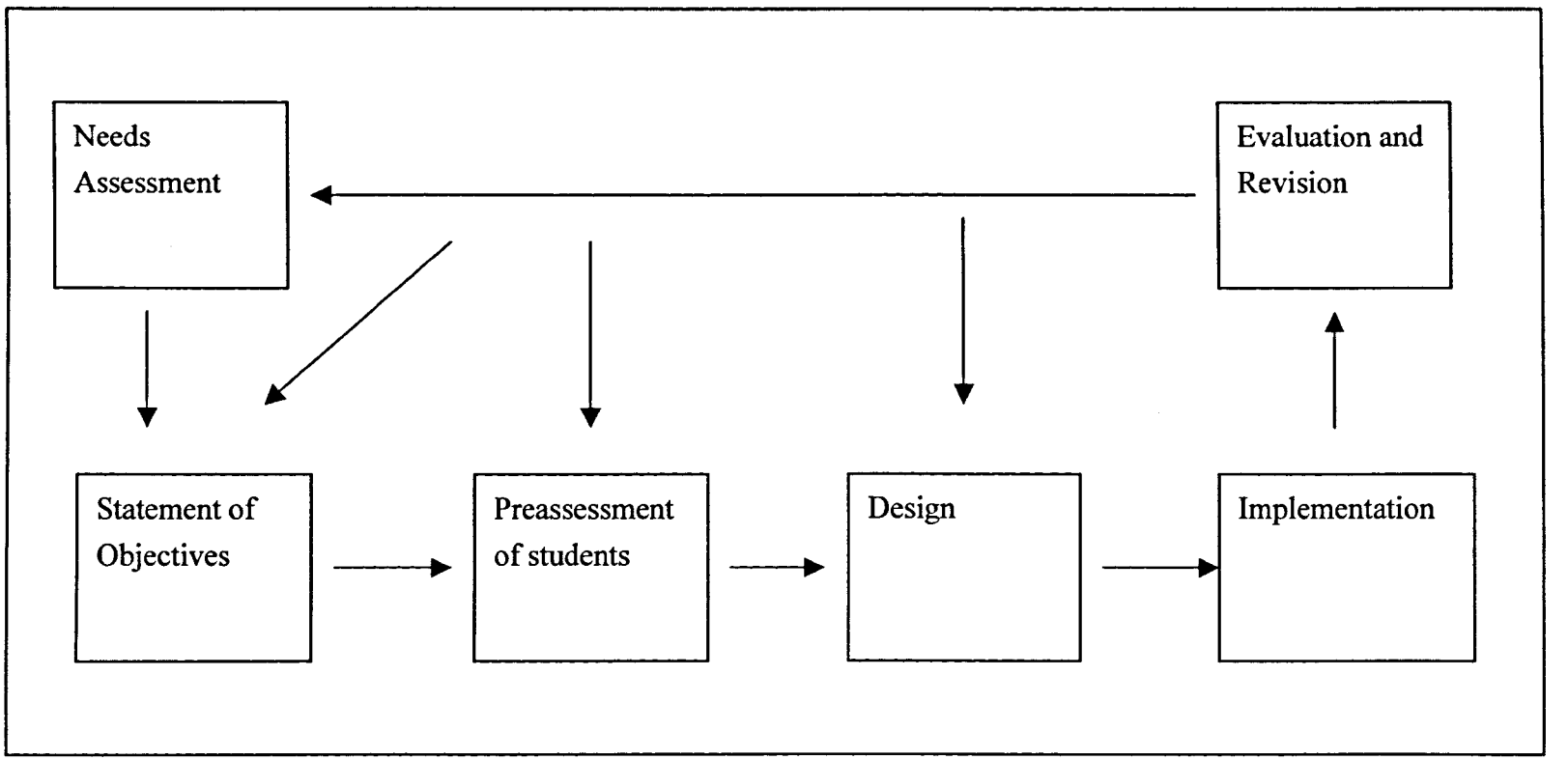


Source: Dunn and Griggs, 1995, p. 83

Appendix 4: Screen Design Principles (Szabo and Kanuka, 1998, pp. 29-32) – colour is excluded

Design Principles	Methods	Sample Screen
1. Unity	Proximity, Repetition, Continuation - Space between each object should be less than the width of each object	
2. Focal Point (Emphasis)	Contrast -Even a slight change on the third object from the left, the eye is attracted to it	
	Separation - The object becomes different by its placement	
3. Balance	Symmetrical - When there are objects of the same general size and shape placed in an equal distance from the centre	
	Asymmetrical - Balance is achieved by placing the larger object lower in the composition.	

Appendix 5: A General Model of Instructional System (Diamond, 1989, p. 330)



Appendix 6: User-Interface Focus Group Questionnaire

COURSE EVALUATION QUESTIONNAIRE
User-Interface

Course Title: Mandarin CBI

Name : Date:

Tick The Appropriate Box

	Very Good	Good	Fair	Poor
How would you rate the following?				
The general structure (layout) of the course				
The instructions on navigation through the course				
The animated graphics/effects in the course				
Graphics and sound(if used) are appropriate				
The screen layout and appearance				
Displays are uncluttered				
The appropriateness of the use of different colors				
Menu items are understandable and descriptive				
The terminology				
The understandability of the English/Portuguese used				

1) Other comments?

_____

_____

2) How many CBI courses had you taken before this one: _____

3) Total time spent on the course: _____

COURSE EVALUATION QUESTIONNAIRE
User-Interface

Course Title: Mandarin CAI 普通話的電腦輔助教育軟件

Name : Date: April 21, 1999

Tick The Appropriate Box

How would you rate the following?	Very Good	Good	Fair	Poor	NA
The general structure (layout) of the course 整個課程結構					
The instructions on navigation through the course 課程瀏覽指示					
The screen layout and appearance 屏幕效果					
The graphics or animated graphics effects 圖像及動畫效果					
Sound effect 聲音效果					
The appropriateness of the use of different colors 顏色的使用					
Menu items are understandable and descriptive 選單清楚, 明白					
The understandability of the Portuguese/Chinese/English used 葡語/中 文/英語 清楚, 明白					

1) Other comments? 其他意見

_____

_____

2) How many CAI courses had you taken before this one: _____
以前使用過多少電腦輔助教育軟件

Appendix 8 : In-class Observation Classrooms

Traditional Classroom



Computer Room Setup





Computer Classroom









Glossary

ARPANET	Advanced Research Projects Agency Network, a system developed by the American defence industry in the 1960s as the first flexible, large-scale, packet switched network. Precursor to the Internet	Ravet and Layte (1997, p. 286)
Ability	A stable tendency to perform well on a range of tasks, part-learned and part-inherited.	Biggs (1993, p. 521)
Affective Domain	The domain that emphasises feelings, motivation and reactions to other people and oneself.	Biggs (1993, p. 521)
Anxiety	A feeling of threat, accompanies by high arousal.	Biggs (1993, p. 521)
Artificial intelligence	The capability of a computer system to learn from its experiences and simulate human intelligence in areas of judgment, reason, and learning.	Nader (1998, p.34)
Browser	A client program used to surf the Web. Also called navigator.	Ravet and Layte (1997, p. 287)
Attitude	A learned predisposition to respond either positively or negatively to persons, situations, or things.	Sprinthall and Sprinthall (1990, p. 614)
CAI	Computer Assisted Instruction is actually instructing students, range from reactive to highly interactive, includes simulations, word processing and teaching writing, problem solving, etc.	Biggs (1993, p. 523)
CALL	Computer Assisted Language Learning is an approach to language teaching and learning in which computer technology is used as an aid to the presentation, reinforcement and assessment of material to be learned, with interactive elements.	Davis (2000, p. 90)

CD-ROM	Compact Disc Read Only Memory; a device used to store large quantities of information (640 MB).	Ravet and Layte (1997, p. 287)
Chunking	The grouping together of several separate items in order to aid in their recall.	Sprinthall and Sprinthall (1990, p. 617)
Collaborative Learning	Peer group learning through sharing and exchanging information, group dialogue and assessment.	Ravet and Layte (1997, p. 288)
Constructivism	A viewpoint of the nature of learning, which emphasises the relativity of knowledge, constructed by the learner.	Biggs (1993, p. 524)
Control Group	In experimental research the comparison group, or the group that ideally receives zero magnitude of the independent variable.	Sprinthall and Sprinthall (1990, p. 620)
Courseware	Course material produced for any medium – print, audio, video, computer program, etc.	Laurillard (1996, p. 267)
Dependent Domain	Refers to domain that changes in response to variations in other domains. The selection of dependent domain determines the ethnographic research topic.	Schensul, Schensul and LeCompte (1999, p. 29, 33)
Dependent Variable	In any antecedent-consequent relationship, the consequent variable that measures output.	Sprinthall and Sprinthall (1990, p.621)
Drill and Practice	The repetition of short sequences of intensive practice to develop basic skills like language pronunciation.	Ravet and Layte (1997, p. 289)
E-mail	The use of computers to send mail to an electronic mailbox, generally located on a server.	Ravet and Layte (1997, p. 289)
Ethnography	Scientific approach to discovering and investigating social and cultural patterns and meanings in communities, institutions	Schensul, Schensul and LeCompte (1999, p. 2)
Evaluation	Refers to ways of testing the quality or value of something in the educational context usually course materials or teaching methods	Laurillard (1996, p. 267)

Extrinsic Motivation	Where learning or performance takes place as means of gaining some material reward or avoiding a punishment.	Biggs (1993, p. 525)
Feedback	The information provided to the learner about a specific action.	Ravet and Layte (1997, p. 290)
Formative evaluation	Describes the evaluation of course materials that provides information for improvement of those materials	Laurillard (1996, p. 268)
Formative Research Model	A diagram that represents the initial relationships among elements or concepts with regard to the topic under study. This model is subject to modification, refinement, and improvement at any point throughout the life of the study	Schensul, Schensul and LeCompte (1999, p. 23, 65)
Grounded Theory	A logically consistent set of data collection and analytic procedures aimed to develop theory	Charmaz (1996, p. 27)
Hypertext/ Hypermedia	Refers to text whose interconnectedness is made explicit and navigable, in the form of links between words or phrases or chunks of the document. The chunks can also be audio or video material, hence the extension of the idea to hypermedia	Laurillard (1996, p. 268)
Independent Domain	Precedes dependent domains in terms of presumed causality. The search for independent domains in either category is a strength of the ethnographic approach.	Schensul, Schensul and LeCompte (1999, p. 30, 40)
Graphical User Interface (GUI)	A class of software that provides the user with a graphical interface to the computer.	Ravet and Layte (1997, p. 290)
Independent Variable	In any antecedent-consequent relationship, the antecedent variable that may be manipulated or assigned.	Sprinthall and Sprinthall (1990, p.630)

Interactive	Used to differentiate computer-based learning from other methods by virtue of the computer's capability to be programmed to change its behaviour according to learner's input.	Laurillard (1996, p. 268)
Internet	Known in its modern forms as the World Wide Web (WWW), the Web or the Net. The network of tens of thousands of computers that creates the greatest database ever accessible, through intuitive graphical interfaces known as browsers.	Ravet and Layte (1997, p. 291)
Intrinsic Motivation	Where learning or performance takes place in the absence of any extrinsic, social or achievement motivation.	Biggs (1993, p. 521)
Language Learning Strategy	Any action that language learners perform in order to increase their target language proficiency.	Little (2000, p. 579)
Learning	A very general term referring to a process that leads to a relatively permanent change in behaviour resulting from past experience.	Sprinthall and Sprinthall (1990, p. 633)
Learning Style	Cognitive Differences in the ways in which individuals learn.	Duda and Riley (2000, p. 346)
Motivation	A general psychological term used to explain behaviour initiated by needs and directed toward a goal.	Sprinthall and Sprinthall (1990, p.636)
Multimedia	In computing, this term refers to the presentation of information on a computer using sound, graphics, animation, and text.	Nader (1998, p. 446)
Network	A system allowing computers to work together by exchanging and sharing data.	Ravet and Layte (1997, p. 293)
Novice	A relative beginner at a task who, no mater how bright, has yet to build a specific knowledge based for the task in question.	Biggs (1993, p. 528)
Observer Effects	Derives from the fact that people tend to act differently when they know they are being watched than when they are unobserved.	Schensul, Schensul and LeCompte (1999, p. 280)

Paradigm	Perspective or viewpoint of the researcher	Schensul, Schensul and LeCompte (1999, p. 9)
Self-efficacy	A person's expectation that he will perform a task at a particular level of effectiveness.	Biggs (1993, p. 530)
Summative evaluation	Describes the evaluation of course materials that provides information on the success or otherwise of the implementation of those materials, possibly in comparison with alternative teaching methods.	Laurillard (1996, p. 270)
Tutorial program	A computer program that presents information, sets exercises for the student, accepts answers in some specific format, and gives feedback on those answers	Laurillard (1996, p. 270)

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