

The University of Hull

***A Cognitive Approach to
How Children Understand the
Concept of Death as Scientific Knowledge***

**Submitted By
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Dedication

*To my husband Shafeeg Al-Thegah, who was extremely supportive and sacrificed
tremendous time for this study to succeed;*

*To Mohammad and Jaida'a, who interest my life with
their vivid philosophy;*

*To my mother Latifa Jalal, for her love, encouragement
and prayers for me;*

*To the memory of my father Ibrahim Zamka, I only now answered the question of
how I lost him in one minute;*

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philosophy of death and astronomy.*

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Abstract

This study focuses on children's cognitive understanding of the concept of death from a scientific perspective. The investigation is conducted through the sub-concepts of understanding death - irreversibility, inevitability, universality and non-functionality – derived principally from the work of Jean Piaget. I propose within this study that children's understanding of these sub-concepts is mirrored by their understanding of astronomy as the concept of death includes the idea of *hidden phenomena*, *disappearing*, *existence*, and *non-existence*, *alternation* or *seriation* (death after life) and *time*. Whilst these concepts are part of other sciences such as physics, cosmology and mathematics, these particular phenomena are only found in the scientific field of astronomy. Specifically, therefore, instead of investigating their understanding of the concept of death through the knowledge of cessation, it is an investigation of their knowledge of the concept of time. The study thus includes the concept of time within the sub-concepts of death to judge the children's understanding of death. The study employs qualitative methods, uses the interpretive paradigm, and relies on investigating the children's knowledge of astronomy in order to find out how they construct their understanding. This is related to the common cognitive thinking that children do in their daily life with the phenomena of astronomy. To support this investigation, two common children's stories are used as tools of the study, in order to probe their cognitive thinking. The first story focuses on the concept of death. The second story focuses on the knowledge of astronomy.

The sample includes 21 children from ages 4 to 9 years. The results show that children have a schema of cognitive thinking based on inferences and scientific knowledge that enables them to understand the concept of death beginning at age four. They are able to make logical inferences inductively and deductively. They show that they have developed cognitive concepts, which allows them to classify scientific from non-scientific knowledge. Their understanding of the concept of time and the phenomena of astronomy support them in understanding that death is inevitable, universal, irreversible and non-functional.

Children in this sample reflect that they understand non-functionality as they relate it to the concepts of non-existence, invisibility and disappearance from the environment. This study finds that educational intervention can confirm these insights. Inductive and deductive strategies can be used when dealing with the concept of death. The study also sheds light on children's knowledge of astronomy as a way to acquaint children with the concept of death as scientific knowledge.

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Introduction

This study focuses on how children think about the concept of death by using scientific knowledge. In most education systems scientific knowledge is an important path for children to understand life. Usually, children are encouraged to learn biology, physics, chemistry and mathematics, by using experiments and making inferences, because this comparison supports the ability to build concepts about life. In this thesis I will explore the philosophy of death and its scientific interpretation as another important path that needs to be understood by children. It is a portrait of two phenomena that are connected to each other, life and death. In this case death is seen as an end of life.

The concept of death has been the focus of discourse by many schools of thought and different disciplines such as philosophy, anthropology, theology, and sociology. However, in this thesis the phenomenon of death is approached from the cognitive lenses of scientific knowledge as the phenomenon of death needs to be understood by children while they grow cognitively. This is a complex perspective to be investigated, as the tendency in most of the research in the field of cognitive psychology is concerned with testable, measurable and observable methods which capture children's thinking through the process of cognitive growth. Moreover, this perspective is not easy to be investigated in their type of thinking as children have their own structure of understanding which is not similar to an adult's understanding. As the dominant contemporary issue in the field of education and psychology is children's perspectives it is important to understand how children understand the concept of death from an epistemological aspect.

This focuses on when and how death as a cognitive object is constructed and developed in young children.

As I studied the development of previous investigations on the meaning of the concept of death it seems that all domains of research had to investigate the meaning of the concept of life in order to understand the meaning of the concept of death. Both phenomena are related to each other and, I argue, can be demonstrated through scientific knowledge. This position can be found in philosophy, metaphysics, religion, psychology and science. Examples can be found in Freud's theory of death, Piaget's theory of cognition and in Susan Carey's research about conceptual change (Freud, 2010; Carey, 1985; 2000; Inagaki and Hattano, 2002; Jaakkola and Slaughter, 2002).

In the psychological domain Freud depicted the meaning of death as a scientific theory, which shows death as a biological instinct that drives the human to the non-existent level. In his theory he linked both drives of life and death to infantile and childhood experiences although his work in this domain was not accepted generally (Bliss, 2008). Later, in the psychoanalytical domain, investigations about sadness and loss in children could not prove that children understood the concept of death (Nagy, 1948). Consequently, investigation was directed toward studying children's cognitive development in order to see how they could understand the concept of life and death. It appears that all these investigations portray that people recognise the phenomena of death at an early age as they face these problems in early childhood. Subsequently, through cognitive development studies, the concept of death became

clearer because it was shaped and based on the cognitive concepts in Piaget's theory (Piaget, 1951). This thesis and research in the field used Piaget's perspective and divided the study into four main sub-concepts: universality, irreversibility, inevitability and non-functionality.

Piaget, the famous Swiss psychologist, initially started his investigation about cognitive development with a biological vision which, it is suggested, influenced his thinking (Sylva and Lunt, 1994). Through biology Piaget was concerned with various anatomical structures that help animals to cope and adapt to particular environments, so he started to study the mental structure that animals use it in order to survive (Sylva and Lunt, 1994). He found that this mental structure consists of two types of knowledge - *knowledge about things* and *knowledge about how to do things*.

As a result of this impasse, Piaget started to study mental structures and departed from the method of biology. In order to study IQ testing, for example, he interviewed children by asking them for reasons when they gave their answers. Instead of measuring the unusual answers as wrong, he tried to pause and reflect in order to understand what motivated a child to answer with a particular idea. Piaget arrived at the conclusion that (1) children do not think in the same way adults do because their minds organise differently and (2) they experience the world differently with different structures as children age (Sylva and Lunt, 1994).

Piaget postulated that children do not make mistakes in thinking, but they shift from one mode of thinking to another during the age of infancy and childhood. He called this mental structure:

a *schema*. Fundamentally intelligence enables human beings and animals to cope with their environments to use the knowledge about things and the knowledge about how to do things (Sylva and Lunt 1994). With this schema of knowledge and his recognition that children have their own visions of the world, Piaget started to ask different types of questions in the interviews. His style of interviewing children was very different from the usual interviews at that time and they are called Piagetian “clinical interviews”. They are different than Freud’s interviews because they are not psychiatric interviews based on the theory of psychosexual development (Cohen, 2002; Sylva and Lunt, 1994). Piaget focussed on exactly what children say and do at their early age (Cohen, 2002). Both Piaget and Freud studied one person at time, using fewer questions in order to encourage the interviewee to explain individual thoughts. Freud based his theory on what adult patients remembered about childhood while Piaget studied only normal children and interviewed the actual child (Cohen, 2002). Therefore, Piaget asked children questions about natural phenomena and mortality. Based on the concepts he discovered, he differentiated between the thinking of babies, young children, older children, adolescents and adults. From these differences, through thirteen years of meticulous observations of children (Cohen, 2002) he established his famous stages: sensorimotor, pre-operational, concrete-operational and formal (Sylva and Lunt, 1994), claiming that at the final stage children can draw logical inferences (Cohen, 2002).

Understanding the phenomena of life and death is one of the concepts Piaget investigated through these cognitive theories. He based this on children's visions, which are constrained by egocentricity and intentionality. In the stages of cognitive development he identified he indicated that children are unable to understand the concept of life and death in their pre-operational stage and they could start to understand it by the concrete-operational stage. He portrayed the schema of thinking to be based on the ability of logical inferences which is unavailable in the pre-operational stage. For Piaget and later, Carey (1985) (who agreed with him), cognitive concepts such as conservation, reversibility, universality, linguistic ability and biological knowledge are weak and naïve at an early age (in regard to the concept of death).

Although this perspective of Piaget was challenged on the grounds that cognitive development was due mainly to linguistic capability (Parisi and Schlesinger, 2002) later a new stage of research started to focus on the biological knowledge of young children and established a new assumption around their understanding of the concept of death. This perspective was the next wave of research in cognitive theory with different results to Piaget and is an important extrapolation in the investigation because it took a scientific path.

This new path made the assumption that children were able to understand the functions of internal organs based on investigations into children's inductive reasoning and assumed an understanding through the sub-concept of non-functionality, which causes death. This biological assumption included the idea that cessation of life could be understood not only about human beings, but also about animals and plants (Nguyen and Gelman, 2002). Based on

what was mentioned initially - that the phenomenon of death is an end of life and is scientific - biological knowledge is an important angle to investigate children's understanding of the concept of death.

This scientific perspective (which only focuses on biological knowledge) was confined to the cessation of internal organs functions, however, and studies of children's knowledge indicate that children can show an understanding of biological information (Slaughter, 2005; Springer and Keil, 1989; Jaakkola and Slaughter, 2002; Slaughter and Lyons, 2003). Neither the results about the relationship between the cessation and death, nor the understanding of the death of plants reflect, however, that children have clarity in their understanding (Nguyen and Gelman, 2002). Thus using biological knowledge as a scientific angle to investigate the sub-concept of non-functionality was incomplete and this weakens the argument that children are able to understand the other sub-concepts from a scientific angle. The conflict between understanding that a dead body has no biological functions and that there is a belief of a possibility to return back after death and this creates an ambiguity in understanding a main aspect of the concept of death. This aspect is the angle of impossibility of reversing back to life once the moment of death happens. There was a neglected focus on the factor of time in evaluating the schema of thinking to understand the concept of death. It is a missing step which created a barrier that prevented previous researchers studying the scientific thinking of children about the sub-concepts. For example, previous studies which recognised children's responses about the

notion of afterlife and returning back to life assumed that children are weak in understanding the sub-concepts of irreversibility (Speece and Brent, 1984).

In the meantime, Speece and Brent (1984) mention some studies such as Koocher (1973) and Hornblum (1978) that found that children reflect an understanding of a cognitive concept of death at an earlier age than Piaget thought. The different results of whether children understand these concepts indicate some ambiguity and maturity issues about all sub-concepts. Consequently, for further investigation my study focuses on the children's knowledge base, which contains multiple configurations and concepts which is built through their interaction with others by using logic and inferences. This encouraged me to focus on the cognitive process of inferences to see how children could think about a phenomenon which includes many angles about the concept of death.

Aspects of the phenomenon of death relate to understanding the (1) end moment of the duration of life and understanding of (2) the notion of that the existent entity is no longer present in the environment by this end moment. This remains a cognitive, scientific and inductive hypothesis - to investigate a child's understanding of death - rather than only look (deductively) at a relationship between the cessation of internal organ functions and death. In order to investigate this schema, it is needed to find out what is children's knowledge of a wide range of cognitive concepts about the phenomenon of death. This includes investigating not only understanding of the functions of the body, but also investigating how children understand the concepts of time, concepts of existence and non-existence in their daily life interactions.

These concepts are found in other sciences, and particularly in astronomy which provided Piaget with another way to undertake his efforts with cognitive theory. Piaget asked questions about the sun and the moon in his clinical interviews with children in order to investigate their reasoning about the concepts of being alive (Piaget, 1951) as well as questioning children about the concept of time (Piaget, 2006). These studies also included a perspective of investigating how children observe and recognise that living things become non-existent in their environment. Children need to know how and what they infer from the relationships of phenomena around them and deal, for instance, with alternation of day and night phenomena and the phenomena of the sun and the moon which often appear serially. It was concluded, therefore, that investigation in terms of living things through astronomy will be easier than cessation. This is based on their interactions with making inferences about abstract concepts such as existence/non-existence, appearance/disappearance and visibility/invisibility. In general, it will be easy for children to observe astronomical events in their environments so as to build their knowledge. For instance, their bedtime is based on day and night. So, there is no doubt that children have an idea about the sun and the moon as entities in space, often found in their drawings and stories.

It is claimed that children gain their scientific information from curricula, laboratories and real life (Bruning, Schraw and Ronning, 1995). Studies also indicate children's knowledge about scientific concepts such as gravity, gas and air (Carey and Smith, 1993) deal with cognitive concepts of existence and non-existence (Vosniado and Brewer, 2003). Other studies relate

their knowledge of astronomy, space, day/night, the sun, the moon and the earth (Sneider and Ohadi, 1998; Hannust and Kikas, 2007). Consequently, in my study I argue that children have knowledge of astronomy which is created through their interaction with daily life. This astronomical knowledge is an important premise to investigate their early biological knowledge in childhood. To sum up, following the cognitive theory of Piaget, who established the four stages of sensorimotor, pre-operational, concrete-operational and formal stages, I focus on a child's cognitive schema of thinking in relationship to death. Based on the development of the concept of death which comprises four sub-concepts as Piaget portrayed under the pre-operational and concrete stages I argue that my investigation is supported by studying children's knowledge of astronomy. Therefore, the main question of my study is trying to read children's schema of thinking about two main fields, the phenomenon of death and the knowledge of astronomy.

Research Questions

- ***What is the relationship between children's understanding of death and their scientific knowledge, as demonstrated through the domain of astronomy?***

From the main question, four sub-questions are highlighted:

- How do young children understand the ***universality*** of death?
- How do young children understand the ***irreversibility*** of death?
- How do young children understand the ***inevitability*** of death?
- How do young children understand the ***non-functionality*** of death?

To illustrate the link between children's scientific understanding (and in particular Astronomy) there are five further sub-questions:

- What is the children's knowledge *of the sun*?
- What is the children's knowledge *of the moon*?
- What is the children's knowledge *of the earth*?
- What is the children's knowledge *of life in space*?
- What is the children's knowledge of the phenomenon of *alternation*?

To answer the question of this investigation, the following is an overview on the thesis. This study includes:

- Part one (1) The Literature Review includes two chapters;
- Part two (2) The Methodology includes chapter three;
- Part three (3) The Analysis includes three chapters—the Results, the Discussion and the Recommendations and Conclusion.
- Part four (4) The References and Appendices.

Part (1) The Literature Review

Chapter (1) *An overview of the meaning of the phenomenon of death since early childhood.* This chapter includes two sections - (1) *Perspectives:* This is an overview that briefly introduces Freud's theory of the concept of death, followed by another perspective focused on the feeling of sadness and loss in children's personal experience. This perspective opens a way for psychology to investigate the cognitive development started by Piaget. In terms of his famous theory of cognitive development, Piaget stated that children do not understand the concept of death. The immaturity of biological knowledge is one of the challenges of a cognitive weakness in understanding death. A new path of the debate, a different type of scientific knowledge, is established in this stage. Explanation of this debate will be previewed in this chapter. (2) *Critical review on children's understanding of concepts of death.* This section presents the debate from

researchers who studied children's understanding of death. Through each sub-concept of death, this section indicates the importance of focusing on astronomy.

Chapter (2) *Cognitive perspective on children's understanding of death through the knowledge of astronomy.* This chapter includes three sections - (1) Through the knowledge of astronomy, several concepts create a basis to understand the phenomenon of life and also the phenomenon of death. The knowledge of astronomy includes knowledge of the sun and the moon, alternation and time. Through these concepts the research seeks to explain how young children understand the concept of death. This is not the first time these ideas appear in the field, but it was often a fragmented observation in children's thinking. For example, Piaget mentioned knowledge of the sun, the moon and the earth. This study focuses on all the evidence under the name of the astronomy to strengthen the scientific investigation. (2) In order to find out a clear relationship it is important to focus on children's reasoning and inferences as they construct their conceptions. This section shows the inductive and deductive reasoning they use. (3) This section concludes the previous perspectives and introduces the problems and the research questions.

Part (2) The Methodology

Chapter (3) *Research methodology.* This chapter discusses the research paradigm, the methods of the study, the tools used, the pilot study, the ethical issues and the implementation and the analytical framework.

Part (3) Analysis

Chapter (4) Results. This chapter includes three sections - (1) The results of the study in relationship to death; (2) The results of the study in relationship to astronomy and (3) the use of children's drawings.

Chapter (5) Discussion. This chapter is divided into two parts: the first part discusses an understanding of death, which includes linguistic ability, logical reasoning, observation, seriation, universality, classification, existence, non-existence, appearance, disappearance and invisibility; the second part discusses the concepts of astronomy, which include concept of time, concepts of space, distance, features, functions and characteristics.

Chapter (6) Conclusion and Implications

Part (4) References and Appendices

Chapter 1

Literature Review

**An overview of the meaning of the
phenomenon of death in early
childhood**

Section (1)

Perspectives

Psychologists have often explored the meaning of the concept of death. Freud and Piaget are examples of those psychologists (Speece and Brent, 1984; Kenyon, 2001; Hunter and Smith, 2008; Slaughter and Lyons, 2003). In this chapter I identify three stages of focus on the meaning of death. This is introduced in this chapter through (1) psychological perspectives - Freud's psychoanalytic view; (2) cognitive perspectives - Piaget's theory and the new derived view from cognition theory; and (3) biological perspectives.

(1) *Psychological perspectives on the meaning of death*

Between 1919 and 1923 Freud wrote his theory of the death instinct in *Beyond the Pleasure Principle* (Freud, 1962). He related human instincts to the neurological representation of physical needs which motivates humans to act on the behaviours. At first, he saw the motivations as controlled by the life instinct, which he called *libido*. The *libido* assists humans in being satisfied and at peace.

Later in his life, he believed that under and beside the life instinct is a death instinct (Boeree, 2006). He thought that this death instinct was the aim of life. All living things die for internal reasons and it is a way toward non-existence, nothingness and the void, but it is a negative way because it drives humans to the opposite side of life; toward dissolution, unbinding and dissociation. In his view, death releases the feeling of struggling or exhaustion from pain that motivates people to direct their efforts toward aggression, cruelty and destructiveness. He posited a view that every person has an unconscious wish to die (Boeree,2006).

The demands of living organisms also need to be fulfilled. That concept, Freud (1920) called *the pleasure principle*. Freud analysed the energy of the libido as a subject to be controlled by “destrudo”, the opposite. Consequently, it is the final stage in human life, which transfers from organic to inorganic state. This is a dualistic theory of life and death which was not accepted by other psychologists, however, because it was considered as a scientific rigour, particularly as a biological aspect (Georgescu, 2011). In addition, this theory conflicted with his views about the sexual instinct and the self-preservation instinct, which he assumed were related to Darwinian theories (Bliss, 2008).

This study will not go further about Freud as this introduction is all that is needed to shed light on the inevitability of the death instinct in relationship to the infantile stage (pleasure and beyond pleasure) and focuses specifically on the ability of young children to understand the concept of death from the psychoanalytic perspective. The psychoanalytic perspective (Anthony, 1940; Nagy, 1948) focused on young children’s emotions and feelings of sadness and fear of separation in order to find out whether they understand the concept of death (Slaughter, Jaakkola, and Carey, 2005; Slaughter, and Lyons, 2003).

In previous studies, it was reported that young children understand the concept of death as a sleep or a trip (Carey, 1985; Speece and Brent, 1984). An example of a child at age four:

A dead person is just as if he were asleep. Sleep in the ground too. Well-close his eyes. Sleeps like people at night. Sleep like that, just like that. I know if they go to bed at night and don’t open their eyes. If somebody goes to bed and doesn’t get up, he’s dead or ill (Slaughter, et al., 2005).

Children also could understand that dead people live in places which were designed especially for them such as heaven or a cemetery. They could justify the permanence of separation since dead people were unable to come back to life because heaven is too far away from earth.

The psychologist Maria Nagy (1948) described the understanding of death based on children's ages. She said that they understand it in three stages according to age much like the stages Piaget described in cognitive development (Kenyon, 2001).

Stage One: Children from 3-5 years believe in the continuation of life. Death is similar to sleep but for a long time. A dead person has less activity, but can wake up and come back to the life spontaneously (Nagy, 1948).

Stage Two: Children from 5-9 years understand that death is final and irreversible, but there is a possibility of escape if a person is clever or lucky. Children in this stage understand death in the form of a person such as a clown, a shadowy death-man or a skeleton.

Stage Three: Starting with age 9, children understand the mature components of death. They understand that death is final, inevitable, universal and personal. Nagy explained that children understand that a mouse and an elephant can die, strangers and parents can die, and everybody will eventually die whether they are good, bad, lucky or clever (Nagy, 2010).

With this perspective, psychoanalytic researchers argued that this misapprehension of the concept of death is due to the limited capacity of children's cognitive thinking and also their lack of understanding biological concepts (Slaughter, 2005). The psychoanalytic perspective shed light on the other angle which explains the weakness in children's understanding of the meaning of death - cognitive development. The psychoanalytic perspective thus focused their investigation as to whether children do or do not understand the concept of death based on their cognitive development. However, at that time the knowledge about death was not

categorised in terms of the cognitive terms later devised by Piaget of universality, irreversibility, inevitability and non-functionality.

To conclude, the psychoanalytic perspective assumes that children at an early age are unable to understand the concept of death biologically due to the weakness in their cognitive development.

(2) Cognitive perspective on children's understanding of death

Piaget started his investigations as a biologist early in his life and studied animal behaviours before he studied human cognition (Sylva and Lunt, 1994). He proceeded to study how the human brain understands phenomena, with life and death being two examples of these phenomena. His perspective on the phenomenon of death started in the 1960's under two of his well-known stages - the pre-operational and concrete-operational stages which focus on children's development between ages 3-9 years (Slaughter, 2005). Pre-operational children are distinct from concrete-operational children in their responses; the former decide intuitively based on their direct experiences, while the latter decide more logically about concrete objects (Baker, 1973).

Piaget believed that pre-operational children are unable to use clear language to explain their meaning. His judgement was challenged by later research, however, which showed that young children could expand their vocabularies through conversations with adults (Baker, 1973). These children are unaware of any symbolic viewpoints and they only focus on their own world, consequently they think that everybody thinks, perceives and feels like they do. Piaget called

this concept *egocentrism*. Another term he used is *animistic*. This reflects how young children believe that inanimate objects have lifelike qualities such as feelings, wishes and thoughts. For example, young children could think that the sun is angry when clouds appear and the sun could chase them away (Berk, 2000).

Through both stages Piaget stated that children's understanding of life and death are related to cognitive concepts and skills they develop in their thinking. This basis includes *egocentricity, animism, causality, reversibility and conservation* (Mahon, Goldberg and Washington, 1999; Slaughter, 2005). These concepts are described under each stage below to reveal how the concept of death was organised based on four sub-concepts.

Piaget's perspective on children's cognitive thinking about death

Pre-operational stage

This section explains the cognitive concepts in Piaget theory to illustrate the phenomena of life and death. He explained every concept regarding children's understanding of both phenomena.

Egocentricity and animism

Egocentricity and animism are two concepts that categorise children's thinking. In egocentricity he focused on three types of action; causality, intentional causality, and mechanical causation (Berk, 2000). Egocentricity is present when pre-operational children represent the external world around them and use their own symbolic viewpoints. Egocentricity controls animistic thinking and, therefore, children believe that other people think, wish and feel in the same way as they do.

Pre-operational children also believe that inanimate objects have the same realistic qualities they do (Berk, 2000). For example, a little boy described his curiosity about the moon. He felt that the full moon looked like a face and he thought that it was a living being. He tried to prove to himself that the moon was alive by challenging the moon and using four different movements. He believed that the moon followed his four different movements believing that the moon and its light was alive and under his control (Piaget, 1951).

Causality and intentionality

According to Piaget, children get their ideas by thinking that inanimate objects can intentionally cause things. This is because they do not have a notion of mechanical causation compared to intentional causation. In probing their understanding of physical phenomena, Piaget found that their interpretation is related to the intentional state of inanimate objects. For instance, a child of 6 answered a question about why the sun is hot by saying that the sun *wants* to keep people warm. Therefore, children under the age of 10 tend to have the belief that inanimate objects, such as the sun, the moon, cars, the wind, bicycles, clocks and fires, are alive with intention (Carey, 1985). Therefore, Piaget portrayed children's reasoning as three woven threads of animism interacting together:

- Animistic causal reasoning.
- Over-attribution of an intentional state to inanimate objects.
- Over-attribution of being "alive" to inanimate objects.

When young children are asked to give a reason or cause of a phenomenon they use the only schema they have, called *intentionality*. Intentionality means that young children attribute intentional states to active objects, inanimate objects, consciousness and life. However, this claim of Piaget has been challenged as well, as in Gelman, Spelk and Mech (1983) and Dolgin and Behrend (1984) who assume that young children are able to differentiate between active and inanimate objects (Carey, 1985). This explains why young children, as Piaget assumed, attribute the animation to the sun and the moon. In addition, pre-operational children's often make decisions that include contradictory facts or disconnected ideas. For example, they link cause-and-effect between two contradictory facts because the facts appear in the same time and space. This type of reasoning focuses on thinking from one particular case to another particular case. Piaget called it *transduction reasoning*. For instance, when answering a question about clouds, young children said: "When we move along, they (clouds) move along too ... The cat, when it walks, and then the dogs, they make the clouds move along" (Berk, 2000: 241).

In studying a case about the concept of death, a child who lost her cat thought that she caused her cat's death. Initially she thought that her cat was sleeping. However, she was very sad when the cat was unable to move. When her teacher told her that the cat died and will not wake up again, the girl tried to find a reason for its death. She made a link between chasing her cat too long and the cat's death. Sadly, the little girl made a connection between two situations, which were not related to each other - they just happened at the same time (Berk, 2000). In this case, the child relied on egocentric and transductive reasoning when trying to understand the concept of death.

Later studies challenge this claim by showing that young children do not have problems with mechanical causality (Carey, 1985).

Conservation

Conservation is the ability to think logically. Conservation means that “. . . certain physical characteristics of objects remain the same, even when their outward appearance changes” (Berk, 2000: 240). Pre-operational children are unable to conserve. If they focus on one aspect of a situation, they cannot focus on other important features. For example, they think that the amount of liquid changes depending on the shape of a container; however, it is the same amount of liquid. Their inability to conserve is due to three related aspects of thinking:

The first aspect is *centration* which means that young children focus only on one aspect instead of many features at the same time;

The second aspect is *being bound by perception* which explains how concrete objects easily distract them. For example, they believe that a bigger glass contains more substance;

The third aspect is *reversibility*—their thoughts are still intuitive and they are mentally unable to make decisions logically. Young children are incapable of going through a series of steps and then reversing direction to the first point. This is why they are unable to imagine the first amount of water that changes in different shapes of glass. So, what Piaget observes is that when pre-operational children are able to be logical, they gain reversibility and the new stage is called concrete-operational (Berk, 2000: 241).

In young children’s responses researchers found that they believe that dead people come back to life spontaneously (Speece and Brent, 1984). Children believed that reversibility can happen by medical intervention, after eating and drinking, through magic, or by praying (Carey, 1985;

Speece and Brent, 1984). Before going further it is important to show cognitive development theory in understanding life and death concepts.

According to Piaget, pre-operational children cannot understand the *irreversibility* of death because they lack the concept of *conservation*. (Understanding conservation demands that a pre-operational child would not think egocentrically, understand transformation and move from transductive reasoning to logical reasoning. In addition, young children would understand irreversibility). Piaget argued that grasping conservation is only developed gradually between the ages of 8-12 (Piaget, 1974). Full understanding of conservation is a prerequisite to a mature understanding of death. Therefore, young children do not have a developed understanding of conservation and reversibility and that compromises their understanding of death (Hunter and Smith, 2008).

Pre-operational children also believe that death is *not universal (not everybody dies)* and not *inevitable (people can avoid death)*. This was similar to what is claimed by Nagy (1948) who said that young children think that being clever or lucky helps a person to avoid death. They also think that they themselves, their immediate family, their teachers, and children in general, can avoid death and take actions to do so (Speece and Brent, 1984; Speece, 1995). For example, Schilder and Weschler (1934) found that young children believed that other people would probably die before them. This result challenges the egocentrism of pre-operational children (in Piaget's stages). In this case, these children believed that if they themselves do not die, they also will deny that other people die (Speece and Brent, 1984).

On the other hand, some studies demonstrate that children recognise their own personal mortality before they recognise that other people die (Speece and Brent, 1984; Speece, 1995). This

explains how children use the concept of conservation in understanding the irreversibility of death (for themselves or for other living thing). This is also, in addition to what was mentioned initially - that life and death are two phenomena that are related to each other and gives a reason for psychologists to study children's understanding of the concept of life. This is explained in more detail in the next paragraphs below.

Understanding the concept of life

In explaining egocentrism, animism and causality Piaget elucidates how young children understand the concept of life, alive and not-alive. As explained previously, young children use intentionality to prove to themselves how these inanimate objects are alive. For example, a rock rolling down a hill, for young children, is alive; but a rock at rest is not. This is because intentionality is the only schema that is available at this early age. However, when they use this intentionality to interpret understanding alive objects, this does not reflect their understanding of the meaning of *life*. We cannot use the frequency with which young children use the word ‘alive’ to judge their understanding about living things or alive things (Carey, 1985).

For Piaget, children’s answers about ‘what does life mean?’ showed that there are four stages that systematically occur in children’s lives. These answers showed that young children, between 3-4 years, are too young to understand what the meaning of life is. This means that young children lack the ability to explain what they understand. For example, in *the first stage*, children understand life in relationship to activity in general. For them, to be *alive* ‘is to do something or to move.’ The sun is alive because ‘it gives light,’ while a candle is not alive ‘when it is not giving light.’ A cloud is alive because ‘it sometimes moves.’ The moon is alive because ‘it sometimes hides behind the mountains’ (Piaget, 1951).

In *the second stage*, for children between 6-8 years, life is related to movement, which is genuine meaning in their eyes. For example, a lake, the sun and the moon are alive because they ‘move.’ A bicycle is alive because ‘it can go.’ A fish is alive because it ‘swims.’ A stream is alive because ‘it’s always going fast.’ A mountain is not alive because ‘it’s always in the same place’ (Piaget, 1951).

In the *third and fourth* stages, children between 8-9 years, and between 11-12 years respectively, start to think about the distinction between spontaneous movement and imparted movement. It is a stage of confusion between the biological and mechanical. For example, clouds are not alive because 'if they were alive they could come and go as they wanted. It's the wind that drives them.' The wind is alive because 'it is the wind that drives the clouds.' The worm is alive because 'it can walk.' These stages are the most important period in a child's animism (Piaget, 1951).

To conclude, according to Piaget and Carey's perspectives, it is not possible for pre-operational stage children to understand either the concept of death or the concept of life.

The concrete-operational stage

By the time they reach the concrete-operational stage, children begin to change their views. Their thinking starts to transfer from centration to decentration and their understanding of the conservation of liquid develops from the previous stage. Berk (2000: 294) provides an example such as "The water's shorter, but it's also wider. If you pour it back, you'll see that it's the same amount." This response of a child is an example that shows the development in the concept of conservation, which includes reversibility and decentration (Berk, 2000).

Piaget portrays other concepts that children have in this stage also. They gain the ability to think forwards and backwards in space and time and are able to use the skills of classification, grouping, differentiation, extension, seriation and the combination of existing structures into a new relationship. In comparison with the formal stage (the next stage of Piaget), however, children's abilities in the concrete operational stage are still limited in dealing with the abstract.

This is because the children are only able to make correct decisions when they deal with concrete objects and cannot deal with abstract ideas.

However, many studies showed that Piaget underestimated children's abilities for this age (Baker, 1973). This means that if children understand the concepts of the concrete-operational stage at an earlier age than Piaget indicated, then it is worth investigating how children use these concepts in relationship to death. These concepts (for example, classification and seriation) are explained below in order to shed light on how it can be understood in relation to death.

Classification

Grouping and differentiation are cognitive abilities that focus on several categories at the same time. They relate to the concept of hierarchy such as superordinate and subordinate. Children of this age develop the ability to group objects into categories; they collect and group coins, stamps, cards and rocks, for example (Berk, 2000).

Seriation

Seriation is the ability to put items in order along a quantitative dimension, such as length or weight. For instance, children at this level can arrange sticks of different lengths from shortest to longest. *Transitive inference* is an ability, which derives from seriation. This means that children (from observation of different length) can make a decision about these objects in terms of length and weight. For instance, between three different lengths of A, B and C children can know that if A is longer than B and B is longer than C that A is longer than C as well. Children in the late concrete-operational stage, ages 9-10, are able to infer the logical idea that A is longer than C (Berk, 2000).

According to Piaget, children in this stage start to recognise irreversibility and they can start to understand that death is irreversible and universal. Piaget explained that children in the concrete-operational stage understand that all players in a game must follow the same rules and they understand the universality of rules. Therefore, it can be predicted that concrete-operational children understand that death must happen for all people (White et al., 1978).

Another dimension of cognitive development is that children shift from believing that death is avoidable. If children understand that death occurs at some point in the future, it means that they understand that they too will die. This implies an understanding of the sub-concept of universality (Speece, 1995) and the sub-concept of inevitability. Therefore with the concept of seriation this means that children can think about time.

Considering the concepts of time and duration, Piaget stated that the principles of time appear in three stages. For children to have a complete grasp of the notion of time, they have to understand that events happen in a serial order and within a duration of time that is specified and measured

(Baker, 1973). Through these stages, Piaget explained that most children, specifically in the pre-operational stage, lack the ability to understand time and duration. (These steps of understanding of the concept of time will be shown in the next section on children's understanding of the sub-concept of inevitability). Piaget concluded that the reason that they fail to understand duration is because they fail to think simultaneously about starting and ending points. Usually pre-operational children base their opinion on only one of those points (Baker, 1973).

Speece and Brent (1984) show that Hornblum (1978) argues, however, that children's understanding of irreversibility depends on their conceptualisation of time and noted that pre-operational children move from a cyclical notion of time to a linear notion of time. With that accomplishment they move into the concrete-operational stage (Speece and Brent, 1984). Hornblum also found that children in the concrete operational stage, who understand linear time, understand irreversibility more than pre-operational children who still think in cyclical time, but 40 per cent of the children in the pre-operational stage (in her sample) understood both irreversibility and non-functionality. This led Hornblum to doubt that age and cognitive development made a difference in regard to death and she concluded that there is no relationship between children's concepts of time and their understanding of irreversibility and their understanding of death (Speece and Brent, 1984). Hornblum's study (1978) is possibly the only study that focused on the relationship between children's understanding of the concept of death and their understanding of the concept of time and is an important argument because it tried to focus on another angle of children's thinking.

The establishment of the four sub-concepts of death

The organisation of human life in four serial stages was established by Piaget based on these cognitive concepts. The four stages are the sensory motor stage, the preoperational stage, the concrete-operational stage and the formal stage (Berk, 2000). These organised stages support the investigations about the concept of life and death from several views. The cognitive concepts and skills such as egocentricity, causality, intentionality and conservation indicate that researchers could understand the meaning of life and death in every stage of life. Each concept is part of the cognitive base that explains the meaning of both phenomena. Consequently, Piaget's cognitive theory touches on four sub-concepts:

- The sub-concept of irreversibility,
- The sub-concept of inevitability,
- The sub-concept of universality
- The sub-concept of non-functionality.

This is due to the clarity of the definition of the concept of death. Therefore, studies started using these sub-concepts in various investigations (Kenyon, 2001; Slaughter and Lyons, 2003; Slaughter, 2005; Hunter and Smith, 2008). However, there is some debate in the research about the ability of young children to understand death, so the following section reviews the definitions of these sub-concepts.

Definitions of the sub-concepts of death

Here are the definitions of the sub-concepts used in all studies that focus on the cognition theory used in investigating young children's understanding of death.

Sub-Concept of Universality

Universality means that all living things die (Cuddy-Casey, Orvaschel, and Alfred, 1997; Kenyon, 2001; Nguyen and Gelman, 2002; Hunter and Smith, 2008). In some studies, other terms are used to refer to universality such as *immediate possibility*, *personal experience*, and *inevitability* (Barrett and Behne, 2005; Cuddy-Casey et al., 1997).

Sub-Concept of Inevitability

Inevitability means that death is ultimately unavoidable and necessary for all living things (Kenyon, 2001; Nguyen and Gelman, 2002; Hunter and Smith, 2008). There is some conflation of the terms *inevitability* and *universality* (Cuddy-Casey et al., 1997).

Sub-Concept of Irreversibility

Irreversibility means that when a living thing dies, its physical being cannot come back to the life again (Cuddy-Casey et al., 1997; Speece and Brent, 1984; Kenyon, 2001; Hunter, and Smith, 2008). According to Speece and Brent (1984) some studies use the term *irrevocability* (as in the study of White et al., 1978), or the term *finality* (Nguyen and Gelman, 2002) to refer to irreversibility. However, Speece and Brent (1984) make the point that physical death is distinct from spiritual life, and irreversibility refers to physical death.

Sub-Concept of Non-functionality

Non-functionality means that biological functioning ends (White, Elsom and Prawat, 1978; Speece and Brent, 1984; Cuddy-Casey et al., 1997; Slaughter and Lyons, 2003; Polling and Evans, 2004; Barrett and Behne, 2005; Hunter and Smith, 2008). All life-sustaining functions stop with death (Kenyon, 2001). Other terms for non-functionality include *cessation* and *dysfunctionality* (Speece and Brent, 1984). A further sub-concept, *unpredictability*, is mentioned only in Slaughter's (2005) study. He claims that the timing of natural death cannot be predictable.

To conclude, studying the meaning of life and death took several angles which were explained initially by psychoanalytic theory followed by cognitive theory. Under cognitive theory, a new perspective was established that focuses on children's understanding of death in terms of their biological knowledge. The following section describes this perspective of how could children understand the phenomena of life and death through biological knowledge.

(3) Cognitive perspective on children's understanding of the death through biological knowledge

The following paragraphs review the perspectives of the understandings that children have about the concept of death:

1. A brief history is established with the biological perspective;
2. Contemporary studies are examined to study children's understanding of death biologically, and
3. The effects of the metaphysical aspect on concept of death biologically.

(1) Establishment of the biological perspective

This approach focuses on cognitive developmental research and theories regard to how children learn. Through domain-specific conceptual acquisition and domain-general development this approach suggests that young children construct naive theories about the world (Berk, 2000). This model of cognitive development shows the importance of the causal-explanatory models in organising children's knowledge and illustrates the existence of conceptual change in children's learning. Analysing children's understanding of biology is an example of this new approach (Carey, 1985; Gopnik, Meltzof and Kuhl, 1999; Inagaki and Hattano, 2002; Slaughter et al., 2005; Wellman and Gelman, 1992). The following section contains perspectives of cognition theory on the biological development during various stages.

Understanding the concept of life through biological knowledge

Piaget considered essential cognitive development to be the growing distinction between intentional and mechanical causation. In the scientific perspective, Carey (1985) considers essential development as related to biological knowledge.

Piaget confirmed that the schema of young children's thinking indicates that they do not understand the meaning of life. This is similar with Laurendeau and Pinard who argued that children's justifications about animals and plants being alive are insufficient to enable them to understand fully the meaning of life. This encouraged Carey to focus on understanding children's semantic source of their judgments. From this exploration, Carey claims that only at age 10 do children become able to achieve a fuller understanding of the biological concept "living thing" and the word of "alive" (Carey, 1985).

Having investigated children's inductive reasoning through many studies, Carey (1985) explored the extent to which different entities (such as people, animals, insects, and inanimate objects) possess biological properties such as the capacity to eat, breathe, feel emotion, reproduce, die and sleep. She then claimed that young children do not have the skill of thinking logically to categorise people and animals under one category, due to their bias to people. They also do not categorise animals.

Carey (1985) found that children understand that entities have biological status similar to the status or behaviour of 'people', but not to those of 'living thing'. This is because children do not have a coherent understanding of how biological phenomena relate to living things. By studying children's justifications including some that were biological, Carey found that children 3-4 years do not understand the concepts of alive and not-alive. She argued that 4-7 year old children have

no biological knowledge about life. They understand the concepts of biological phenomena (such as animals, babies, life, growth, and death) as a naive framework of psychology (Carey, 1985; Slaughter and Lyons, 2003) because they do not recognise either internal organs or the functions of these organs.

Another group of studies found that 3 year old children are unable to use some knowledge of biology in their reasoning or prediction about an animal's lifestyle (McCarrell and Callanan, 1995; Graham, Williams and Huber, 1999).

This means (for this study) that previous waves of research, whether psychoanalytic or cognitive, have judged children's understanding of the concept of life and death by only one scientific point of view - biological knowledge. It is a focus similar to one aspect of Freud's theory. The key problem with this limited view is that it is confined the biological aspect as causing life and death deductively, which has narrowed the investigation scientifically.

There is an issue which must be considered seriously: if some children do not develop an understanding of the existence of internal organs and their functions; or if they do not understand the concept of cessation, it is not a complete scientific investigation. Children could learn biology through the pre-school curriculum, and in the school curriculum, but are those children able to understand the complexity of the abstract notion of cessation and life and death?

Understanding growth

For a further investigation on children's understanding of the concept of life, research looks at their understanding of growth. For Carey (1985), young children lack an understanding of growth. This is due to their lack of understanding in regard to the functions of internal organs. Consequently, they are unable to understand the relationship between biological functions and death. Young children assimilate the notion of death to a psychological phenomenon rather than a biological phenomenon. For example, they think that dead people sleep for good or go away for good. She argued that the lack in young children's understanding of biological status is the reason for their misinterpretation of the meaning of death (Carey, 1985; Slaughter, 2005).

Opposite results to Carey's finding were stated by several studies focused on children's understanding of biological issues and death (Slaughter, 2005; Springer and Keil, 1989; Keil, 1992; Slaughter, 2005; Springer, 1995; Solomon and Cassimatis, 1999; Jaakkola and Slaughter, 2002; Hatano, 1994; Kalish, 1996). The results from these previous studies indicate a new shift in the research on children's understanding of biology and the concept of death. These studies contradict the idea that children's understanding of biology is weak. They claimed that young children are able to understand the concept of life in relationship to understanding their body's internal organs functions.

However, these results were considered after the educational intervention of training children, as young as four, to work with biological activities such as understanding the function of heart or lungs. The aim of that claim is to train them to practise biological activity. This was assumed to help children to shift from a psychological to a biological understanding about life and death. To

be more precise, the assumption predicts that when they understand the concept of life, this helps them to understand the concept of death (Slaughter, 2005).

These results that based on children's thinking about biology show that young children between ages 4-6 begin to understand the biological side of the human body (Slaughter, Jaakkolah, and Carey, 1999; Jaakkola and Slaughter, 2002; Slaughter, 2005). They start to understand the principles of organs. This reasoning ability is organised by the causal-explanatory principles that use biological form instead of psychological form. Through this biological training argues Slaughter (2005), children could understand life and death. This explains Piaget and Carey's perspectives on underestimating biological knowledge as different from other. The following section relates the various arguments of these studies in their attempt to shed the light on children's knowledge of biology.

(2) Contemporary perspective on children's knowledge of biology

Through the previous explanation I showed that Piaget and Carey focused their attention on the scientific aspect as one of the main parts of children's thinking to understand the concept of death to make their investigation clear. In this section I draw attention to the following stage of research to Piaget and Carey which continues the same scientific path of investigation. This highlights the arguments among studies which focused on children's abilities to understand biology. Based on this biological debate in the field, I move to show my research path in the same scientific field from a new angle.

Since the work of Piaget and Carey many studies claim that pre-school children are able to understand the meaning of life and living things (Keil, 1992; Inagaki and Hattano, 1993; Keil, 1994 and Slaughter and Lyons, 2003; Kelman et al., 2003). They found that children think about living things based on understanding bodily functions (Kelman et al., 2003). However, it should be noted that the main goal of these studies (Inagaki and Hattano, 1993; Keil, 1992; Keil, 1994 and Slaughter and Lyons, 2003) was to investigate children's understanding of living things, but not to investigate their understanding of the concept of death. The focus was on probing their scientific abilities such as inferences and reasoning.

Kelman et al.(2003) indicate that several studies explored young children's ability to use functional reasoning in terms of inductive structures about living things; they used a structure of teleological-function as the first reason for any biological phenomena, such as growth, illness and bodily function (Slaughter and Lyons, 2003). In the study of Kelman et al. (2003), the

inductive method introduced young children to information about living things. The aim was to investigate whether children are able to use this information in their decisions about living things and their behaviours and their conclusion states that 3-5 year old preschool children employ functional reasoning in making inferences about the behaviour of the entities. They confirm that children categorise and reason about living things based on their biological thinking and used logical reasoning about the function of living things. However, their ability to explain their reasoning - which is based on the inductive information - is still limited (Kelman et al., 2003).

Brewer and Samarpungavan (1991) confirm a great challenge here. They show that as young children used the underlying information instead of the surface information, this is strong evidence of their ability to infer logically. This means that children's inferences do not rely only on concrete objects, so we could argue strongly against the idea of children being simply concrete thinkers. It is logical analysing, because they were able to make inferences successfully, through inductive strategy and from the clues. But at the same time it is possible that they could understand an animal's or bird's instincts or external bodily functions, such as eating or breathing. It is not easy for them to recognise internal bodily functions. It is not easy as well to recognise the link between these internal bodily function and life.

Besides inductive reasoning, there are other studies which focused on children's deductive reasoning (Richard and Sanderson, 1999; Dias and Harris, 1988, 1990). These studies – which show that young children are able to make logical reasoning deductively - will be discussed in section two in Chapter Two. If young children are able to use the biological information from the external functions of body, it does not reflect their understanding of how life would be

impossible without those organs. It is an argument that means that children do not have a full understanding of death from the point of the biological cessation.

Other studies focus on what children understand about bodily function. Atwood (1984) related that young children recognise physical deterioration after death. In this study, 25 per cent of children considered that dead people could feel hungry and could have emotions. Atwood suggests that this means young children have a limited awareness of non-functionality. In the study of Speece and Brent (1992) 90 per cent of children recognise the cessation of motion, 65 per cent understand that sentience (thinking, feeling) and perception (hearing, seeing) end with death (Kenyon, 2001). Still another study found that boys understand cessation more than girls do. However, there was no specific reason mentioned to justify the reasons (White et al., 1978). These findings are dissimilar to Nagy's (1948) who found until the age of 9 children do not understand physical deterioration. Carey (1985) supports this finding. Children at ages 6-7 respond to the meaning of death as a thing that happens to people - getting shot or contracting diseases. But they do not understand that these external events affect the internal organs which could cause death. Carey clarifies that young children do not conceptualize death with regard to biological reasons (Carey, 1985; Lazar and Torney-Purta, 1991). Moreover, Carey (1985) states that young children are unable to build biological knowledge; because children must (1) differentiate between biological entities, and they also must (2) understand the causal mechanism that enables them to predict and explain the behaviour of the entities (Slaughter and Lyons, 2003).

In contrast to Carey's finding, other studies have challenged her findings (Inagaki and Hattano, 1993; Keil, 1992; Keil, 1994; Opfer and Gelman, 2001; Jaakkola and Slaughter, 2002; Slaughter and Lyons, 2003; Kelman et al., 2003). There is unanimous agreement of results between all these studies which explained children's thinking in trying to understand life and death from the biological domain. In addition, studies by Inagaki and Hatano (1993, 2002) show that by the age of six, children's concept of life is the basis of biological phenomena such as growth, illness and bodily function (Slaughter and Lyons, 2003).

By investigating the mechanism of biological causal-explanatory and vitalistic causality, researchers such as Slaughter and Lyons (2003) presented evidence on children's ability to use this mechanism which enables them to develop an autonomous domain of biology. They then tested the children's acquisition of life and death concepts in terms of this framework. They posit that when children work on the framework, they re-organise their concepts about life and death which shows their ability of making biological reasoning and inferences.

While focusing on the meaning of the concept of death from scientific point of view it is impossible to neglect another aspect that appears usually on the surface of negotiation while (some) people think about death. This aspect affects children's understanding as well. This aspect is metaphysics, which I argue is important to discuss it in this field in order to make every part of the investigation clear from any ambiguity. In the following part an explanation shows two points I argue create confusion for some researchers while making their decision on whether children understand the concept of death or not. This confusion is related to two of the sub-concepts (reversibility and non-corporeal continuation) as it can be interpreted from several meanings such as the notion of coming back to life from death (reversibility) which has

seemingly happened in some rare cases or the notion of dead people having an afterlife (non-corporeal continuity). In order to explain that my argument (about children's understanding of the concept of death from scientific knowledge) is clear from any metaphysical aspect, I provide an explanation about these two sub-concepts in the following paragraphs.

(3) The effect of metaphysical aspects on children's understanding of the concept of death biologically

Heaven and moving to places far away from earth is a common subject that children interact with within their societies. These stories go hand in hand with the meaning of the concept of death or answering questions about death. It is an issue that should be included here in order to depict a perspective of this study in order to see what type of schema children use to understand death cognitively. Metaphysical aspects include two issues which are (1) medical reversibility and (2) non-corporeal continuation. The reason for mentioning both issues here under the biological section is that both issues could refer to internal matters, such as functions of organs and the existence of the soul. It is important to understand children's responses since it is mentioned by other studies that reflect beliefs, the existence of spirit, and that dead return to life (Anthony, 1939; Candy-Gibbs, Sharp, and Petrun, 1984-1985; Kenyon, 2001).

1.1. Medical reversibility

The first issue, medical reversibility, is a subject found in some news or television programmes. It refers to cases of dead people who were diagnosed as having technically died but then they returned to life for unknown reasons (Speece, 1995). This sometimes happens with cardiopulmonary cases. This situation is unusual and it is under medical investigation. An illustration about these cases and the investigation on it reversible is found widely in the project AWARE, which was established by Dr. Sam Parnia (Parnia, 2008). His investigation focuses on establishing a new scientific way to find out what and why these cases happened (Parnia, 2008)

and to explore the biology behind this reversibility. For instance, during a professional football match in Bolton, England the footballer Fabric Muamba collapsed in front of 35.000 spectators and millions watching on TV on 17th March 2012. He was diagnosed that by the time his head hit the floor technically he was dead by cardiac arrest. It was a phenomenal case as his heart was under electric stimulus for fully 76 min after it stopped before it burst back into a beat. This event received much medical attention in suggesting many biological reasons caused his 'death' for this long period of time before strangely he reversed back to life. The biological investigation on this case left many people announcing their confusion. Was he dead? Some people reflected their acceptance with the idea of reversibility (Bazian, 2012).

Discussion on this medical reversibility was opened some time ago in research such as in Speece (1995), who described people's reaction toward this notion and its cases. Adults are divided into three different groups in their attitudes about reversibility: 1) death is never reversible; 2) death is sometimes reversible and 3) death is possibly reversible (Speece, 1995). Some young children think that dead people are brought back to life by doctors in hospitals, while older children show that they believe that dead people could come back to life (Speece, 1995). Speece and Brent (1948) and Speece (1995) indicate that this belief in medical reversibility can cause confusion for some adults and children. In the meantime, Speece (1995) cites other researchers such as Robinson (1977); Weber and Fornier (1985) and Walco (1984) who all show that their results are the opposite which reflect that some people do not believe in reversibility. Mahon et al., (1999) also mention that some people do not believe in reversibility. It seems that the cases of medical reversibility makes the definition of irreversibility more complicated than is suggested because

there is still confusion among researchers on what children could understand about irreversibility. In justifying that this conflict is found in results, Speece suggested that there were problems in the methodologies of the previous studies and recommended that future studies seek a better understanding of how to decide on the connection between understanding of the concept of death and medical reversibility (Speece, 1995).

Before moving to conclude section (1) and to the next section, another metaphysical point will be mentioned below. It is another point that could confuse researchers in deciding whether children understand the irreversibility or not.

1.2.Non-corporeal continuation

This issue refers to the belief in continuity after death to another life called the afterlife, which includes heaven and hell. It is a complicated issue because it includes additional complexity such as the belief in the resurrection, belief in spirit and soul, and belief in energy continuation (Noppe and Noppe, 1997; Kenyon, 2001). As mentioned above about belief in possibility for dead people to come back to life, the belief in the non-corporeal continuation is an important issue must not be neglected. It was a usual justification in discussion about death, which researchers found in most children's answers about what happens when we die.

Studies which investigated adult's and children's understanding of death indicate that while pre-operational and concrete operational children show an understanding of the irreversibility of death, adolescents see it as reversible. These results indicate that the children's religious background strongly affects an understanding of death (Candy-Gibbs et al., 1984-1985; Kenyon, 2001; Noppe and Noppe, 1997). However, these results are still unclear in showing whether

children understand that the person who died is physically returning from death or spiritually continuing on in another existence (Kenyon, 2001). Consequently, this makes the definition of irreversibility more complicated because it reflects that some people believe in that dead people are able to live their same lives invisibly.

By explaining the two points above, I assume that children in my data will reflect some information about dead people reversing back to life. Whilst respecting the wide knowledge children could have, however, my investigation is focusing only on pointing out any scientific understanding that shows children are able to recognise death in the final moment that cannot allow for any reversibility. Consequently, it is important that the scientific perspective be included in the definition of the concept of death. To do this, it is important to focus on each sub-concept of death to shed light on the weakness of the definition if it does not include a scientific perspective.

Summary

This section has shed light on the development of previous investigations regarding the concept of death. It has been demonstrated that all domains of research need to investigate the meaning of the concept of life in order to understand the concept of death. In the psychological perspective, Freud related the drive of the death instinct in the infantile and childhood experiences and depicted a part of the meaning of the death in a scientific form, which shows death as a biological instinct which drives the human to a non-existent level. However, his theory was not accepted, since the effect of the experiences of sadness and loss couldn't prove that children understood the concept of death.

Consequently, the investigation of children's understanding of death was directed toward the theory of Piaget to study cognitive development in regard to life and death in each cognitive stage. All investigations portray the construction of the concept of death as it happened since early childhood. Piaget's view of the concept of death became clearer as it was divided into four sub-concepts. Based on his stages of cognitive development Piaget claimed that children could only start to understand the concept of life and death at the stage of concrete-operation. This is because only at this level will conservation, universality and reversibility be developed. It is also because biological ability is naive and it would not support children's understanding of death until age 10. On the other hand a new stage, based on challenging Piaget's perspective on young children's cognitive ability, has later started to focus on the biological knowledge of young children and has established a new assumption around their understanding of the concept

of death. The next section describes the debate among studies that followed the cognitive theory of Piaget on children's understanding of the concept of death.

Section 2

Critical review on children's understanding of the sub-concept of death

Critical review on studies that focus on children's understanding of the sub-concepts of death

The previous section explains the psychological, cognitive and scientific perspectives on the meaning of the concept of death. This section shows the results of studies which focus on how children could understand the four sub-concepts of death identified by Piaget; *universality, inevitability, irreversibility, and non-functionality*.

Generally, and as shown previously in this thesis, arguments among studies into children's understanding of death differ between agreement and disagreement on their capacity to understand the meaning of life and death. However, it has been demonstrated that the results of those studies which claimed that children are able to understand the concept of death were ambiguous in some points. The claim of these studies includes a suggestion that this investigation needed to be more precise. This section, therefore, undertakes a critical perspective on the previous investigations.

Understanding of the Sub-Concept of Universality

To investigate how children understand that all living things die we have to focus on their understanding of the concept of *living things*, the meaning of *life* and the relationship between *life and death*.

With the importance of the cycle of life and death, research in the cognitive field investigated children's understanding of biology as an attempt to measure their understanding of death (Slaughter, 2005; Kenyon, 2001; Slaughter and Lyons, 2003; Polling and Evans, 2004; Barrett and Behne, 2005). This biological aspect is a fact, which means that the functions of internal

organs cause life and death to every entity. It is the first logical idea that comes to mind when understanding what could cause problem to the body as it loses functions. This means non-functionality of organs cause death of the body. This is an adult's view, however, that suggests children should understand this relationship and assumes that children understand the cessation of internal organ functions not only of human beings, but also animals and plants. Based on this definition, previous studies judged children's understanding of death.

Biology is a starting point to learn about life and to build knowledge of categorizing biological phenomena. Children usually learn biology through educational interventions in preschools/schools or at home. Through this educational intervention they could grasp a wide range of complicated ideas from biology to support them in building their knowledge and make their own judgments on these phenomena. It is a path that drives to understand what, when and how things live (but probably how to die).

Understanding that all entities die

Previous studies had claimed that the full understanding of death as a biological process means that children should understand the universality of death for all biological entities, including themselves, other people, plants and animals. In Carey's (1985) investigation she stated that young children understand the concept of biological phenomena (such as animals, babies, life, growth, and death) as a naive framework of psychology, but not before the age of ten (Carey, 1985; Slaughter, 2005). Another group of studies found that three year old children are unable to use biological knowledge in their reasoning or their predictions about an animal's life cycle

(McCarell and Callanan, 1995). Nguyen and Gelman (2002) examined children's biological reasoning between ages four to six years to ascertain their understanding of death in plants and animals. This is particularly interesting in understanding plants, because, unlike animals, some plants live for hundreds of years. Plants also could have some dead parts, but can still be alive which could confuse young children with these biological processes and could infer that plants do not die. The results of these studies show that children at age four years do not normally understand universality, while children at the age of six years do, accurately assessing a biological reason for the plant's death. However, Nguyen and Gelman (2002) confirm that there was confusion between the two groups in understanding death for all types of plants. For example, children were confused between the death of flowers and weeds. Consequently they assessed that children do not have a fully coherent understanding of plant death.

Thus it was suggested in some studies that children in the pre-operational stage do not have the cognitive capacity to understand the meaning of universality. As Hunter and Smith (2008) indicates in both the pre-operational and concrete operational stages children do not understand universality. This result is similar to Piaget's view, which indicates that they do not have the ability to conserve, which is a prerequisite to a mature concept of death (Hunter and Smith, 2008).

As Hunter and Smith (2008) describe, Hyslop-Christ's results (2002) are completely different than Hunter and Smith's (2008) which reflect significant relationships between children's age, children's ability to grasp the idea of seriation, and their understanding of the universality of death, with children understanding the universality of death from the age of four (Hunter and Smith, 2008). To explain these cognitive concepts, some studies focus on *the order of*

acquisition of the sub-concepts of death. Lazar and Turney-Putra (1991) and Kenyon (2001), for example, are similar in their results in that children initially understand universality, then irreversibility, and then non-functionality.

In other studies five to 11 year old children were asked about their understanding of universality (White et al., 1978; Koocher, 1973; Kane, 1979). Their results show that children understand universality between six to eight years (Koocher, 1973; Kane, 1979; Mahon et al., 1999). This result is similar to Piaget's perspective that children in the operational stage, who understand conservation, understand universality (Mahon et al., 1999; White et al., 1978). On the other hand, Mahon et al. (1999) found that 63 per cent of the children of their sample understood universality and this result is quite different from Koocher (1973) and Kane (1979). Mahon et al. (1999) instead found that six year old children have a clear understanding of the concept of death and are similar to children at age 10-11. Conversely, however, at the same time of similar understanding between these groups of age they also found that an older child at 12 years did not have a mature understanding of the concept of death.

These results motivated Mahon et al. (1999) to see that the developmental level was not necessary for having a mature understanding of concept of death. They justify this possibility as related to the children's experiences of death, such as awareness of a war situation or the death of someone close to the child. It also could be related to what they have learned about death in school (Mahon et al., 1999). These results about children being able to understand death much earlier than the concrete-operational stage are thus similar to those in other studies (e.g. Reilly et al., 1983; Orbach et al., 1985-1986 and Hyslop-Christ, 2002, Hunter and Smith, 2008).

Several studies challenged Piaget's theory that young children cannot understand death. This is because they found that children in their pre-operational stage understood that death comes to all people and happens to all people alike (White et al., 1978). These investigations focused on children between ages 4-12 and found that there is a significant relationship between age and universality (Childers and Wimmer, 1971; Atwood, 1984; Hunter and Smith, 2008; Cuddy-Casey et al., 1997; Speece and Brent, 1992; Kenyon, 2001; Candy-Gibbs et al., 1984-1985; Hunter and Smith, 2008).

So, to judge children's understanding that all entities die based on understanding of functioning, previous studies couldn't confirm this capacity. The different levels of ages in children's understanding, particularly in regard to seriation and universality, reflect that there could be a missing link in the investigation.

Problems in investigating children's understanding of universality

Investigations which focus only on the biological view related to the internal organs and external classification have examined children's thinking on only one scientific aspect and it is important to shed further light on this, particularly as this aspect could be very abstract to some young children. From this point of view, there are three problems that exist in studying children's understanding of death through biological concepts:

1. the relationship between the phenomena of life and death is an abstract notion for young children;
2. the notion that all living things die when their organs fail to function is abstract; and

3. the notion of organ function and its cessation are very difficult for children to understand. Slaughter (2005) argues that the invisibility of the organs is a reason for this complexity,

To avoid these problems, I sought to find another link of investigation in cognitive understanding. From the point of view that 'my pet is not here anymore' or 'my grandfather is not living any more with us at home and we are unable to see him again', if another type of investigation focuses on the notion of the disappearance or non-existence of the body, and alternative from situation to another, this strengthens the investigation. Therefore, this requires finding out how children understand the concept of the existence and non-existence of an entity. In addition, as previous investigations focused on understanding internal organs which are *invisible*, the argument here is a need for a further investigation of understanding of the concept of invisibility. This might help us to focus on how children understand other entities which are invisible. There are lots of examples children could learn about such as germs, air, gas, gravity and very simply, the sugar which dissolves in water. In astronomy, for example, people believe in the existence of the sun while the moon appears in the sky, and they believe in the existence of the moon while the sun appears in the sky. Understanding the invisibility of the sun and the moon in the sky could thus be much easier for children to understand more than understanding the invisibility of organs inside the body. To recognise that all entities die, become not existent anymore and disappear from our environment, it needs a development in the cognitive concepts of existence and appearance. The notions of existence and non-existence, appearance and disappearance of a person or pet could be a scientific link to understand death through other concepts such as in physics and astronomy. These are abstract concepts which are not easy to

investigate, but I argue that it is an introduction to understand the cognitive schema children have because sciences such as physics and astronomy are based on systematic patterns and stable phenomena.

Concepts that are interrelated to each other shape children's cognitive knowledge in understanding their lives. This is because children deal with these concepts every day in their activities. For example, to explain how these systematic stable phenomena are one of the children's interaction repeatedly in their daily life we can see that there is a time for the sun to exist in the sky and another time when the sun transfers to another place and ceases to rise up and exist in the sky. It appears and begins to exist in another place. Consequently, the point is how children construct days and nights in their mind. In other words, it helps us to understand how children think about the duration of a day or even a year which ends at a specific time. Every year ends and every day ends in a specific time and cannot return back. This aspect is found among children's observations or explorations of the environment around them. During this daily journey they use a systematic pattern of reasoning, justification, classification and seriation to support themselves to understand not only what exists and what not exists. They also understand the relation of this existence with time.

In the field of research under cognitive thinking several attempts thus have been made to investigate how children understand entities which are invisible. In the section about children's understanding of astronomical concepts (see the next chapter), the description of invisibility and hidden entities or phenomena will be discussed more fully under the understanding of existence.

A new path of investigation

The conclusion to be drawn at this stage is that the investigation of children's understanding that death is universal is based on understanding personal death and other living things become non-existence at a particular time. Consequently this requires that this study add a new scientific term, the concept of *time* which will be discussed more fully at the end of chapter (2).

Children's understanding of the Sub-Concept of Inevitability

Similarly, to other investigations into children's understanding of death the sub-concept of inevitability has been a focus point for researchers. The factors to consider in this context are cognitive development, age and biological knowledge.

Some studies focus on the effect of cognitive development (Speece and Brent, 1984; Lazar and Torney-Purta, 1991; Hunter and Smith, 2008). Lazar and Torney-Putra (1991) found that children understand universality and inevitability before they understand the causality of death (Hunter and Smith, 2008). Reilly et al. (1983) considered children's understanding of loss to examine their belief in personal mortality and their results show that children's beliefs about their personal mortality is related to their cognitive ability. For example, 100 per cent of their subjects who understand conservation also understand personal mortality, but 63 per cent of their subjects who do not understand conservation do not understand personal mortality (Kenyon, 2001; Hunter and Smith, 2008).

Hunter and Smith (2008) mention that Hyslop-Christ's (2002) study shows that until the age of eight children do not have the cognitive capacity to understand the meaning of inevitability

(Hunter and Smith, 2008). On children between ages of four and seven, Hunter and Smith (2008) examine the effect of three cognitive skills - the ability to grasp conservation, classification, and seriation in regard to children's understanding of inevitability. The results show a significant relationship between children's abilities of seriation and conservation and their understanding of inevitability. According to Hunter and Smith these results confirm that children in the pre-operational stage understand the concept of death earlier than reported in previous studies. To investigate children's understanding of inevitability through biological knowledge, it was assumed that children could recognise that all living things die and cannot avoid death - people, plants and animals.

As mentioned previously in the sub-concept of universality Nguyen and Gelman (2002) focused on children's understanding of plants which resisted efforts to kill them. This study is mentioned here because to understand the death of living things inevitably demands that young children realize specific types of plants and biological characteristics. Nguyen and Gelman's research suggests that young children do not have a full coherent understanding of a plant's death. Their results are similar to other studies which argue that children's understanding of death depends on their understanding of the type of entity involved and the way in which these entities could appear or react differently. To make it even more confusing there could also be different types of the same entity such as weeds and flowers (Orbach et al., 1985). To conclude, therefore, these studies conclude that children do not have a full understanding of the relationship between biology and the inevitability of death, with children being inconsistent in their understanding of death for different types of entities (Nguyen and Gelman, 2002). The general line of argument is that children understand the concepts of life and death through their understanding of functions

(of flowers and weeds) which are internal and invisible to them. Whilst children can understand the cycle of life and death in particular cases they are often confused with the wide variety of plants.

However, there is a wonderful feature about these cases. As we are trying to focus on what children's point of view is when they think, the science of biology supports us in studying their vision. For instance, it is easy to investigate children's understanding of a flower's lifespan. Children usually are able to take care of their own small flowers in their classrooms or homes - they water and look after them, but later on they see their lovely flowers do eventually die. They could understand that their flowers die because these flowers only have a limited life which allows us to then focus on time and duration for living things that eventually die.

In one study children's knowledge of the inevitability of death is considered by looking at children's understanding of animals who are extinct and what extinction means and asked the whether children understand extinction in terms of biology (Polling and Evans, 2004). In their sample they interviewed adults, biologists and young children between the ages of 4-9. They found that biologists gave a biological reason, represented by Darwinian evolutionary theory, whilst the explanation from other adults about what happens after death was divided into two categories. The first explanation is a spiritual or metaphysical belief. The second is a popular response, which relates to cultural practices such as burial and funerals. Polling and Evans (2004) reported that the understanding of extinction for biologists is different from other adults and concluded that adults and young children deny the idea of inevitability for the extinction of a species specifically for humans. However, children seem to understand universality in regard to human beings and animals with their explanation being biological (for example, dead things do

not breathe and the reason for their death is lack of air). Polling and Evans (2004) suggest that in future studies a greater emphasis should be placed on the relationship between ecology and existential reasoning. By this suggestion, it reflects that there is a need for invitation to extend the investigation into more scientific perspectives. It seems that inductively there is a need to focus on more than one area of biology such as ecology as another angle to understand life and death. This sheds lights on understanding the relationship between population and the environments. Once we are able to discuss the ideas of populations and generations with children, it means that we are using the cognitive concepts of seriation, duration and time. It suggests further investigation among the areas of scientific knowledge. As some other studies did, such as the study of Hunter and Smith (2008) who focus on the concept of seriation as one of the concepts play a main role of understanding the concept of death cognitively, I will discuss below in more details the factor of time in understanding that death is inevitable.

As mentioned in chapter (1), the concept of seriation is a cognitive concept that Piaget illustrated that not before the concrete-operational stage children are able to rely on it to understand death. Simply, it is because they are unable to understand the concept of time. However, my argument is a confirmation that investigation of understanding of the concept of time is an introduction and a bridge guides us to study children thinking about the concept of death as a new path of investigation.

The factors of time and duration

It is reasonable to focus on another scientific fact instead of biology as this could create a new understanding regarding the inevitability that humans cannot avoid death. It is true that organs keep people alive, but the focus could extend to each person's particular time of death. Some

people live longer than others, but people are aware that they can die at any time. There is always the possibility of death, so death puts a stop on life (May, 2009). Therefore, time is a factor that albeit is a complicated issue to be investigated.

At the same time that those ideas are complicated, they are still less complicated than understanding the cessation and the wake up after death.

Cessation is an abstract idea for young children to imagine. Educational intervention does prepare preschool children to understand some internal organs and their functions, but cessation is still a difficult process for adults (who are not biologists or specialists in anatomy) to understand and a complicated subject for children as a reason of death.

In addition, under the notion of non-corporeal continuation, which is the belief about continuity after death to another life (Kenyon, 2001; Noppe and Noppe, 1997), the belief of reversibility about souls returning to life, strongly affects the understanding of irreversibility (Candy-Gibbs et al., 1984-1985; Noppe and Noppe, 1997; Kenyon, 2001; Speece and Brent, 1992).

Cessation and non-corporeal continuation are two different directions children face during their growing. There are different paths of learning. They are parallel with the development of understanding of the concept of time.

Beliefs can thus not only affect understanding of irreversibility but it also an understanding of inevitability. To divert understanding from irreversibility to a reversibility of death is a serious weakness when trying to understand the meaning of inevitability and irreversibility. Such explanations tend to overlook the factor of time. For example, people die because there is a time in which they have to die, and people are unable to come back to the previous time because time

is linear which means death is irreversible. We cannot avoid this moment in our future because time is linear which means inevitability.

Piaget considers the concept of time and concludes that in the concrete-operational stage children are able to think forwards and backwards in space and time (Piaget, 2006; Baker, 1973). That understanding gives them more abilities than pre-operational children in grouping, differentiation, extending, serialisation and combining existing structures into new relationships. However, children at the concrete-operational stage still have limited abilities in dealing with abstract ideas. In dealing with children's problems about time and duration, Piaget stated that the principle of time develops in three stages. These stages are distinct and take place during each stage of the pre-operational, concrete-operational, and formal. Piaget explained that through these advancing stages of time and duration, most children in the pre-operational stage, lack the ability to understand time and duration. Children have to understand three operations:

1. Children need to understand seriation of events, which represents chronological succession;
2. Children need to understand that intervals between events happen in a certain time period which is called duration (events starts at a specific time and end at a specific time); and
3. Children need to understand temporal metrics which are analogous to spatial metrics (Baker, 1973).

Children in the pre-operational stage fail to judge duration because they tend to be concerned only with physical and psychological contents that attain speed. Also, they fail to judge duration because they lack the ability to think about both points at the same time - the start and the finish. They confine their observations to only one of those points (Baker, 1973).

2. A new path of investigation

Working from scientific understandings, death is the end of a lifespan and happens once. This end (death) means that a living thing does not exist anymore and also means that at a specific time the bodily functions cease. To find out if children are able to understand this scientific meaning it is reasonable consequently to explore a new path to investigate their understanding of time and duration related to death. The addition of the concept of time is important and strengthens the investigation because it sheds lights on how far children are able to recognise the relationship of the concept of time with their daily life. This will be discussed more fully in the chapter on methodology.

Based on the fact that death is an end of life span of the body and causes its cessation permanently, then death is a phenomenon includes many scientific aspects such as physics, mathematics and biology. Addition of other sciences would focus on children's understanding of physics and mathematics before focusing on the internal functions of the body. For example, to have this opportunity of investigation of how to understand the concept of time it is possible to investigate how children understand phenomena in astronomy, because it is a science which does includes the dimension of the concepts of time, duration, numbers, size, and temporal/spatial metrics.

So, dealing with the science of astronomy will supports us to focus on the cognitive development of understanding basic configuration of these scientific concepts in children's minds.

Children's understanding of the Sub-concept of Irreversibility

The meaning of reversibility in Piaget's theory was mentioned in the first section, Chapter 1, and is one of the cognitive skills related to the concept of conservation. From the concrete-operational stage children are able to follow a series of steps and reverse back to their beginning point (Berk, 2000). They also are able to think forward and backwards in time which is not possible in the pre-operational stage because they are incapable of reversing their direction to the start (Baker, 1973; Piaget, 2006). Children who understand both reversibility and conservation understand that when people die they cannot come back to life again. This understanding is achieved by children at the concrete-operational stage while children in the pre-operational stage think that people can return.

As mentioned in the definitions of the sub-concepts of death (Chapter 1, Section 1), in previous research one definition was used for investigating the sub-concept of irreversibility, which means that when a living thing dies its physical being cannot come back to life again. This meaning guided researchers to follow some paths such as focusing on that understanding of death is linked to their cognitive development (Speece and Brent, 1984), or focusing on the effect of age, developmental process and biological knowledge in regard to children's understanding of irreversibility. In the meantime focusing on the corporeal continuity went side by side with the investigation of biological phenomena (Speece and Brent, 1984).

1. Effect of age

In the studies of White et al. (1978) fewer than half of the subjects, who are between ages 5-11, understand irreversibility whilst Hunter and Smith (2008) express the view that neither children

at 3-5 years old nor 6-8 years old understand irreversibility because they do not have the cognitive capacity to understand it. In both studies, most of children think that dead people come back to life; which reflects that irreversibility is not dependent on the age of child, as Piaget suggested (see Chapter 1, Section 1).

2. Effect of cognitive skills

Some studies use the Piagetian approach in cognitive development and suggest that the understanding of death and sequences of cognitive stages are parallel (Anthony, 1972; White et al., 1978; Speece and Brent, 1984; Koocher, 1973). For example, some of these studies suggested that the abilities of classification, transformations, linear notion of time and reversibility are essential for children to understand irreversibility (Speece and Brent, 1984; White et al., 1978; Koocher, 1973). Some of these studies found that there is a relationship between cognitive development and children's understanding of irreversibility (Koocher, 1973). On the other hand Koocher (1973) found 60 per cent of pre-operational children of the sample as same as Kalmbach (1978-1979 – cited in Speece and Brent, 1984) who found also that 73 per cent understood irreversibility. It was a surprise that among these results a high percentage of pre-operational children understood that dead people cannot come back to the life. This means that the pre-operational stage is sufficient to for some children to understand irreversibility. That challenges the theory of Piaget.

Conversely, the studies of White et al., (1978) found that there is no relationship between children's understanding of irreversibility and the development of cognitive abilities. For example, they found that only 33% of concrete-operational children in their sample understood

irreversibility, but it is a low percentage in this stage. This means that concrete thinking is insufficient for understanding irreversibility (Speece and Brent 1984).

These studies show an opposite result to Piaget's theory, which suggest that children in the pre-operational stage lack some cognitive skills until they progress to the next stage, the concrete-operational stage. However, others criticised the explanation and justification of this comparison between the understanding of death and cognitive development as unclear. Speece and Brent (1984) illustrated that the rationale of these studies was unclear and needs further explanation.

Another study focused on the effect of IQ on children's understanding of irreversibility (Orbach et al., 1986). These researchers found a significant relationship between intelligence and age and children's understanding of irreversibility. Intelligence supports children as they develop their abilities of abstract thinking, inference, and logic. These abilities help children understand the meaning of death (Kenyon, 2001).

While all previous studies have investigated cognitive development in children's thinking of death, a minority of them have explored cognitive development and age at the same time (Anthony, 1972; Kane, 1979; Koocher, 1973; White et al., 1978; Speece and Brent, 1984; Orbach et al., 1986). For example, as Speece and Brent (1984) show that Hornblum (1978) argued that cognitive development and age should not be separate issues in investigating children's understanding of death. Hornblum focused on the children's level of cognitive development independently of conservation. She used Piagetian time-concept tasks. As mentioned, Hornblum found that 40 per cent of children at the pre-operational stage understood both irreversibility and non-functionality. This is a high percentage of pre-operational children, which leads Hornblum to doubt the effect of age and cognitive development in regard to

irreversibility. Hornblum finally concluded that there is no relationship between children's concept of time and their understanding of irreversibility (and non-functionality) (Speece and Brent, 1984).

3. Effects of the developmental process

I mentioned that initially that based on a definition of the irreversibility, investigations were guided toward lots of paths. In order to shed light on these I explain below the focus of some studies which faced some confliction between their results due to the ways of understanding the meaning that death is reversible. For example, in exploring the developmental processes, Brent et al. (1996) examined the understanding of irreversibility in children from 4-16. Children's responses in their sample show highly correlated answers to questions about their understanding of irreversibility. The majority of the children (70-90 per cent) between ages 3-6 reflect the understanding that dead people cannot come back to life. But surprisingly, the results indicate that 60 per cent of the responses in their 16 year olds suggest that death is reversible. The justification of this change in their answers between the early years and teen years is that children understand irreversibility in their early years, but they adjust their understanding in their teens. Children in their early years give naturalistic explanations, which relate to scientific experiences, but in adolescence they abandon these scientific explanations in favour of spiritual explanations (Brent, et al., 1996). This justification is the same as result found by Noppe and Noppe (1997) who explore the concept of death in teenagers and college students. They explain how belief in spiritual life and non-corporeal continuity affect student's understanding of irreversibility. Teenaged students reconstruct their understanding of irreversibility due to their belief in heaven and hell, reincarnation, and eternal life (Kenyon, 2001). This reconstruction of

irreversibility seems to affect their understanding of non-functionality. Some studies indicate that some teenagers express their beliefs in non-corporeal continuation in both spiritual and physical functioning (Candy-Gibbs et al., 1984-1985; Kenyon, 2001).

To conclude, the different paths of investigation interpreted the results based on different views on the same definition. This motivated the interpretation of the results to assume that however there is developmental process children are unable to understand the sub-concept of irreversibility.

4. The religious/spiritual background of irreversibility responses

It is another path of investigation that some studies focus on an exploration of children's religious background. Children from 5-7 years who are raised in a religious background like Christian-Baptist (Candy-Gibbs et al., 1984-1985) or Muslim (Anthony and Bahana, 1988) believe that death is reversible according to their belief in the afterlife. Christian-Unitarian children, who believe in the finality of death, report different responses than Muslims and Baptists. Christian-Unitarian children understand that death is biological cessation (Kenyon, 2001). Slaughter (2005) concludes that some reports indicate that children with a highly religious belief, compared with their peers, are less mature in their understanding of the irreversibility of death.

Other studies compare children's understanding of death in different societies (Kenyon, 2001; Brent, Speece et al., 1996). These studies indicate that religious practices affect children's understanding of irreversibility between the ages 5-19. In the early years, children understand death as irreversible but they change this understanding from irreversibility to reversibility when they become 15 year olds. However, children's understanding of physically returning to life, or

spiritually continuing is not clear in these studies (Kenyon, 2001). It was also suggested by (Noppe and Noppe, 1997; Anthony and Bahana, 1988; Brent et al., 1996) and also concluded by Slaughter (2005) that teenagers who understand that death is irreversible, reconstruct their understanding to the reversibility of death. It would be reasonable here to suggest that this has confused previous researchers in their evaluation of what a child could understand about death. This is because it assumed that the new meaning of reversibility was achieved –deductively – by reconstruction. In fact, it was neglected that it is a separated paths of thinking moves in parallel with scientific knowledge.

Therefore, there is a serious weakness with these arguments, which suggests that responses of returning back to the life confuse an understanding of death. It is a methodological problem and this argument seems to have created confusion about the definition and resulting studies of irreversibility. Consequently, this study will seek to avoid the conflict of understanding caused by religious and spiritual beliefs and instead judge the meaning of the concept of death through scientific reasoning, using the factors of time and duration of life span.

5. Effect of the factor of time

Educational intervention by schools or families affects children's verbal explanations about the concept of death. Various socioeconomic backgrounds also shape children's meaning of death. However, it is not an easy task to investigate children's understanding because two difficult aspects caused confusion. These two aspects are (1) the notion of afterlife and (2) the abstract factor of internal organ functions. Having considered this confusion, these aspects missed one vital factor - time. The following paragraph justifies why this missing link affects the concept of death.

1. The notion of afterlife

A religious perspective on life and death has very wide and deep implications of belief and life and afterlife. Among all prophetic religions, Judaism, Christianity and Islam, there is a consensus about the concept of death. This consensus is a belief that death is the end of life (Anthony, 1972; Ayoub, n.d.; May, 2009; Zarbozo, 2002; Rasekh and Ayati, 2007).

Researchers found many religious comments among responses in their samples, such as “. . . people go to heaven after they die but their souls come back and visit their families on earth” (Speece and Brent, 1984). The focus of this study, however is on the duration of physical life from the moment of birth until the moment of death. This premise is based on the scientific fact that time is linear and the period of life that people in this study consider alive is separate from the any period of perceived afterlife. Clearly, therefore, the notion of linear time supports an understanding of irreversibility which separates the period of physical life from any other suggested period. Moreover, irreversibility is based on physical appearance. By using the main definition of irreversibility people are born in a moment and either live a short or long period and then die in a moment when physically it is impossible to live again. Therefore, by understanding the notion of linear time, this premise would support researchers understanding of irreversibility from a scientific aspect.

2. The abstract factor of internal organs function

Studies which have focused on biology assumed that young children understand the concept of death through that aspect of science. However, studies should not underestimate children’s capacity to think about other scientific aspects to understand irreversibility. I argue that it is not easy for young children to understand the cessation of internal organs functions which cause

death, but it could be possible to see if they understand that in time organs of the body will cease to function will not have any value any more. Therefore, this study could expand the investigation into other scientific fields. In order to achieve greater understanding of children's concepts of death, this study thus seeks to show the kinds of thinking children use to understand the concept of death besides biological knowledge such as the cessation of internal organ functions.

A new path of investigation

This study is thus expanding the parameters of scientific investigation and provides a focus on the information children could recognise inductively or deductively to build ideas about irreversibility in their minds. For example, children could recognise that the lifespan of some butterflies is not more than one week and for another kind of butterflies, it is not more than 12 weeks that those butterflies will not be alive again. This shows an understanding of the effect of time instead of internal functions. Children could recognise that dinosaurs were living in an era of time, for example, but are now extinct. This shows an understanding of time instead of reproduction or other internal biological reasons.

It is proposed, therefore that it may be easier for children to imagine the existence or non-existence of entities as related to many scientific factors instead of only biological factors. These concepts could create a link toward the impossibility of coming back to physical life again after death. This requires studies that strengthen the scientific vision in the main definition of irreversibility, which is a focus of this investigation and will be explored more fully in the chapter about methodology.

Children's understanding of the sub-concept of non-functionality

Working on how children understand biology is a very important field in education which was directed in more depth from the other side of Piaget theory. Piaget portrays children's knowledge of biology as weak in their pre-operational stage which prevented them understanding the phenomena of life and death (see Chapter 1, Section 1). More contemporary studies opened wider investigation on children's abilities by suggesting new ways such as using inductive strategy. This supports the investigation to see the depth in children's understanding of the internal functions of organs. This section shows the angles of these investigations such as studying the effect of age, cognitive skills, development process, the notion of after life and the children's knowledge of biology yet it is very difficult to evaluate whether children understand the concept of non-functionality (Kenyon, 2001).

1. Effect of Age

In investigating at which age children could recognise the relationship between biology and death, the following studies focus on young children's understanding of what could happen to the body after death found that young children understand non-functionality (Atwood, 1984; Speece and Brent, 1984; Mahon et al., 1999 ; Kenyon, 2001; Reilly et al., 1983). As mentioned in the section on irreversibility, some studies investigate whether children between ages 5-11 could understand non-functionality or cessation of bodily functions (see, for example: White et al., 1978). Similar to irreversibility, less than half of the children in this study understood non-functionality.

It was found also that some children could understand fragmented ideas about cessation. For example, when young children were asked why dead people cannot see, they answered “because their eyes are closed”. Consequently it seems they understand the concrete aspects which are visible to them (Lazar and Torney-Purta, 1991). This results that shows fragmented understanding is the same as what Piaget pointed out: understanding biology would increase with age, but not in the same way as children in concrete-operational stage understand biology and non-functionality (White, et al., 1978).

In contrast, Mahon (1999) found that 45 per cent of five year olds in the sample understand non-functionality while the majority of 6-7 year olds understand non-functionality, which are not small percentage. Similarly, Reilly et al. (1983) found that 78 per cent of preschool children understand that people are different after death.

2. Effect of cognitive skills

Generally, there is consensus between studies that understanding death and the cognitive stages are parallel (Anthony, 1972; Kane, 1979; Koocher, 1973; White et al., 1978; Speece and Brent, 1984). At the same time among the studies, however, there are contradictions within the results. I found in Speece and Brent (1984) that Kalmbach (1978-1979), Townley and Thornburg (1980), and White et al. (1978) found that there is no relationship between children’s cognitive development and their understanding of non-functionality. Kalmbach (1978-1979, cited in Speece and Brent, 1984), found that 84 per cent of pre-operational children understand non-functionality. It was stated that pre-operational children do not understand any of the sub-concepts of death, but this percentage means that at this stage young children can understand non-functionality. In addition, White et al. (1978) found that only 32 per cent of children in the

concrete-operational stage understood non-functionality which contrast with what was stated by Piaget that concrete-operational children understand death, but this result means that they are not at cognitive stage to understand non-functionality (Speece and Brent, 1984).

3. Developmental processes

It seems that understanding of non-functionality and irreversibility are related to each other and is a dual relationship. For example, to understand that dead has no more functions of organs should develop side by side with the meaning that one of those organs cease there is no more chance to reverse back to life again. Also, this irreversibility means that non-functionality is permanent and final. In exploring the effect of the developmental processes on children's understanding of the concept of death, Brent et al. (1996) examined the non-functionality in children between ages 4-16. In highly correlated answers 70-90 per cent of the children, between 3-6 years showed that they understand non-functionality. However, their results indicate that children adjust their responses from pointing scientific reasoning into non-scientific when they become 15 year olds.

Brent et al. (1996) explains that in their early years children give naturalistic explanations, which are related to their scientific experiences, but as they get older children abandon these scientific explanations in favour of spiritual explanations (Kenyon, 2001). This reasoning is the same as Noppe and Noppe (1997) who explore the concept of death in students who are teens or in college.

I conclude that these studies which investigated the developmental process neglected studying the non-functionality as a separated path which is parallel with the metaphysical path. The adjustment of the meaning of the non-functionality that allows the mind to accept reversibility of

the dead based on non-scientific reason is ambiguous. This leads me to conclude that the notion of linear time should be one of the main factors for exploring both irreversibility and non-functionality. Suggestions (that the belief in spiritual life and non-corporeal continuity) affect understanding both sub-concepts need not confuse researchers as such answers are not part of a scientific discussion (Kenyon, 2001; Noppe and Noppe, 1997). Simply put it is another and different path which is invisible knowledge during the growth of the child.

4. Effect of the notion of afterlife

In dealing with all aspects that could affect children's understanding of death, several studies explored the notion of afterlife in regard to death (Kenyon, 2001). This was discussed previously in the section of irreversibility.

Another view from the work of Harris and Koenig (2006) focuses on young children's belief in life and death regarding the philosophical and religious viewpoints by examining children's concepts of God and spirit. Harris and Koenig (2006) emphasize the parallel relationship between children's learning from science and religion discuss this relationship in terms of three examples from science - children's concept of the brain, the shape of the earth, and the functions of hidden organs.

In addition, they discuss this relationship in terms of two more examples from religion - children's concept of God and of their concept of afterlife. Harris and Koenig (2006) indicate that children and adults alike build their beliefs and knowledge based on first-hand experiences as well as on the testimony from others. Children learn about God, that the earth is spherical, that the brain is inside the body not from their own first-hand experience, but from their parents or teachers. Due to difficulties in observing these issues first-hand they focus on learning from

adults, but at the same time classify these testimonies from adults and decide what to learn and believe in or what not to believe in (Harris and Koenig, 2006).

When they investigate invisible or hidden phenomena such as earth is a sphere or that the brain is inside the body, Harris and Koenig (2006) found that children have fragmented notions about these phenomena. They need teaching from adults to understand the meaning of phenomena that cannot be seen first-hand. They need verbal explanations and visual proof. For instance, if children have intuitions about the human body or about the earth, they need to see pictures of the body in order to understand the location of the brain. Also, they need to see pictures of the earth in order to understand its shape.

As children understand the visual pictures of organs in the body, they also need to hear verbal explanations about the function of these organs. Harris and Koenig (2006) emphasise that some testimonies encourage children to elaborate on their pre-existing intuitions. That means when adults teach children an idea, this will help children to analyse their pre-existing intuitions and generalize them to a new idea. For example, Harris found that when children learn from adults about the function of the brain, they then build their own knowledge about various mental processes. Children at age five think that if a brain was transplanted to another person, it would alter the new person's ability to count, speak or remember; and thinking will cease in the person who has the new brain. Children of ages 7-8 believe that a child's identity is related to the brain and once this brain is transplanted into an animal, this animal will have that child's identity. They think that personal identity is so closely related to the brain, that the mental processes and the identity will be transplanted to the new body. Harris and Koenig (2006) conclude that

children construct a biological concept of death even in their early years. During these early years, children believe that mental processes continue beyond death.

This creates two distinct notions about death. The first notion is based on the biological terms that the lack of continuity of functions causes death. The second notion is based on religious terms that spells out a continuity of functions (Harris and Koenig, 2006). Children's have a cognitive capability of analysing and generating new ideas as they deal with all information whether it is visible, invisible, or hidden phenomena. Therefore, the focus of this study is investigating children's cognitive capability to think in scientific facts and classify it from non-scientific information they learn. This study is interested in how children construct their knowledge based on their interaction with phenomena surround them. This depends on the period of life and learning scientific reasons to understand it. Consequently, the notion of afterlife is not related to a concrete scientific observation that this study could use.

5. Biological knowledge

In the first chapter, I explained that Carey (1985) studied children's understanding of biology and illustrated that until 10 year olds children are unable to understand the concept of death because they are unable to understand biology, which means that they do not conceptualize death with regard to biological reasons (Carey, 1985; Lazar and Torney-Purta, 1991). For instance, at ages 6-7 they respond to the meaning of death as something which happens to people such as getting shot or having diseases which, as she argued, they do not understand that these external events affect the internal organs as a reason for death. Her statement of that young children are unable to build biological knowledge is based on that children must differentiate between biological entities, and understand the causal mechanism that enables them to predict and explain

the behaviours of the entities (Slaughter and Lyons, 2003). It is similar to results of Nagy (1948) who found that it is not before the age of nine that children understand physical deterioration.

In contrast, studies challenged these findings through establishing more investigations of children's knowledge of biology. Their results covered some angles show children's thinking of biology. This can be found in the study of Speece and Brent (1984) who found that 90 per cent of their children recognise the cessation of motion, and 65 per cent understand that sentience and perception end with death (Kenyon, 2001). Atwood (1984) found that 25 per cent of the children in their sample recognise physical deterioration after death, but at the same time they reflect that they believe that dead people could feel hungry and could have emotions. This motivated Atwood to assume that it is a limited awareness of non-functionality. Another angle of investigation focused on the effect of the gender on achieving biological information. It shows that boys understand cessation more than girls do. However, there was no specific reason mentioned to justify this result (White et al., 1978).

The work for these studies was motivated by the development in children's information of biology because they show developed achievements. The basis of these studies focused on the interaction of young children with inductive method, which introduced them to different biological information about living things in order to see their ability of making decisions about living things. This can be found in the example of Slaughter and Lyons (2003) who used a framework of the human body's organs and its functions to teach young children biology. They use the mechanism of biological causal-explanatory and vitalistic causality to develop an independent domain of biology. They examined how children use functional reasoning about living things and then tested their acquisition of life and death concepts in terms of this

framework. They argued that when children work with this framework, they are able to re-organise their concepts of life and death. Many studies argued that children understand life and death from a biological understanding (Keil, 1992; Inagaki and Hattano, 2002; Inagaki and Hattano, 1993; Jaakkola and Slaughter, 2002; Slaughter and Lyons, 2003; Kelman et al., 2003; Opfer and Gelman, 2001; Keil, 1994). But this is different than the study of Gelman and Markman's study (1986) who explain that children's reasoning (which is based on inductive information) is limited (Kelman et al., 2003). In the meantime, another angle of investigation of biology focused on children's understanding to the abstract concepts such as existence, non-existence and distinct species, as can be found in the study of Polling and Evans (2004). Their results show that only in late pre-school can children understand that death is permanent and universal for both human beings and animals; also, children understand that dead bodies do not breathe and that lack of air causes death.

In a study about children's biological knowledge, 25 per cent of them recognise physical deterioration after death. They believe that dead people could feel hungry and could have emotions (Atwood, 1984). According to Atwood, this means that young children have limited awareness of non-functionality (Atwood, 1984). In the study of (Speece and Brent, 1984) 90 per cent of the children recognise the cessation of motion, and 65 per cent understand that sentience and perception end with death (Kenyon, 2001). Another study found that boys understand cessation more than girls do. However, there was no specific reason mentioned to justify this result (White et al., 1978).

These findings are dissimilar to those of Nagy (1948) who found that it is not before the age of nine that children understand physical deterioration. Carey also (1985) supports this finding.

Children ages 6-7 respond to the meaning of death as something which happens to people such as getting shot or having diseases, but they do not understand that these external events affect the internal organs as a reason for death. Carey clarifies that young children do not conceptualise death with regard to biological reasons (Carey, 1985; Lazar and Torney-Purta, 1991)

Carey (1985) also states that young children are unable to build biological knowledge. This is mentioned previously in Section 1; children must differentiate between biological entities, and understand the causal mechanism that enables them to predict and explain the behaviour of the entities (Slaughter and Lyons, 2003).

In contrast to Carey's view, other studies mentioned in Section 1 have challenged her argument that children understand life and death from a biological understanding (Keil, 1992; Inagaki and Hattano, 2002; Inagaki and Hattano, 1993; Jaakkola and Slaughter, 2002; Slaughter and Lyons, 2003; Kelman et al., 2003; Opfer and Gelman, 2001; Keil, 1994). For example, Slaughter and Lyons (2003) used a framework of the human body's organs and its functions to teach young children biology. They then tested the children's acquisition of life and death concepts in terms of this framework. They illustrated that when children work with this framework, they re-organise their concepts of life and death. They use the mechanism of biological causal-explanatory and vitalistic causality to develop an independent domain of biology.

Some other studies investigate young children's understanding about living things (Kelman et al., 2003). These studies used inductive structures to explore young children's ability to use functional reasoning about living things. This was mentioned in the section about irreversibility (Slaughter and Lyons, 2003). This inductive method introduced young children to different

information about living things to see whether children are able to use this information in making decisions about living things

As discussed in the previous section, 3-5 year olds have some ability in realizing and using functional reasoning and making inferences about some entities (Kelman et al., 2003). This study is different than the Gilman and Markman's study (1986) who found that preschool children start to use logical reasoning about functions of living things to decide their behaviour as it is mentioned in Kelman et al. (2003). This ability increases and becomes influential during the preschool years. Their ability to explain their reasoning (which is based on inductive information) is limited. This finding shows that children's categorization and reasoning about living things is led by teleo-functional assumptions that are particularly appropriate to the biological domain (Kelman et al., 2003).

Another piece of research, from the field of biology, examines the knowledge of preschool children, lay-adults and evolutionary biologists (Darwinian) about an extinct species and death. The study examines an adult's and preschool children's beliefs of whether human beings or non-human beings existed and now have become extinct (Polling and Evans, 2004). Their results show that only in late pre-school can children understand that death is permanent and universal for both human beings and animals; also, children understand that dead bodies do not breathe and that lack of air causes death.

A new path of investigation

As can be seen from the above discussion there are many debates about what young children understand about life. It shows that not all children in pre-operational stage cannot understand the relationship between biology and death. Also not all children in concrete-operational stage

understand it. The educational intervention that studies used, such as introducing biological information inductively to children in order to see their abilities in biological inferences about cessation, were not clear enough to prove that children are able to see death as irreversible and non-functionality. However, these studies trust that biological knowledge has been present since an early stage. In contrast with Carey (1985) and Kenyon (2001) who have similar results in that young children do not grasp the meaning of life until the age of ten and that affects their ability to understand the meaning of death, studies which used inductive methods state, however, that children as young as age three are able to understand the meaning of life in terms of their ability to use new biological information.

Due to the conflict between studies - whether biological results indicate that young children understand the concept of death or not - I would argue these studies in two main points,

(1) On one hand, I claim that these studies used inductive methods only to teach children to understand the functions and life, but not the depth needed to see these functions in relationship to death. These were complicated tasks for young children which may provide the researcher with some information about children's understanding of the death. There is little doubt that children are capable of showing positive results about inferences. But I agree that biology is a wide surface of investigation because children grow with experiences and the educational intervention they face.

(2) Consequently, it would be reasonable to suggest extending research to investigate what missing points in the biological field we need to concern on within children's reasoning.

This suggestion focuses on their ability to reason and infer inductively or deductively about information not only from biology, but also from another scientific field that support investigation which I conclude is the knowledge of astronomy. The focus is on the relationship

between bodies live for specific time only and the end moment. The relationship between end of the functions and impossibility to survive again is due to the limitation of its life span and linearity of time. I argue that in the absence of understanding of the cessation of internal organs functions it is still scientific understanding which shows a clear angle that death is non-functional. This suggestion will be explained in the next chapter in more detail.

Chapter 2

Cognitive perspective on children's understanding of death and their knowledge of astronomy

Section (1)

Children's knowledge of astronomy

The relationship between children's understanding of the concept of death and their knowledge of astronomy

Under each sub-concept I discussed in the previous section, many cognitive concepts are interrelated to each other to depict a vision about the phenomenon of death. Most of these concepts are abstract and not easy for us to measure in what depth children know about them. One of these abstract cognitive concepts is the thinking of spiritual issues, which I need to explore here in this section in order to shed light on more depth of cognitive thinking.

Spirits, heaven and sky are common subjects in children's comments; as mentioned in previous studies (Anthony, 1940; Kenyon, 2001; Candy-Gibbs et al., 1984-1985). Initially, I make a clear statement that, as concluded in the previous chapter, the existence of spirits or heaven is not included in my study because children's scientific understanding is my focus. What this study has already commented on is the cessation of internal functions, pointing out that it is difficult to be understood by some adults and most young children. To focus on more simple understanding, I suggest studying another angle of children's thinking. So for more clarity in this study to define the phenomenon of death, it is determined as: *an unavoidable end moment of time that faces every living organism and drives it to be non-existent anymore and it is impossible to return back because time is linear.* In this instance this definition of death would be an investigation into the thinking about whether a living thing was active, but for some reason disappeared from the environment; in other words the dead person or thing is not there anymore.

As a consequence of these decisions the focus of this study is to develop an understanding of how something or someone becoming non-existent. This understanding of non-existence includes the exploration of abstract concepts, therefore, such as end moment, duration, time,

living things, unavoidable, life, impossible, returning back and linear constructs. At the same time, the meaning of death includes the idea of hidden phenomena, *disappearing*, *existence*, and *non-existence*, *alternation* or *seriation* (death after life). In order to study children's capability to understand these concepts, I chose active reactions children used in their daily life. Their interaction with activities could show us their deep awareness of the meaning of the end moment or non-existence, for example, in the phenomena around us. All of these concepts and phenomena are part of sciences such as physics, cosmology and mathematics. These particular phenomena however, are found collectively in only one scientific field - astronomy, which includes all those sciences. This supports the investigation of children's interaction phenomena based on those cognitive concepts. Consequently, this study I have determined to undertake an investigation on how far children's cognitive capacity can deal with abstract concepts through their understanding of astronomy.

Just as I consider that the science of biology is wide, I believe as well that the science of astronomy includes massive information about phenomena that affect human's life. I argue that it is possible to consider what depth of awareness children have about the meaning of the concepts of invisibility, disappearance, hidden phenomena in space and in the sky. In specific focus on Space, it includes phenomena which are *hidden*, *disappearing*, or *describe notions of existence/non-existence*. It also includes the concepts of the *size* and *shape* of the earth and *space*, and *the (frequent) alternation* of the sun and the moon, as well as how this takes place in *time*. Therefore, we could study the depth of children's knowledge of astronomy as a way of discovering the level of understanding they have of these concepts which are applicable to similar issues in relation to understanding of death.

The following section outlines the results of studies which focus on scientific knowledge of children and how they understand scientific phenomena. Through investigating how children understand the cognitive concepts of existence this section will be divided into two perspectives - invisibility (and the concept of hidden) and how children interact with scientific and non-scientific concepts in their daily life.

Children's understanding of existence

It is not easy to say that a child understands that a thing exists or is not existent. However, we could probe thinking through another (abstract) concept such invisibility. Simply, I am aware that there is a thing that I cannot see, but I am sure that it is there unless I have evidence to support my awareness. This means that I need to understand two abstract concepts at the same time - invisibility and existence. So, understanding of the invisibility (or also appearance and disappearance) is a measurement to probe understanding of the concepts of existence and non-existence. Consequently, this led me to investigate these concepts and I divided this section into two main perspectives:

- (1) children's understanding of the concept of the invisibility, and
- (2) children's understanding of the concept of hidden.

The last concept supports the investigation of understanding existence through exploring awareness of hidden entities in visible places and serves as an introduction to the meaning of the concept of astronomy in this regard.

(1) Understanding of the concept of invisibility

The aim of this section focuses on how children understand the concept of existence through:

- (1) entities that are invisible – such as air, gas or dissolved sugar in water, and
- (2) abstract metaphysical concepts in order to see their understanding of more abstract concepts that were focused on in the research fields.

1.1 Invisible entities

In contrast with what was stated by Piaget about how children are weak in logical reasoning during the pre-operational stage (Section 1) there is another view about this skillset. For example, children ages 3-5 are scientifically able to give very good explanations about dissolving sugar in water. They know that the substance still exists, making the water heavier and that it can be tasted, but the substance is invisible to the eye in the liquid. Some children said that the particles are too small to be seen inside the liquid (Berk, 2000).

Other studies investigated children's thinking about invisible substances, such as *air* and how they distinguish real physical objects. Carey (1992) explained that children at age three are able to distinguish the differences between physical objects. For example, they distinguish between real cookies and mentally represented objects such as an image of cookies or a dream of cookies. On the other hand, in terms of the distinction between real physical objects such cookies (that can be seen and touched by people) and mentally represented objects (that can be changed by thought alone), Carey (1992) examined whether children can explain concepts like adults. She found that children's concepts and adult concepts have incommensurability, which means there is no similarity between them in understanding. She also commented on children's understanding of physical concepts such as matter, material kind, weight and density and how they classify these concepts. She said that children do not use adult language in explaining their

meaning. The air in their understanding is not the air as adults understand it. She argued that a child's intuitive theory of physical objects is incommensurable with the adult intuitive theory of material entities (Carey, 1992). Carey (1992) goes on to indicate that children at ages 4-6 understand that air and other objects could fit together in one place. They explain that air does not take up a place, air is all over the place, or air is just with something else - when metal is put inside a box, they assume that air still exists in that same box.

Based on the difficulties in specifying at what age young children can understand some scientific concepts, researchers consider their cognitive abilities. Consequently, studies need to consider how children understand other phenomena they are dealing with in daily life. Whilst Piaget (1974) specifies different ages for every new understanding of conservation, as mentioned in Section 1, children also deal with invisible entities.

To conclude, despite what was stated by Piaget (Section 1) and Carey (1992) that young children are unable to make logical reasoning or understand the meaning of existence, there are studies that argue that children are able to give scientific justification and logical reasoning to explain their understanding of the concept of existence.

1.2 Metaphysical concepts

In the first chapter, both reversible and non-corporeal continuity were explored as part of understanding death. This part does not focus on these concepts, but it is possible to amend the discussion here on metaphysics in order to see children's ability to deal with abstract concepts. Again, it shows the possibility of investigating children's understanding of the concepts of existence and non-existence.

However, it is not easy to discover more about children's cognitive thinking of abstract concepts. This can be seen from some studies which focused on children's responding to a concept that hold an idea of existence or non-existence and their abilities to compare it with other concepts. Harris and Koenig (2006) explain, however, that children are able to conceptualize unobservable and metaphysical phenomena. For instance, children are usually told about distant lands, and historical events that have been witnessed by observers. Similarly, children are also told about religious phenomena such as when adults offers testimony about an extraordinary being, such as God, and children do not fully assimilate what they are told. Harris explains that this is because children assume God to be an ordinary human being with power in terms of what they observe to be true for a human being. On the other hand, Barrett, Ritchert, and Driesenga (2001) report that children are very good at conceptualising God's special and extraordinary power. Through their study, they show that by ages 5-6 children recognise that God has an extraordinary power that is different from an ordinary human being. They understand that God is not constrained by perceptual access in the way that human beings are constrained. Gimenez-Dasi, Guerrero, and Harris (2005) agree with Barrett et al. (2001) in that children by the age of 5 are able to differentiate between human beings and God.

This explanation of children's ability to recognise unavailable and metaphysical phenomena thus provides an angle of investigation on how they think metaphorically. In the section below also is another angle of investigation on their cognitive capability to understand concepts as hidden and disappearance. For example, it is to see their awareness of the existence of the hidden phenomena which are available in the environments.

(2) Children's understanding of the concepts hidden or disappeared

The aim of this section is to highlight research that focuses on how children think about visible entities which could be hidden in an invisible place. These are usually phenomena children interact with every day. For example, research has shown that children tend to be aware of the sun, the moon and stars that are located in the sky (in space), leading to debate as to what children know about astronomy. In this section this debate about astronomy will be discussed, starting with Piaget's findings and then moving to other studies.

Piaget did include questions about the sun and the moon in some of his interviews with children in order to understand their thinking about the concepts of life and being alive (Piaget, 1951). He demonstrated three stages in the development of children's concept of the origin of the sun and the moon.

Stage one: A child attributes the sun and the moon to human agency. For instance, one of the illuminating cases that Piaget used to show evidence of the original connection between animism and artificiality in Roy's answers (6 years old).

Q: How did the sun begin?

Roy: It was when life began.

Q: Has there always been a sun?

Roy: No.

Q: How did it begin?

Roy: Because it knew that life had begun

Q: What is it made of?

Roy: Of fire.

Q: But How?

Roy: Because there was fire up there.

Q: Where did the fire come from?

Roy: From the sky.

Q: How is the fire made in the sky?

R: It was lighted with a match.

Q: Where did it come from, this match?

Roy: God threw it away.

.....

Q: If there were no clouds would the moon get bigger then?

Roy: No.....Yes. All the same it would be able to, just like we do.

Second Stage, the child attributes the sun and the moon to half natural and half artificial causes.

Third stage, the child understands the notion that human activity has nothing to do with the origin of the sun and the moon (Piaget, 1951).

From these three stages, it shows that Piaget accepted children's ability to recognise and think of the phenomena in the sky (space) from the angle of the animism and causality. This motivated him to focus on the sun and the moon to reflect their understanding of concepts of life and living things. Piaget's explanation of children's reasoning about physical phenomena depicted that they have an intentional schema that draws their conclusions about inanimate objects and they use activity and movement as a basis for their decisions about what is alive.

This claim by Piaget has been criticized from several points of view, however (see, for example, Carey, 1985). Newer investigations of children's understanding of the phenomena in the sky focused on the scientific understanding in more depth. For example, other researchers who investigated children's knowledge about astronomy and cosmology came up with different results than Piaget. Vosnidou and Brewer (2003) and Vosnidou et al., (2005) pointed out, for example, that young children reflect an awareness of lots of information and ideas about

astronomy. Another study by Hannust and Kikas (2007) found opposite results in that young children have a fragmented idea about astronomy. Siegal and Surian (2004) explained that young children understand some facts about the earth while Hannust and Kikas (2007) mentioned the research about the degree of consistency and coherence of children's knowledge of astronomy shows children's ability to make logical scientific reasoning and justification.

Some studies focused in more depth on how young children's understanding of the cognitive concepts are connected to understanding the phenomena of the sun, the moon and their frequent alternation. For example, Vosnaidou and Brewer (2003) meanwhile analysed young children's thinking about the *mental models* of the earth and also children's explanation of the appearance or disappearance of the sun, the moon and stars during the alternation of day and night. Vosnaidou and Brewer indicate that whilst children in pre-operational stage have a logically and accurate explanation, however, younger and older children in the same stage differ in their reasoning abilities. For example, young children explain that the disappearance of the sun during the day is based on everyday experiences and thus explained the day/night cycle as the sun going behind the mountains. Older children explain the same situation more accurately, however, according to scientific models in which they relate the alternation of the day/night cycle to the relationship of the sun to the moon around a stationary earth. Vosniadou and Brewer added that in late preschool, children have a number of mechanisms to explain the appearance and disappearance of objects. For example, they are able to explain that an object which appears in space could hide another object in another space that cannot be seen. This reflects that children can develop their scientific knowledge toward more complicated ideas that include abstract concepts.

Vosniadou and Brewer (1994) agree with Samarapungavan et al. (1996) that when children in pre-operational stage give reasons they choose theories that are empirically accurate and logically consistent. This suggests that younger children are unable to understand the alternation of day/night and might struggle because they have difficulties in learning the abstract concepts which Piaget cited in his stages. According to Piaget (1951), children in the pre-operational and operational stages have difficulties in understanding abstract concepts and they need to work with concrete materials to help them to see, feel and manipulate what they are learning about. For example, children who are seven will not be able to learn about an abstract concept such gravity without any concrete material (Cameron, 2008).

It seems that in regards to children's understanding of the size of the earth, the sun, and the moon that the sun goes behind the mountains, young children do not yet have an actual idea about the size of space. Cameron (2008) focuses on children's understanding of the shape of the earth and gravity and indicates that they have misconceptions regarding the shape and gravity. However, when they are given information about the earth and gravity, they still find it difficult to understand the contradiction between what they have been taught and what they see with their eyes; this is simply because young children see that the earth is flat.

Nassbaum and Novak (1976) supported by the work of Cameron (2008) explain the differences between children's answers and their understanding. For example, children could answer the question about the shape of earth, but in probing their understanding children learn the facts that the earth is a sphere or that planets are in the sky. They actually believe, however, that earth is a circle like an island around which people can sail. On the other hand Sneider and Ohadi (1998) indicate different results than Cameron (2008) that demonstrate children do not understand

astronomy. They investigated a constructivist-historical strategy in order to change pupil's misconceptions about the earth's shape and gravity. This strategy supports improved children's information and change their concepts.

In a study by Hannust and Kikas (2007) children's knowledge of astronomy was tested. They examined children's pre-existing knowledge about the earth and how it changed after they are taught them. Their methodology focused on the style of instruction that should be introduced to the children. The study focused on children between ages 5-7 and their study agreed with the work of Siegal and Surian (2004). Small children can understand some concepts about the earth. Their results show that simple ideas about the earth they learnt before starting pre-school (whether fragmented or non-scientific ideas) do not match with the new information they learned. They found it is very important for teachers to use methods which satisfy children's curiosity about the earth (Hannust and Kikas, 2007).

On one hand, there are studies that focused attention on children's knowledge of astronomy from scientific understanding and adopted this angle which is an opposite of Piaget. On the other hand, however, there are contradictions in all these results about whether children have the capacity to understand astronomy. However, studies reflect that when children interact with an educational intervention about phenomena in space they reflect their ability to interact with new information about astronomy which shows that they are able to understand it. Therefore, this succeeded interaction reflects that children's cognitive abilities can be used inductively and deductively. This reveals that children's have scientific knowledge that includes astronomical knowledge and not just biology.

The knowledge of astronomy thus includes phenomena that need to be understood through cognitive concepts and skills. Children could have a basis of scientific knowledge besides non-scientific knowledge. This encouraged me to make a case that children can use the cognitive approach in constructing the meaning of death through scientific knowledge. If they have a knowledge about the abstract concepts of existence, non-existence, appearance, disappearance, alternation and time, they then give themselves a chance to build a basis for knowledge of life and death, which could motivate them to define death as unavoidable and the end moment as a point in time which prevents things returning back to life. In order to see this we need to study their ability of to make inferences as well.

The following section focuses on inference skills followed by the problems and questions of the study.

Section 2

Strategies of inductive and deductive inferences

Introduction

As a result of the previous discussion I arrived at a point where I concluded that understanding death includes aspects that are related to both biological and astronomical concepts. Both aspects are abstract cognitive concepts because children appear to use justification from both sciences. Consequently, this is an area where we need to see how children make their inferences and reasoning, maybe inductively or deductively, as a base in cognitive thinking in order to understand environments and phenomena around them. The following is an explanation of these strategies, which I previously gave some examples that show inductive strategy is one of the focus points in previous research (see Carey's work and other in the section of the sub-concept of non-functionality).

Inductive and deductive reasoning are two basic types or schema of reasoning which can be used in mathematics, science and the humanities. Inductive reasoning is based on observation. Deductive reasoning is based on laws or general principles. This section discusses these strategies of reasoning as a schema of thinking.

Studies that used inductive strategy

An inductive strategy is a reasoning process that starts with true premises based on a certain number of specific observations and experiments. However, the conclusion of the argument with several true premises may or may not be true (Horner and Westacott, 2005; Wardburton, 2006; Fletcher, 1961). For instance,

Premise (1): Iron nails oxidize in water and become rust.

Premise (2): Iron washers oxidize in water and become rust.

Premise (3): Iron knives oxidize in water and become rust. Therefore, all iron objects oxidize in water and become rust.

The conclusion may or may not be true because there are more objects from iron that have not been observed (Horner and Westacott, 2005).

People using inductive reasoning look for a pattern in a collection of specific observations and draw a general conclusion based on that pattern. Informally, this is called a 'bottom up' approach. People begin with specific observations and measures, begin to detect patterns and regularities, formulate some tentative hypotheses that can be explored, and finally end up developing some general conclusions (Overton, 1990). Wardburton (2006) explains that people's lives are based on the facts that induction provides them with reliable predictions of the environments surrounding them and the possible results of their actions.

Several studies (Kelman et al., 2003; Carey, 1985; Kynigos, 1993; Prince and Felder, 2006) discussed the effect of using the inductive method in helping learners understand new concepts. Dunber (2002) provides several examples of inductive reasoning to acquire new concepts in science and also concludes Bruner's argument that inductive reasoning strategy is used in many sciences (Dunber, 2002).

In working with children some researchers found positive results after introducing an inductive pattern of information to older children (Carey, 1985), and a pattern of geometrical relationships to children at age 12 (Kynigos, 1993). Children gain many concepts as a consequence.

In investigating children's ability to understand biological phenomena, some studies based on educational interventions introduced inductive patterns to children as young as 4-6 year olds (Carey, 1985; Kelman et al., 2003). Carey (1985) explains that using inductive methods in young children from ages 4-6 is different than using them with 10 year olds. For example, children at age four are still unable to understand biological phenomena, however, they have information about biology gained through inductive pattern. Children, as Carey (1985) claimed, relay these inferences to their psychological beliefs.

Carey (1985) concludes this is different for children at age 10. When they were taught with inductive patterns (such as learning about properties through several observations) they combine the new pieces of information and infer some new categories or new concepts. Children at age 6 are different from those who are at age 4 and age 10 in gaining inferences from the inductive method. At age 6 children start to design their own way of using information to help them make inferences. Consequently, they reorganise their own information and the new information they have learned to make a new judgment.

Studies that used deductive strategies

Deductive strategy is a reasoning process that begins with particular, true and valid premises and then moves logically to a true conclusion that follows from these premises. For instance,

Premise (1): All water contains oxygen.

Premise (2): The liquid in this pot is water.

Therefore, this liquid contains oxygen (Horner and Westacott, 2005; Wardburton, 2006).

People using deductive reasoning apply a general principle to a specific example. Informally, we sometimes call this a 'top-down' approach. People begin with selecting or modifying a theory about a topic of interest. They then narrow that down into more specific hypotheses that can be tested. People narrow down even further when they collect observations to address the hypotheses. This ultimately allows them to test the hypotheses with specific data, with the intention of confirming or refuting the original theories (Overton, 1990).

Some scientific fields such as engineering use deductive reasoning as traditional instruction (Prince and Felder, 2006). However, Leighton (2006) argues that both adults and adolescents usually exhibit biases in their deductive reasoning because it increasingly lacks empirical support. The reasons need to be learned formally. Leighton confirmed that learning deductive reasoning skills is not an easy task. This can affect learning how to reason logically. Leighton found that students improved their mental rules and models, but their reasoning performance improved only moderately (Leighton, 2006). Mansoor (2004) and Leighton (2006) are similar in that adults have difficulties in using deductive reasoning skills. Mansoor (2004) suggests that both teachers and students have difficulties in understanding the differences between hypotheses and predictions in deductive reasoning.

These researchers (i.e. Mansoor, 2004; Leighton, 2006) assumed that deductive reasoning skills were very difficult. However their conclusion is different from other research which found that young children are able to use deductive reasoning skills. As mentioned previously (Chapter 1), Richard and Sanderson (1999) stated that children ages 2-4 are able to reason logically and make

correct conclusions deductively. This is also similar to the studies of Dias (1988, 1990) that indicate children's ability to form inferences and logically reason at ages 4-6.

These confirmed results are dissimilar to Piaget's theory who illustrated that children are unable to reason with premises that contradict empirical facts until 12 years of age.

Studies using both inductive and deductive strategies

Several studies with adults show evidence of the use of both inductive and deductive strategies (Dunber, 2002). Foltz and Overton (1995) considered inductive and deductive approaches in the construction of problem-solving. They assessed their strategy with adolescents (relying on Piaget's suggestion that the developmental of deductive systems should only be undertaken in adolescence) and not young children. Their results support the view that there is a cognitive developmental progression and changeover from the inductive approach to the deductive approach (Foltz and Overton, 1995). Through the history of combining inductive and deductive methods in science, Fletcher (1961) describes successful results by using a combination of both strategies. This allows science to proceed with a rhythmic alternation of both methods of thought.

In investigating early childhood, many successful results were recorded using each strategy. Using inductive methods in concept development has been investigated by researchers such as Carey (1985), Kelmen, et al. (2003), Prince and Felder (2006), and Kynigos (1993). Using deductive method has been investigated by researchers such as Harris et al., (1996), Richard and Sanderson (1999).

From this field of investigation, it can be seen that children's reasoning is focused as a measurement of their cognitive thinking which reflects some good news about their achievements at early ages. This allowed me to come back to the focusing on more than one science in understanding how children think about the concept of death. It is an area of many sciences such as biology and astronomy.

Consequently, in this study, astronomy is a field of science which covers all aspects, and is useful in creating a new path for the investigation of children's understanding of death. For example, astronomy includes the concepts of existence and non-existence which could be easily recognised by children. There is a relationship between motion in space and time. Also, astronomy is a common subject in children's drawing in their early years of life. They not only like to draw but they also like to tell stories about their drawings. Inductively, astronomy could be used besides the biological perspective, which focuses on children's cognitive capacity to understand death. This leads me to conclude that it is permissible to search children's knowledge of astronomy in order to see what depth of knowledge they use to support themselves as they come to understand death.

The next section is a conclusion of the whole evaluation of the field of investigation of children's understanding of the concept of death. It guides the argument of focusing on the concept of death from the scientific and astronomical thinking into the research questions.

Section (3)

Summary of theoretical problems

The theoretical problems

Both previous chapters portrayed how children understand the concept of death, yet the debate continues. In investigations of cognitive thinking mentioned so far, astronomy is seen as a key science. This section critically examines this perspective and concludes that previous lack of clarity have affected definitions and missed the factor of time. Therefore, this section explains (1) clarity of the definition, (2) concept of time and (3) the concepts of astronomy.

(1) Clarity of the definitions

Based on previous investigations of children's understanding of death, this study relies on children who have manifold configurations and concepts in their knowledge. This could create several perspectives that could be investigated through their cognitive approach to scientific thinking. In Section 1 the sub-concepts of death, which were derived from Piaget's theory, were established. However, this study should cover all the sub-concepts that demonstrates some changes in their definitions. Therefore, in order to confirm the rationale of this study and in order to investigate this scientific approach a new perspective needs to be added - the concept of time - both cyclical and duration. The following section includes the new additions.

The benefits of this clarity in using the definitions in more depth scientifically are the following.

1. This will strengthen the evaluation of the results and avoids the same problem faced in previous studies - reconstructing the meaning of irreversibility to reversibility.
2. It will also shed light on another scientific angle of the concepts of invisibility, non-existence or disappearance. Instead of focusing on understanding the cessation of invisible organs, it will investigate children's recognition of the non-existence of the whole entity in a specific time.
3. It will provide a focus on the missing points of understanding the factor of time on the duration of life, which means understanding that death occurs in a specific time for every living thing.
4. It will reveal the children's cognitive approach for constructing their knowledge of death; and the possibility of including not only their knowledge of biology, but also their knowledge of astronomy.

From these benefits I clarify these sub-concepts with the following new additions.

1.1. The clarity of the sub-concept of irreversibility

To avoid reconstructing the meaning of irreversibility to reversibility and to avoid the confusion in how to classify this reconstruction, the definition will be used from two perspectives. It is a confirmation of (1) using the same definitions used by previous studies and (2) adding a

scientific angle to the same definition. This means that when a living thing dies, its physical being cannot come back to the life again **because of the limited time of the life cycle**. Using this scientific perspective will further explore the results as a guide to decide whether the child understands the concept of death.

1.2. The clarification of the sub-concept of non-functionality

Based on a major debate among researchers on children's understanding of death more is needed to support this investigation scientifically. The argument in this study suggests that biology is not the only scientific perspective to judge children's understanding of the concept of death, but a second angle is needed with astronomy. This is an attempt to create a new path to investigate whether children understand that bodily functions end because of the limited lifecycle. Therefore, it would be reasonable to confirm the definition of non-functionality and amend it by adding another scientific perspective. Non-functionality means that biological functioning ends **because of the limited time for a lifecycle**.

From this point of view, acceptable answers that show an understanding of non-functionality will replicate the following examples. Children who show an understanding (1) of the limited time of a life cycle, (2) and that every living thing has lifespan, would understand non-functionality. This understanding is accepted even if they do not show any understanding of the cessation of an internal organ's functions.

1.3. The clarification of Sub-concept of universality

Based on the complexity of understanding the continuity of functions, the argument is amended to include humans and all other living things. Particularly, the complexity of internal process of

function confused children about the death of plants. Therefore, the argument confirms the scientific side of the investigation needs to include the factor of time.

Consequently, in the evaluation of the results, answers will be acceptable if children can talk about (1) scientific views such as an understanding the factor of time - as all living things die because of the limited time of life cycle; and (2) biological views such an understanding of the death of humans and animals even without understanding that plants die.

1.4. The clarification of Sub-concept of inevitability

Similarly, the factor of time is assessed in the definition, to confirm the investigation scientifically. In the evaluation of the results, acceptable answers will be determined if children know that understanding inevitability is based on the knowledge of time. Figure 2.1 (which I designed below) shows the common definitions of death.

(2) The factors of Time (FT)

We should remember that organs have a particular time of cessation. Life span is different between living things. In some cases humans face the same ends such as in chronic disease and sudden death. There is no doubt that the body could be affected by other biological problems, which could cause death, but sometimes treatments or medicines cannot postpone death. People also face a limitation of life, which is called the lifespan. It seems that an end of time could explain not only the sub-concepts of universality, irreversibility, and inevitability but also the sub-concept of non-functionality. This means that functions end by cessation in a specific time.

This study highlights the factor of time, which controls life and death. It would be reasonable to create a new path to investigate children's understanding of the duration of life. This

investigation might indicate whether children are aware of the serial process and what happen systematically.

People are born, they live and then they die. It is not necessarily that death happens by external causes such as diseases, accidents or even old age.

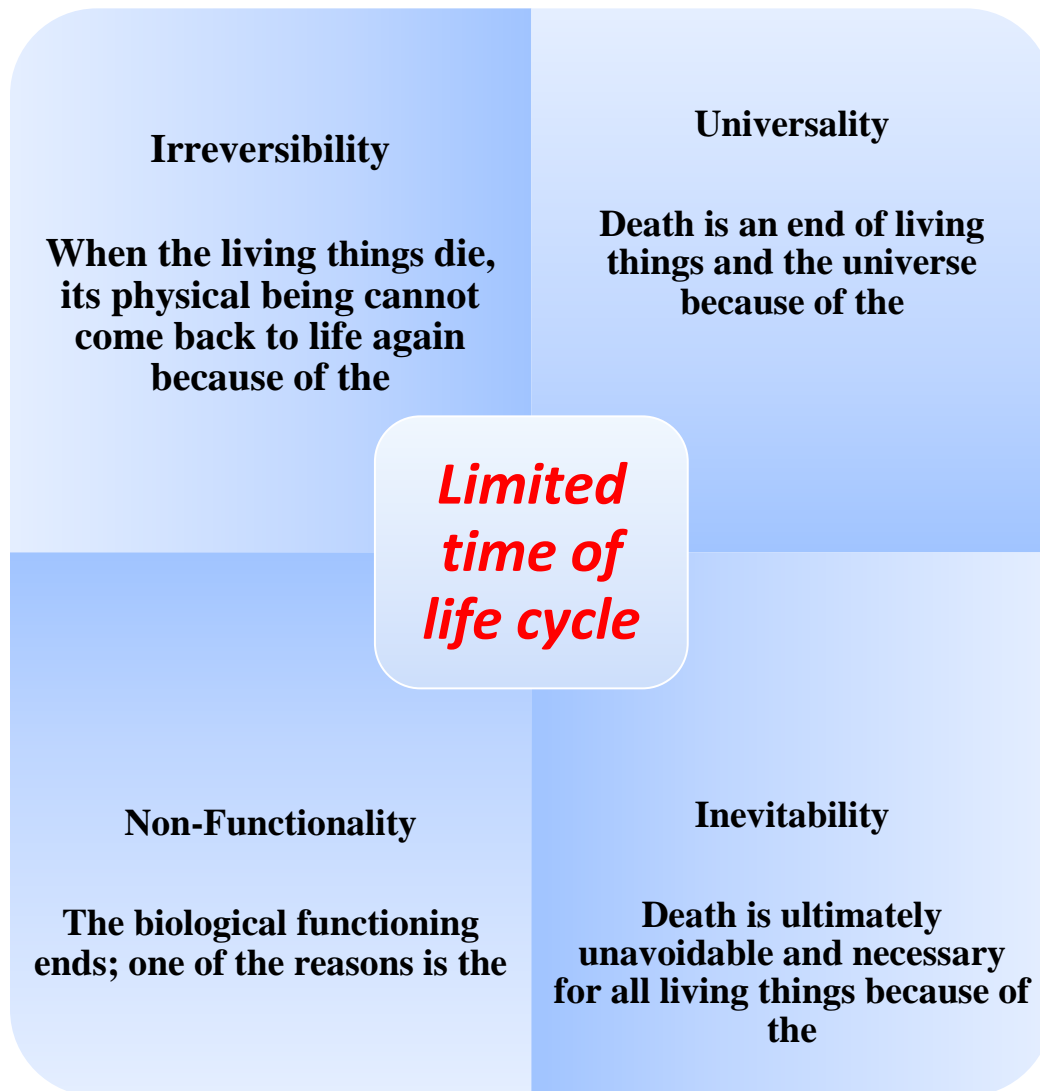


Figure 2.1 - I designed this figure in order to explain the new view on the definition of the concept of death

Scientific understanding could support the solution of some psychological problems in bereavement. For example, it would be easier to release any fears from diseases or loss. Through focusing on children's cognitive abilities and scientific knowledge, children could be protected from the fear of being sick, or the fear of losing another person because s/he has been sick. But what if we try to explain the meaning of death from another angle - that time is part of what ends life, as it happens in a butterfly's lifespan? A butterfly's life ends after only one week from its birth. Some kinds of butterflies die after only six months from their birth. Based on children's ability to infer, children could be able to build an understanding of the concept of death logically and scientifically and become a way of coping

Consequently, this study is an attempt to probe children's cognitive understanding of time, duration (start and end points), existence and non-existence. It is an investigation of how they structure their observations on the phenomena around them to understand these concepts. Children interact with these phenomena in their daily life.

(3) The knowledge of astronomy

Day and Night, the Sun and the Moon, the Sky and the Earth are common subjects in children's daily life. These subjects can be found in conversations between parents and their children, on children's television or computers programmes, in children's drawings, in children's books or stories and in conversations among peers or with their teachers.

In order to find out how much children could recognise and reveal information about astronomy the method needs to use a tool that children feel familiar with, like using scenes with a discussion about Space. This is to encourage children to talk about these scenes. Asking children open-

ended questions about these scenes could show us how they would reflect their observations on the phenomena in the sky or in space. For example, *what do they understand about the existence of the moon while the sun appears in the sky? Or what do they understand about the existence of the sun while the moon appears in the sky?* If they explain that the moon (or the sun) is in another area in the world, this could suggest that they are able to understand the concepts of existence and non-existence - both of which are abstract.

There is a relationship between existence and non-existence with the phenomenon of alternation. Asking children open-ended questions about the size of the sun and the moon in space, and about their frequent *alternation* could indicate their observations of these phenomena and the concept of time. For example, if they answer that the scene is at night because the moon is in the sky; and another location is during day time because the sun is present, this could reveal that they understand limited time. They would understand that this period starts from a specific time and ends at a specific time.

In addition, talking about the size of space and how people could travel to the moon, would reflect their understanding about life in space. This is a common subject because children talk about heaven in the sky. Do they understand people's ability to live on another planet or would they die if they left the earth? It is not an easy question for an adult to answer, but we could use it to find out how children explain their understanding of the concepts of life and death.

Astronomy is a science that enriches an investigation of children's understanding of death, in much the same way as biology and psychology. The knowledge of astronomy is an ambitious attempt related to using inductive and deductive strategies in teaching and learning processes. It is reasonable to find out how children could construct their reasoning and inferences when they

build their knowledge. As was stated in Chapter 1, Section 1 previous studies investigated children's knowledge of biology based on inductive strategy. In this study, the investigation is to see what type of strategy they use to understand astronomy. They could have cognitive strategies based on astronomy to understand the concept of death. It could be inductive thinking, deductive thinking or both types of thinking.

Children may think of information about astronomy in the same way as biological information is thought of inductively, or they may be able to build up their knowledge deductively. Consequently, they could use inferences based on their astronomical and biological knowledge to understand the concept of death. In other words, if children understand four sub-concepts that are related to biological knowledge and astronomical knowledge, there could be an investigation of their reasoning using a wide range of observations.

From these perspectives on the relationships between the death and knowledge of astronomy, the main question and sub-questions of this study are as follows:

Research Questions

- ***What is the relationship between children's understanding of death and their scientific knowledge, as demonstrated through the domain of astronomy?***

From the main question, four sub-questions are highlighted:

- How do young children understand the ***universality*** of death?
- How do young children understand the ***irreversibility*** of death?
- How do young children understand the ***inevitability*** of death?
- How do young children understand the ***non-functionality*** of death?

From the main questions I also have these sub-questions:

- What is children's knowledge ***of the sun?***
- What is children's knowledge ***of the moon?***
- What is children's knowledge ***of the earth?***
- What is children's knowledge ***of life in space?***
- What is children's knowledge of the phenomenon of ***alternation***

Chapter 3

Methodology

Introduction

In the literature review the psychological perspectives of the phenomenon of death and its relationship to understanding of the phenomenon of life were demonstrated and it seems they are two avenues for one phenomenon. This appears in each perspective investigated the meaning of the phenomenon of death, its reasoning and causes. This explains the development of this investigation on whether young children had cognitive abilities to understand the concept of death that was initially denied by psychologists (see previous chapter). Also researchers who used the scientific perspective of understanding the phenomenon of life typically underestimated children's capability to understand the concept of death from the biological angle (again, see previous chapter). Debates among studies focused on differing results, because it appears that some children in the pre-operational stage understood the concept of death, while some children in the concrete-operational stage did not. Particularly, some researchers faced the problem of restructuring the phenomenon of death from the meaning of irreversibility into reversibility (Speece and Brent, 1984). Consequently, light needs to be shed on the importance of amending the investigation to be from more than one angle. This study claims that young children could have cognitive capabilities which support their understanding of death from the perspective of time.

This study thus attempts another path to find out how children build scientific views through causality and reasoning. This is supported by their knowledge of astronomy, which already holds some researchers' attention. In order to support this study's claim, I present the questions that will be used as a focus.

Research Questions

- ***What is the relationship between children's understanding of death and their scientific knowledge, as demonstrated through the domain of astronomy?***

From the main question, four sub-questions are highlighted:

- How do young children understand the *universality* of death?
- How do young children understand the *irreversibility* of death?
- How do young children understand the *inevitability* of death?
- How do young children understand the *non-functionality* of death?

From the main questions I underline these sub-questions:

- What is children's knowledge *of the sun?*
- What is children's knowledge *of the moon?*
- What is children's knowledge *of the earth?*
- What is children's knowledge *of life in space?*
- What is children's knowledge of the phenomenon of *alternation?*

In order to answer these questions, the following is an explanation of the ontological, epistemological and axiological stances of the study. It is a bridge to justify using my chosen research design to answer the questions.

3.1. Ontological, Epistemological and Axiological Stances

Ontology

Children's cognitive thinking on how they gain concepts and skills is the axis this study focuses on. Particularly, it is a focus on understanding what kind of thinking they have to understand scientific side of the concept of death. Therefore, to investigate that, I illustrate that there are three views that form the ontological stance of this study: (1) the meaning of the concept of death, (2) The variety of knowledge children could gain and (3) children's ability to think.

About the concept of death

Every living thing's life is in relationship to the duration of lifespan; starting with birth (or the conception period) and ending with the moment of death. Therefore, the end of life of living things means the end of this period of lifespan. Life is a limited time. There is a relationship between the phenomena of life, death and the concept of time.

The scary thing about death is that it usually happens in an unexpected moment. In some cases, death can be predicted, but not its moment. Whether it happens surprisingly or predictably, people believe that it is an end of the duration of life. Moreover, some people live for a short time while others live for a long time. Sometimes death happens at the stage of the embryo in the uterus. This makes living things non-existent in people's lives. So, one perspective on death is a scientific understanding based on the concept of time, which explains why non-existence occurs in a particular way of death. Even if people cannot understand the biological reasons that cause death, it is still possible to recognise the scientific perspective, which is the effect of the factor of time on the duration of life span. Consequently, understanding the factor of time and its effect on life means that all living things lose functioning and die inevitably and irreversibly.

About the variety of knowledge children could have

Inductively, children face a huge amount of different experiences and information while interacting with phenomena in their daily life. This supports them to gain several types of knowledge as they are educated on achieve it. These types could be scientific and non-scientific knowledge, which motivates me to investigate their understanding of the concept of death from

the scientific knowledge. The following point is another view of the ontological stance that shows that children build their knowledge on logical thinking.

About children's logical inferences

Based on what knowledge children have, it is important to know whether they have particular philosophy or not. The reason for this importance is because that their accelerated questions reflect their ability of observations about phenomena around them. Education provides them with the opportunities to practice experiments. Other opportunities encourage them to raise more questions, to predict, to find solutions. Those who watch them grow usually feel happy with all their abilities particularly when they show improvements such as the ability to make generalisations. That is why parents and guardians scientifically start their intervention with children at early age, which surrounds them with scientific phenomena. For example, this can be the phenomena of the sea, the phenomena about living things on earth, and phenomena in the sky or in space. We provide them officially with biological information, physics information, chemical information and technological information and even more. Consequently I proceed on the basis that these abilities of scientific reasoning and inferences support children to create their own philosophy about the phenomena of life and death.

Epistemology

Research of investigating young children's understanding of death started to focus on children's understanding of biological cessation, due to their perspective that children have scientific knowledge. This was elucidated in Chapter 1, Section 1. From those studies in the field, I

consider that the focus on biology is an attempt to prepare children to understand functioning, in order to go one step further in regard to cessation of life. At the same time, those previous investigations focused on the relationship between the concept of death and the knowledge of biology and confined the investigation to only one sub-concept, non-functionality. This limitation in investigating the other sub-concepts confused researchers about whether children understand or do not understand the concept of death. This confusion was created based on the ambiguity of the irreversibility of death. I relate that the missing step that failed to be investigated, as argued in the literature review, was the concept of *death and time*.

Consequently, in order to stay in the area of scientific investigation it is better to widen the scientific angle. Investigating how children understand the concept of time would be easy, but it is not easy to investigate if they see the relationship with the concept of death. So, it has been argued earlier in this thesis, it would be better to focus on how young children interact with the concept of time in their daily life. This means using their inferences and reasoning on the concepts of duration, limitation, seriation, reversibility, existence and non-existence.

Dealing with the concept of time usually begins at home before they start pre-school. Typically, much importance is placed on training children about the concept of time, in order to improve their organisation skills, and to have an awareness of their daily tasks and life activities. An example of this improvement is to train children to recognise the time they wake up in the morning (sunrise), and the time they go to sleep at night (sunset). This happens naturally by observing the existence of the sun and the moon in the sky. So, existence or non-existence are two concepts children use to connect with phenomena in the sky by relying on their skills of inferences.

Therefore, in order to examine children's cognitive thinking, these characteristics and their awareness of the phenomena of alternation is deemed to be the best way for this examination to proceed. Based on the relationship between natural and astronomical phenomena in human life, we usually work with children on what they know about phenomena in space to improve an awareness about their lives. These phenomena are alternation of the day and night (often including alternation of the sun and the moon) that affect the weather (rain, wind, cold and heat). What motivates us to include this intervention in educating children is their successful interaction with us through their ability of inferences, reasoning and generalization. From this point, the knowledge of astronomy may be a link between training thinking to understand abstract concepts and understanding the phenomenon of death. For example, concepts of existence and non-existence are abstract, but children interact with this polarity every day so these concepts are in their mind. Consequently, I examine children's epistemological understanding of the effect of the phenomena in space as it is related to their daily life. I argue that investigating children's understanding of the concept of time through the knowledge of astronomy indicates that children have their own philosophy about the phenomena of life and death.

To conclude, in order to take further steps to support logical conversations with young children about the meaning of the concept of death, this step focuses on children's ability to think scientifically. Based on their ability which is often an active and accelerated cognitive interaction, research should focus on investigating children's understanding of the relationship between the concepts of death and time. In order to see how they make this relationship in their mind, I suggest that the investigation should focus on their understanding of the common

cognitive concepts between both concepts. Therefore, their knowledge of astronomy helps researchers understand how they think cognitively and scientifically about the concept of death. Consequently, the research design below interprets this argument.

Axiology

Thinking on the phenomenon of death from the scientific side could help in releasing pain or sadness. Facing the trauma of death when someone dies close to the child could obstruct this child's confidence and could cause some problems. When a child misses a vital member from the family, this could imbalance a child's life (Worden, 1996). Supportive actions from adults are helpful in involving a child in normal life and in coping with the activities of daily life. However, getting involved again in normal life doesn't release the painful feeling that could happen by the ambiguity of answering where that beloved person has gone? Why? How did he or she disappear from life and are we able to see him/her again? Answering all these are all questions with scientific and logical reasons, could help in reducing this painful feeling.

Therefore, if this study could find out that children are able to understand the scientific side of the concept this could ease the task of supporting children to cope with their sadness. If this study could prove the possibility that there is a relationship between children's understanding of the concept of death and their knowledge of astronomy it could support educational interventions to release possible fears of death. In addition, it could be a successful treatment based on using scientific conversations as a solution. I conclude here that such treatment could help children to

focus on logical justifications to answer the above questions. So, children understand why it is impossible to see dead people again and why people have to die one day.

3.2. Research Design

Research design was chosen carefully. Previously published research about the understanding of death was critiqued and it was concluded that some factors within the research itself affected understanding of the concept of death. One of the factors that affects the results of these previous studies is a methodological problem. Such studies point out that results were inaccurate, and recommended that the new research could focus on methodology in greater depth (Speece and Brent, 1984; Lazar and Torney-Purta, 1991; Kenyon, 2001; Mahon et al., 1999).

In order to carefully choose a suitable paradigm to examine children's scientific thinking and the relationship between the concept of death and their knowledge of astronomy, the method will be interpretivist. It employs qualitative method and tends to focus closely on how researchers think and how they form and construct their ideas about the specific circumstances with particular participants (Silverman, 2010). Through the interpretivist paradigm, the tasks are not easy, because the participants are children between ages 4-9, who generally find it hard to express themselves. In addition, the circumstances of the investigation are also a difficult situation because it requires the researcher to understand how (young) children understand abstract concepts at this age. Due to the young age of the children, the investigation is not straightforward. It will focus more on their actual words, nods, smiles, blinks and movements of their shoulders and then those results to interpretation (Westcott and Littleton, 2005). Having

experience with young children made my decision about interpretivism easy. This helps confidence in trial conversations with young children. Moreover, communicating in the pilot study with young children was a valuable experience to listen and to talk to them confidently. These experiences are very important issues in the interpretivist paradigm because it describes the researcher's account of the field (Edwards, 2010) and influences perceptions and interpretations.

However, the study required a triangulated method, which means comparing and contrasting between several sources of evidence (Robert-Holmes, 2011). The following explains the triangulation for this study.

Triangulation and validity

Triangulation is used in the social sciences in a qualitative way, as it aims to support the researcher. As mentioned above the interpretivist paradigm is a qualitative method which can be used to carefully verify the structure of children's thinking. Since I decided to focus on interpreting the data from several different angles triangulation benefits my argument. Focusing on a problem from several perspectives is better than viewing one side because critical awareness often rejects some points or it confirms using other points.

There are several types of triangulation. These types are: investigator triangulation, theory triangulation and methodological triangulation (Thomas, 2009). Triangulation is challenging and important, but not all studies apply all versions. In addition, it is not a restriction or an obligation for the researcher to observe the phenomenon from more than one angle. Despite the origins of

the term, it is a wise decision to point out what the important source of evidence is, and then elaborate this evidence with more background data.

For example, using triangulation in a study of how children are supported as learners, observational data is needed, but it may be necessary to do interviews or record a planning meeting with practitioners. Another example might be to combine data with how children interact with books. Observation is needed but it may also be necessary to augment them with interviews with parents and to collect planning and assessment documents provided by early childhood staff (Edwards, 2010).

Since I am focusing on the interpretation of data, I addressed triangulation in three ways in order to see children's thinking on both concepts (the concept of death and concepts of astronomy) from several angles in order to support me to analyse children's reactions. I consider that the analysis will be multimodal since death includes some expressions through body language.

The first part of the triangulation is interviewing children. This interview includes two stories. Based on these stories there are transcripts of questions in order to discuss the stories during the interview.

The second part is children's drawings and a subsequent conversation about their drawing.

The third part is observations using a video camera to focus on children's gestures while answering questions about (1) stories and (2) their drawing.

The following paragraphs explain these methods in detail.

3.2.1. Methods

To strengthen the perspective of interpreting the data, this study uses three methods (1) interviews, (2) drawings and (3) observations through video recordings as they do their

interviews and drawings. Before explaining this study's methods it should be mentioned briefly what methods were used in previous studies in the field, to give reasons for this current study. The following paragraph is an overview of methods that were used in previous studies. The researchers thought of:

1. Interviews, defining the word “dead”, writing an essay, a story, and answering a questionnaire on understanding of death. Some studies also included interviews with other techniques such as an interview with a drawing, with a description of pictures, with spontaneous play, with directed play, or interviews with non-verbal tasks (Speece and Brent 1984).
2. Former studies also had problems using longitudinal questions, under-reporting demographic information and interpretation of drawing, stories and play.
3. Still others had standardized instruments to measure concept of death - often there were none that were suitable; and finally
4. There were problems in providing a statistical analysis with frequency data (Kenyon, 2001).

Consequently, initially I decided to: (1) avoid any method that could cause harm or disregard their feelings or scare children, such as the direct tasks of talking or showing pictures about dead people. I would also (2) avoid using direct tasks of reading and writing, because young children are not yet ready to write these kinds of answers and (3) avoiding using standardized instrument or statistical analysis because they are unsuitable for the circumstances of dealing with this small sample. Therefore the decision to use interviews, drawing, and observation was considered to be the best approach for this study. The following is the description of these three methods. In order not to confuse the reader, the instrument of the stories will be discussed later in this chapter, following the section on the pilot study.

1. Interviews

In order to find out how children construct their inferences to explain their understanding of cognitive and abstract concepts, I chose interviews based on the benefits they provide. The concepts (the four sub-concepts of death, the concept of time and also the cognitive concepts I mentioned in Chapter 2) motivated me to meet children face-to-face in order to encourage them

to talk and to answer more open ended-questions. Interviews help to prompt thoughts, feelings and perspectives (Willington, 2006). Interviewing children is a social and psychological activity such in counselling, child development (Piaget's clinical interviews) and in studies about daily life. Children have the ability to provide studies with significant data by reflecting their own thinking, experience and education (Folque, 2010). The one challenge is that interviewing children is a very difficult task (Westcott and Littleton, 2005).

I used interviewing similar to researchers in other studies to investigate children's understanding of death (Speece and Brent, 1984; Lazar and Torney-Purta, 1991; Kenyon, 2001). However, I differed from Lazar and Torney-Putra (1991) who argued that the best way for measuring such understanding is to ask children direct questions. I concluded that children need to listen to easy open-ended questions. This helps them understand what they are asked to do, because if the question is too complex or has a hidden meaning, they will not understand the question (Westcott and Littleton, 2005).

Interviewing children is a challenge because the interviewer needs to encourage them to engage purposefully with the questions. They need to feel free in their expression and explanation. Their views and ideas are very important (Folque, 2010). It seems clear that an interview is a valuable technique and a useful method of the interpretivist paradigm. As Westcott and Littleton (2005) mention that while it is vital to focus on the outcome of the interview, it is also vital to focus on the moment-to-moment interaction. To avoid children's refusal to answer questions if they don't understand them, the interviewer focuses on the conversation in its *details* rather than only on the *outcomes*. It should be based on a co-constructive process - a negotiated and re-negotiated interaction. Children should be provided with the opportunity to explain their responses and

encourage them to create a meaningful context with the interviewer. In this way, children become an active participant in the interview process (Westcott and Littleton, 2005). The interviewer thus encourages the interviewee to speak and talk about particular issues. This requires that the interviewer (1) listen carefully, (2) ask for the development of issues and (3) ask direct questions when necessary (Robert-Holmes, 2011).

In the interviews of this study I considered children's views, ideas, expressions and gestures. It was my concern how I could gain all that from the interviews particularly in talking with them about cognitive concepts and skills. Therefore, my priority was to have a conversation with young children with easy wording based on conversations about familiar subjects to them. The key point was to encourage children to express their understanding about the concepts. Therefore, questions were designed to probe their visions on particular scenes within the chosen stories, which related to the concepts. I used these stories as instruments to support children in their focus on particular concepts. These stories are explained below after reporting the three main methods. Consequently, the interviews are semi-structured providing the opportunity to support them, to listen to the questions about the scenes, and to motivate them to talk and involve them in discussion.

Questions for the interview were derived from two well-known stories in British society. The first story is about the concept of death. The second story is about the concepts of astronomy. I decided that the scenes of the stories would help children understand what they are asked. It is reasonable to ask them open-ended questions as these could help them think and reflect on their understanding. It is important to include many styles, such as questions that seek clarification,

probe reasoning, give evidence, explore alternatives, implications, consequences, and questions for discussion (Fisher, 2003).

2. Drawing

Three benefits are found in using the children's drawings as a means of allowing children to express themselves. These benefits are cognitive, affective and linguistic. Cognitively, drawing is a valuable way of demonstrating their thinking, knowledge and the way in which they explore the world that surrounds them. Affectively, drawing and painting are valuable ways to explore their feelings. Linguistically, children get a space to develop their visual language and it becomes as powerful as writing to represent their meaning. In addition, drawing plays an important role in play, imagination and creativity (Robert-Holmes, 2011).

Asking young children to draw is a common method to investigate their thinking (Speece and Brent, 1984). Some studies used drawing as an instrument to explore children's understanding of the concept of death, such as Nagy (1948); Childers and Wimmer (1971) and Tamm and Granqvist, (1995). However, some researchers feel that as an assessment tool it has not been examined extensively (Bonoti et al., 2013). According to Marsal and Dobashi (2011), who examined children's philosophy about death through their drawing and narratives, children may not be able to express this understanding verbally; but at the same time their drawings and narratives reflect their ideas, belief and their understanding of death.

Since children generally love to draw, they could spend a long time drawing and explaining their thinking and ideas, it is an excellent technique in exploring children's thinking (Robert-Holmes, 2011). Particularly, it supports some children who could find it difficult to express their experiences verbally and might allow them to feel more comfortable (Bonoti et al., 2013). It also

illuminates evidence if drawing is used with spoken or written comments. Therefore, children should be given enough time to draw and to talk about their drawing (Robert-Holmes, 2011).

Since all these benefits make sense I chose the task of drawing as a supportive method to the interviewer to see if it reflects something about their thinking of concepts. As I mentioned in the section of the triangulation, children's drawing will be an angle to assist the (semi-structured) interviews. Expressing their thinking through drawing supports their conversation in the interview about the meaning of death. The benefit of the task of drawing that it investigates death indirectly. The task is related to a cognitive investigation of their knowledge of space. This is done to seek more depth in their understanding of space and life and death. Consequently, it is a simple task for them which is to draw what they know about space, seeking more expression about the concept of death.

By this method of drawing, the expectation is to probe children's knowledge of the concept of death and astronomy through their explanations of their pictorial representations. For example, what can they understand about space, the sun, the moon and other planets? What can they understand about alternation? What can they understand about life and death in space? So, their drawings include scientific ideas, logical reasoning, and life and death.

3. Observation

The third method of this study is observation. It is a method that plays an important role in studying an object or a person within a specific context, through recording or watching directly for a period of time (Palaiologou, 2009). Systematically, in research, observation is usually done in combination with other methods. For example, researchers can apply observation when

carrying out interviews, drawings or questionnaires (Robert-Holmes, 2011). This focus means that data from interviews, surveys, questionnaires and physiological recordings are observational (Rolfe and Emmett, 2010).

Observing young children is a common form of first-hand evidence to support and clarify children's behaviours (Robert-Holmes, 2011) and it is a vital tool to collect evidence about children's behaviours and development (Palaiologou, 2012). In observation, researchers usually look and listen for information to help them answer their questions. To avoid bias, in light of reading the literature review, these observations must be critically, radically open for evidence and information (Robert-Holmes, 2011)

I chose the method of observing children because it is important to focus on their reactions and expression while answering questions of both sides. I also chose video recording to allow more examination of the children, to avoid doing several tasks during the interviews (such as writing children's answers and focusing on their faces to extend the conversations). Recording the interviews improves accuracy and the quality of data (Willington, 2006). It is a common and useful technique of observation for research with young children (Robert-Holmes, 2011). It was the reason that video recording children is one part of the triangulation of this study, which benefited the methodology in three ways: (1) in writing the transcripts, (2) in focusing on conversation with children and (3) in focusing on children's body language.

One of the benefits of using a video camera to record children during the pilot of this study is that I recognised that children were enthusiastic to talk to the camera (and seeing themselves) and this encouraged them to do more speaking.

In using video recording observations, there are some procedures that need to be done (Robert-Holmes, 2011) in order to follow the ethical framework established for this study which was considered in the consent forms (The ethical details are written in the section of ethical issues P.159).

Pilot study

Due to the sensitivity of speaking with young children about the concept of death, I carefully considered providing a suitable story for them without harming their feelings and to avoid frightening them. It is an important principle, in collecting data, to avoid harm to research participants (Silverman, 2010), particularly when these participants are children. I mentioned in the section of the interviews that it was important for me to design suitable questions that support the method of interviewing children. There was also a brief mention of the story I used. The stories are fully explained in the following paragraphs. These two stories were chosen carefully about the concept of death and the concept of astronomy. In the case of choosing a story about the concept of death, the choice was between some books are part of children's literature and real families' experiences that faced the death of parents).

The stories I chose are *Goodbye Mog* and *What is the Sun?* Initially I made a decision to work with some children on these stories as a pilot study. The purpose of doing a pilot study is to find out whether these stories are suitable for this sensitive investigation or not. In addition, it was to see how children reacted and how they answered questions specifically in regard to death. According to Robert-Holmes (2011) doing a pilot study alerts the researcher as to how best to

judge the research questions and to ensure that the proposed research methods are ethical and achievable. This could require the researcher to change, refine or rephrase some parts of the study when undertaking subsequent research.

After receiving five permissions from children's parents, I interviewed children at their homes. Their ages were between ages 4-6. I read these stories to (and with) each child and I asked him/her some questions after each story. I recorded the interviews with the video camera. Through these transcripts of five interviews, I considered and examined carefully their answers and reactions (all actual words and their gestures) about the stories. I decided that both stories were suitable for this investigation for the following reasons

1. The story, *Goodbye Mog*, is familiar to the children. They like the characters and the scenes of the story. It conveys the information with simple actions. It includes fun. All the children liked Mog.
2. The story of Mog is suitable for this investigation because it includes the meaning of the four sub-concepts.
3. Due to the popularity of the story *Goodbye Mog*, I decided to include children between ages 3-9 in the sample to extend my understanding how children think about the concept of death. The reason for this initially was because some children in the pilot study were at ages 4 and 5. This encouraged me to examine children who are classified based on Piaget's theory into two stages, pre-operational and concrete-operational. Therefore, I decided that the familiarity of the story of Mog between children at both stages could show what kind of development and differences between these both stages. However, I did not receive an acceptance from parents who have children at the age of three. Therefore, there are no children at age three in the main sample.
4. The story of *What is the Sun?* is also familiar to the children. Children interacted with its scenes positively. They reflected their experiences about the sun, the moon and every part of the story.

This gave me an idea that children at this age have knowledge of astronomy because they are able to give some scientific justification and make some reasoning about phenomena in the sky and space. This point confirms to me that my argument is derived on course.

Procedure of interviewing children in the pilot study

(1) Place and Numbers of interviews

In the pilot study, children were interviewed in their homes near their mothers, so they could feel free to talk. Meeting children at their homes gave the children a comfortable place for a conversation with me. For example, they felt confident to move around to eat, drink or play with something, their dogs or their brothers and sisters. Sometimes, I followed them to choose the place where they preferred to listen to the story. However, in total, the full time I spent with each child was about one hour. For each story we spent 20 minutes and between 5-7 minutes for drawing.

The order of which story to read first was random. That means children chose which story they started with. Some children were interviewed initially with the story of Mog. Some of them started with a drawing activity. Some of them started with the story of the sun. The reason for this was to avoid making the order of the stories a result of the analysis.

(2) Video recording of the interviews

I recorded each child by video camera once I received permission from the parents in addition to the child's permission as well. While the children were drawing, my concern was to focus the camera closely on the drawing and on the child as we talked about his/her drawing. I transferred all video-recorded data into transcripts the same day of recording.

(3) Questions of scripts

Based on what was explained earlier, in the pilot study I encouraged them to talk about the meaning and the reasons of both story's scenes. Therefore, I designed questions to focus on each

of these stories using open ended-questions to encourage them to talk more. For example, I frequently asked: “Would you like to tell me more?” Children had a positive interaction with the questions and answered them all, which motivated me to use the same questions in the official data collection. To explain the design of these questions, I shed light on the stories as instruments to cover the concepts of the study. The following is the explanation of these instruments.

(4) Instruments as Stories

In explaining the method of the interview, children were encouraged to express what they know about the concepts. Consequently, I used an instrument to collect the data in relationship to the interviews.

Lowe (2007) denies that children are completely egocentric as Piaget maintained. She claims that children are able to appreciate any story, and to understand its motivations, emotions, desires and characters. As they enjoy the stories, they are able to “recognise that fictional characters at least do perform actions that are motivated by thoughts” (Lowe, 2007). In order to start conversations with children and probe their understanding about the sub-concepts I decided to use stories in the first part of the interview. This is to encourage them to concentrate on the meaning of the concepts they know.

There was, of course, a strong possibility that the story lines of each book could have influenced the answers children gave and shaped the way in which I drew conclusion about their understanding. Every effort was made, however, to avoid the possibility of this having significant effect on the children’s answers through careful questioning, including verification routines, and subsequent data analysis through triangulation.

The following paragraphs explain the features of the stories, and state how they were used to create the scripts of the semi-structured interviews. These stories are *Good bye Mog* (Kerr, 2003) and *What is the sun?* (Lindbergh and Lambert, 1994).

4.1. Story (1) *Good bye Mog*

In order to show how this story provided questions for this investigation, the following section presents the whole story and how it is related to each sub-concept of death. It will explain the (1) choice of the story, (2) the content of the questions and scenes and (3) the design of the scripted questions. The questions are found in the table 3.1 below.

4.1.1. Choice of the story

This story is able to reflect the meaning of the four sub-concepts. The aim of the story, its scenes, and characters are useful in supporting the investigation. Particularly, the story was considered to avoid harmful feelings.

4.1.2. Content and questions

Mog is a cat, which is the main character in this story. Mog is from a series of stories and *Goodbye Mog* is the final story of the series and depicts the cat's death. Mog is not coming back to live with the family. Mog did not choose to die.

In the beginning of the story, Mog is unable to move because she died. She mentions that she "will sleep forever", but a part of her will stay awake to see what will happen after her death. Other characters in the story are living in the same house with a new cat joining them.

4.1.2.1. The section about irreversibility

Investigating how children could understand irreversibility is to question whether Mog (or dead people) will come back to life and live with the family again after death. This can be supported

by choosing the first scene in the story. The interviewer can probe children's understanding of the metaphor behind the term *forever*. The scenes keep reminding the reader that she is dead. This question in the interview is marked CDQ1, Table 3.1.

4.1.2.2. The section about non-functionality

In the story, children listened to several circumstances about existence, not existing, hiding and invisibility. The scenes of the story depict these situations on both cats. The first cat is Mog, who is invisible because she is dead. Another younger cat is Rumpus who tries to hide many times, but continues existence somewhere around the rooms or outside the house. For examples, there are scenes where Mog is invisible in front of the television, watching the little cat drinking milk or watching the family looking for little Rumpus while it is hiding in the garden.

In an attempt to find out if the children understand the factual experience behind the scenes; (that Mog and Rumpus are in the same scenes however only one of them exists and the other one has died) two questions were used. These questions investigate how clearly children could understand the biological ideas in the story between both cats in regard to irreversibility. For example, one investigation is about two points - physical needs and motion between Mog and Rumpus.

In probing children's understanding of the physical needs, some scenes in the story are pointed out to support the investigation. Which cat would the children choose to drink the milk? Would children understand Mog's inability to drink? What reason could they use to explain their understanding of non-functionality in Mog's situation?

Also, in probing children's understanding of motion in a dead body, some scenes in this story focus on moving and jumping. Could Mog move or jump? How could the children know the

difference between the dead cat and the alive cat? Consequently, the investigation is an attempt to see which cat could drink and jump higher? The questions in the interview are marked CDQ2 and CDQ3.

Scenes for the questions

There are two scenes regarding non-functionality.

Scenes related to question 2

The scene that depicts *drinking milk* includes four pictures. Two children in the story pour some milk. Mog appears in the pictures invisibly in a transparent shape watching them pouring milk. Rumpus the alive kitten is not in the same picture, but in another picture Rumpus is standing inside the pot, drinking the milk, and then runs away because it is frightened by noise. The children are talking about the little kitten, Rumpus and trying to pour some milk to gain its attention.

Scenes related to question 3

In some scenes, children (in the sample) listen that Mog intervenes in the situation between the family and Rumpus, in order to support how Rumpus is to be active in family life. The children watch both cats playing together. The dead cat Mog tries to jump and Rumpus imitates this jumping. Mog is a big cat, but still appears invisibly in a transparent shape. Rumpus is a small cat, and appears as an orange colour. Rumpus jumps higher than Mog in the picture. Both of them are happy.

4.1.2.3. The section about universality

The last point of the story shows Mog leaving the house and going toward the sun. It is the final stage in the story, when Mog has to leave the family. This investigation focuses on whether children could understand the facts of the scene. What did they understand about the picture of Mog flying happily to the sun? What is the reason that Mog leaves the family? Would they understand that all living things die? These questions are numbered CDQ4 and CDQ5 in the interview script, Table 3.1.

4.1.2.4. The section about inevitability

Children hear that Mog is leaving the house after feeling satisfied that the little cat Rumpus is happy with the family. In this scene, the family is happy with their new cat, finally feeling that they have a good new pet. Mog is shown watching the family with the new cat. Mog is happy that the family likes Rumpus. Debbie, the little girl in the family, says that she will always remember Mog.

To understand how much children recognise that Mog's death is inevitable, they had to answer question CDQ6, Table 3.1. Mog was the only pet of the family for a long time and her leaving was not a choice. This question investigates how children could understand the cat's inability to choose to leave and its inability to choose to stay.

With the feeling of love for Mog, do children understand the meaning behind the words: "I will always remember Mog?" Why does she have to go? Why are they unable to see Mog again? What do children understand about the word "remember" since it means to recapture the past?

The word also includes the idea of *something that will not happen again in the future*. This means that the concept of remembering is affected by the factor of time and contains cherished feelings. Do they have any feelings about Mog's loss? Do they have any feelings about not seeing Mog anymore? Do they understand the relationship between Mog and the family?

4.1.3. Designing the script of questions

Designing the script was very difficult because it holds the argument of the study. It is a challenge to avoid the problems in previous studies. In the meantime, it needed to address the epistemology of the study and should support fruitful conversation toward the questions of the study.

For a brief view on the problems of previous methods, Speece and Brent (1999) draw the following conclusions. Initially, there were difficulties in the types of questions and the tasks that children had to do. For example, children were asked to define the word "death" or to write an essay about death, or answer with only the responses *yes* or *no* to such questions as "Does everybody die?" Other problems occurred when the interviewer asked a general question such as "What is death?" This general question would be difficult to code and classify under specific

sub-concepts. Finally, leading questions were used; which would guide children with clues about how to answer a question. For example, to use a question such as “Can dead people and animals ever come back to life?” would clue children to use the word “ever” in their answers and biases the question. Some examples of leading questions are “Does everybody die?” “Will you die?” “Can a dead person feel?” “If someone died could he still breathe?” or “Can a dead person do _____?”

In early childhood field, the age of the child concerned many researchers as to what kind of questions could be best used with them in order to get the best answer. It is not an easy task. It is one of the problems raised about Piaget’s questions to children (Donaldson, 1987). Leading questions are not appropriate. Pre-operational children understood death as reversible when children were asked “Can dead things come back to life?” and they answered “yes.” Leading questions let a child answer questions without understanding them (Speece and Brent, 1984).

To avoid using leading questions, and in line with the previous studies’ attempts of using conversation with young children, this study focuses on:

1. Open-ended questions are presented to children after talking with them about the concept of death and the concepts of astronomy. They helped probe the depth of knowledge children have in both areas.
2. Conversations and interviews are based on story scenes that include all concepts. The reason the interviewer used these scenes was to confirm that children understood the open-ended questions asked in the interviews. For example, in a scene related to universality, children are asked an open-ended question related to this sub-concept in the scene. This encourages children to describe and explain their understanding. In addition, it classifies questions and answers under each sub-concept of death. And this prior classification will guide the researcher in how to evaluate the answers from children of the same age.

Children should feel confident in what they are talking about. They might engage with the interviewer about a particular scene within the stories. This should make it easy for the

interviewer to probe their understanding of the sub-concepts in each scene. This is because children do not have experiences in interviews as adults do; therefore an indirect method is a suitable method for children. Indirect interviews use probe tool(s), such as toys, pictures or crayons, and stories to create a conversation with children (Einarsdottir, 2007).

Based on the questions of this study, I designed the script based on four sub-concepts. At the same time, questions are open-ended, and could provide interrelated answers between concepts. And each part of this script includes several questions.

Through these questions, I decided to categorise children's answers into the sub-concepts of death, which are coded later in the analysis with the categories in the table below (Table 3.1). To gain more elaboration, confirmation and clarification on what children mean, some further questions could be asked in the interview such as "can you explain a bit more?" (Robert-Holmes, 2011). In order to do this, I included some probing questions. Can you tell me more? The whole script is found in Appendix 5.

Table 3.1 Questions investigating the sub-concepts of death

Investigation points	Main questions	Questions for seeking more explanations
(1) Irreversibility)	CDQ(1) Mog said she will sleep forever, Can you tell me what does she mean?	Can you tell me more?
(2) Non-functionality	Debbie and Nicky poured some milk. CDQ(2) Who did they pour the milk for? Who will drink the milk? CDQ(3) See this picture. Mog and Rumpus are jumping. Who do you think is better in jumping?	Why? Can you tell me more?
(3) Universality	Mog likes Rumpus. CDQ(4) But where is Mog going? CDQ(5) Why is she going?	Can you tell me more?
(4) Inevitability	Debbie said: “But I’ll always remember Mog”. CDQ(6) Why do you think Debbie said that?	Can you tell me more?

4.2. Story (2) *What is the Sun?*

Similar to the procedure of the previous story, the following explanation depicts *What is the Sun?* and how it is used in relationship to questions about space. It will explain the (1) choice of the story, (2) the content of the questions and the scenes and (3) the design script of the questions. The questions follow in the table.

4.2.1. Choice of the story

The reason for using this story is that it develops the skill of observation; which is based on the ability to recognise phenomena in space. This is due to the high level of curiosity reflected by the character in the story in regard to the phenomena that connect earth with space. The story is based on questions about phenomena and their functions and relationship with life and death on earth. Based on the argument to use another scientific angle and the questions of the study, I was

interested to know what children knew about astronomy. Consequently, I chose this story for that reason and because the story is quite close to the view of the astronomical phenomena this study is looking for. The aim of the story, its scenes, and its characters are useful and support this investigation.

4.2.2. Content of the story

The story is about a child who asks several questions about space. His questions focus on understanding the sun, the moon and the earth. His questions also focus on understanding the relationship between the wind, the sea and the moon. Each idea in this story is suitable for an investigation of scientific thinking. All questions in the story are related to understand the following aspects:

1. The existence of the sun and the moon in space
2. The size of space and the size of some entities in space
3. Life in space
4. The phenomenon of alternation
5. The characteristics of the earth as part of space and that it is a sphere

The script of the questions is based on using particular scenes to ask children open-ended questions. For example, the grandmother told the boy that “the sun is far”. By this information, children were asked “what does she mean?” to probe their understanding of the size of space and the size of the sun within space. It indicates children’s understanding of one aspect of their knowledge of astronomy.

4.2.3. Designing the script of questions

The script was designed cognitively and scientifically based on five main parts to include scenes and open-ended questions. The questions could provide interrelated answers about the following:

1. Knowledge about the sun: to investigate children's understanding of the existence of the sun in space, and size of the sun, the size of space and the phenomenon of alternation;
2. Knowledge about the moon: to investigate children's understanding of the existence of the moon in space, the shape of the moon and also and the phenomenon of alternation;
3. Knowledge about life in space: to investigate children's understanding of what life in space would be like;
4. Knowledge about the earth: to investigate children's understanding that earth is a part of space, that earth is a sphere and the size of the earth;
5. Knowledge about space: to investigate children's understanding of the size of space, the sun and the moon.

The following are the questions for the interview. More detail appears in Appendix 5.

Table 3.2 Questions investigating children's understanding concepts of astronomy

Main questions	Questions for seeking more explanations
CAQ1 The woman said that the sun is far. Can you tell me what she means? CAQ 2 What happens to the sun at night?	Why do you think that? Can you tell me more?
CAQ 3 Grandmother said that the moon is a place. What does she mean? CAQ 4 Can you tell me how we go to this place? CAQ 5: What happens to the moon during the day? CAQ 6 The boy asked: Sometimes thin, sometimes fat? Can you tell me why the woman said 'The moon is like that?' Can you tell me about the shape of the moon?	Can you tell me more?
CAQ 7 What is the wind? CAQ8 Can you tell me where does it blow? CAQ9 Grandmother said the wind blows through the world everywhere. What does she mean by everywhere? CAQ10 Who could live on the moon? CAQ11 What would it be like on the moon?	Can you tell me more?
CAQ12 She said the earth is a big ball? Do you think it is true? CAQ13 If you stand up on the moon, what can you see? CAQ14 If you stand up on the moon, can we take a photo of the earth? How?	Can you tell me why? Can you tell me more?
CAQ15 The boy is going up to see the sun and the moon in space; do you think he can take a photo of the sun and the moon together?	Can you tell me how?

To conclude, questions were designed from the scenes of the story to understand children's knowledge of astronomy. The script is divided into five parts. Each part includes several questions that focus on a particular concept.

3.2.2. Sample

This is a qualitative study, which investigated a small number of children in depth. In addition, due to the sensitivity of the subject, I initially expected that there might be some difficulties in obtaining parental consent. Consequently, I initially suggested a total of 30 children for this study, boys and girls. However, the sample size decreased to a final number of 21 children. The reason for this size is in the section - limitations of the study P.164.

I initially decided the age range between ages 3-9. The reasons for choosing this age related to cognitive stages including children both at the pre-operational stage and concrete-operational stage - the area of the debate in the previous studies about their varying abilities. The literature review mentioned the debate among previous studies on children's cognitive abilities, which found that children at the pre-operational stage do not understand the concept of death while children at the concrete stage understand it. Moreover, as mentioned in the pilot study about the choice of the story, another reason I included both stages of child development in my sample was the familiarity of the story of Mog to all ages of children.

The sample was divided into 5 groups based on age; and appears that way in the results sections. Group 1 is age four and proceeds that way until group five is age 8, the last members of the sample. When I started this study I lived in Scotland, so the data was collected in Glasgow, and I had to learn how to deal with the children's accent. The data was collected at the end of 2009. According to Robert-Holmes (2011) a convenience sampling is a way of choosing a sample from an area where it is easy to access the setting and make the researcher feel comfortable carrying out the research.

3.2.3. Access

A request to collect data was submitted to the Head of Education in the Local Authority (of a particular area in Glasgow), but the request was refused. The reason was that there were many requests for collecting data and there was no chance for additional new requests. While the Local Authority refused permission for the schools in that area to participate in the data collection, some private schools accepted the request. This happened through initial meetings with head teachers of the schools, who welcomed the work with children and agreed to send consent forms to their families. The schools took the role of sending consents and collecting them from families. They also returned them to include those which who refused due to the sensitivity of the subject area. All three schools also prepared the meeting place for children. However, only one private school had a special room for interviewing children, which made interviewing children easier, without annoying distractions.

3.2.4. Ethics

In this study, the main ethical problem is related to the complexity of the concept of death. Talking about death is very emotional and includes sensitive situations for both adults and children. Issues relating to the need for sensitivity with children when dealing with the notion of death are explored more fully later in this section, but it became obvious early in the planned investigation that some parents had been affected by personal experiences of death, or were frightened to speak with children about death. Consequently, that motivated some parents to refuse permission for their children's participation in the study. This reduced the potential sample as will be described more fully below.

Also, another ethical issue concerned interviewing children from a different culture as I was living abroad from my own culture. This is a challenge that faces researchers who research another culture (outsider) and motivates them to recognise the limitation of a potentially biased approach because each society has its own values, behaviours and beliefs. This is normally a major consideration in which researchers seek to protect children's rights and their cultural identities (Palaiologou, 2012).

This important issue was evident in this study. Children's opinions, views, beliefs and their own way of thinking are valuable and were respected by the interviewer. As I mentioned in the ontological stance of this study (P.136), which sheds light on the knowledge children have, this knowledge includes views about both phenomena - life and death. This also confirms that my investigation focuses on only one aspect of this knowledge, their cognitive development. This is with respect to their other views of knowledge about death which reflect their beliefs or religions. Specifically, whilst being sensitive to the possible emotional issues that could be evident in such an enquiry, this study sought to only focus on children's ability to think scientifically about the phenomenon of death.

I followed the ethical guidelines of two universities in the UK: the University of Strathclyde (where I started this study) and the University of Hull (where I completed this study). I used their disclosure forms and consent forms. The disclosure form was approved initially from the University of Strathclyde on December 10th, 2007, and was checked again at the University of Hull on June 3rd, 2011. The details of these documents are shown in Appendix 3.

Achieving the ethical approval

Before explaining the ethical documents, this paragraph shows the journey of achieving approval from ethical committee in the University of Strathclyde.

First, working on questions of the script

Believing in the importance of the ethics matter required me to concentrate on what question I must use in asking children. This guided me to read the story carefully, in order to know which parts of the story support me in probing the child. In addition, following the aim of avoiding any conversation could harm child's feeling; the focus on these parts of the story included a focus on pointing out open-ended questions supporting me to cover the meaning of the four sub-concepts. After many attempts, the script was become ready to be submitted into the committee. I submitted into the committee on 10th Nov.2008. I received the committee comments on 5th Feb.2009. In order to achieve an approval for the form there were some more steps are mentioned below.

Second, meeting the head of committee of ethics

However, whilst the questions initially were ready to be used there were some further steps I was asked to do. The form of the ethics committee was returned with requirement of doing two tasks as following.

(1) Answer some questions was appointed by the committee. (2) Attend a meeting with the Head of the Ethical Committee. The meeting was based on a discussion about (2.1) those questions and (2.2) the relationship between the aim of the study and the questions of the script. In other words, the discussion included explanation about each question from the point of relationship with each sub-concept, the argument behinds using these questions and the method is used for the investigation. In addition, the discussion included the importance of informing parents about the aim of the study and the also the feeling of children toward the subject.

I sent the answers to the committee on 15th Feb.2009. Based on that discussion the form was approved successfully. However, there were slight changes required in the script and the consent forms. The form was approved from the University of Strathclyde on 4th March 2009. By this

approval, the script of the questions about “Goodbye Mog” and “What is the sun” was used finally in interviewing the sample of this study. The scripts are found in appendix 5.

Moreover, due to the change of the registration of my study from the University of Strathclyde on 2010, this approval and disclosure related to the University of Strathclyde were a main step needed to be checked in the ethical procedure of the University of Hull. By submitting the ethical form to the committee of the ethical matter, the ethics form was approved in Hull on 3rd June 2011.

With these points in hand, I sent consent letters to parents through schools or handed it personally. In the consent letters, I informed children, parents, head teachers and local authority about the purpose and methodology and indicated that there were no (perceived) risks involved and the child could withdraw or be withdrawn from the research at any stage if there was any concern. This was also carefully explained it to children before interviewing them when it was confirmed to them through the consent form the confidentiality of their information and their participation as a voluntary experience without any coercion (Silverman, 2010; Edwards, 2011). Consent letters are found in appendices.

Ethical documents

1. Disclosure and the ethical permission was achieved through the university requirements. These disclosures are found in Appendix 3.
2. Letters were sent to some parents, in order to do the pilot study. In addition, these letters were later sent to the Director of Education of the Local Authority, Head Teachers of schools (Appendix 1), and parents or guardians (Appendix 2), in order get permission.

Through the guidelines of ethical matter, I undertook some procedures to solve the problem of the sensitivity of the concept of death (Westcott and Littleton, 2006). These procedures follow.

Solving problems of sensitivity of concept of death

To deal with difficulties that could appear while talking to children about the concept of death, I managed some issues in the pilot study and as well in the main data collection.

1. I used telling a story and talking about its characters to probe children's understanding of a sensitive subject. As I described previously in the section of the methods about using suitable questions to deal with this sensitivity, I decided rather than asking children directly about the concept of death and its meaning, I had conversations about a dead cat which is the character of the story. For example, in the story 'Mog' the cat says: "I will sleep forever". So rather than asking children "what does it mean that death is irreversible?" the question for the children was: Why did Mog say that? This discussion improves my confidence in putting my methodology in line with the right path of investigation in the field.
2. To avoid using closed-questions, which require single-word answers such as "yes" and "no", I used open-ended questions to encourage children to give longer responses. This is very important in asking children to express themselves (Westcott and Littleton, 2006).
3. To deal with difficulties that could appear during the interviews, I designed some procedures to be done before, during and after the interviews. This is a very important step in working with young children (Westcott and Littleton, 2006). Initially, the assumption was if any child refused to answer the questions, or to complete the interview, I would stop the interview about the story. This happened with two children who were age 4 and age 6 who refused to participate in the interviews so I excluded them from the sample.

The aim of this procedure was to focus on the necessity of building trust between the children and myself. Therefore, I let them feel confident in the interviews because I did trial interviews that were mutually negotiated. This process creates successful interviews with children (Westcott and Littleton, 2005). More details about my choice of the most appropriate path of interviewing children is found in the section of the methods and interviews P.137-138.

Procedure of building a relationship with children

1. Before starting the interview, I used eye contact and welcoming sentences. I spoke with children while walking to the interview room, and told them why and how the interview will take place. I informed the children that if they wanted to stop the conversation at any time, their decision would be respected. I asked the children to choose the first story and I also asked them permission to video record them.
2. During the interview, I used eye contact with them. I encouraged children to explain their ideas as much as they like. (Westcott and Littleton, 2006). I asked them open-ended questions to help them explain more about what they think. Moreover, during the drawing part of the interviews I asked them if they wanted a photocopy of their drawing, and respected their request.
3. After the interview, I thanked children for their participation. I told them that it was the last interview, and provided them with stickers at the end of each interview.

This last part of the meeting with children was an important step as an end of my work with children. However, the choice of the correct enhancement achieved my concern. In order to not to cause any allergy for children with some sweet candy or milk or even some fruits, I focussed on providing them with a simple sample that children usually enjoy. Therefore, stickers are the best choice of enhancement with lots of types. I thanked and gave every child the freedom to choose among these types at the end of our meetings.

3.2.5. Limitations

Limitation of the sample

As I mentioned in the section of the sample and the ethics, due to the refusal of the Local Authority in the area for my study to collect data from any schools three private schools only accepted the request to interview their children.

Through the three schools, which accepted the interviews, I sent the consent forms for parents. Some of the consent forms refused permission to collect data from the children due to the sensitivity of the subject.

The sample size of this study was limited by the number of schools and the consent forms that indicated agreement from the schools and parents. Two children were excluded from the sample when they decided not to participate in the interviews. The final number is 21 children. I interviewed each child individually three times. Each interview was approximately 20 minutes for two reasons - a limitation on the amount of time to spend away from work in their classes and to avoid tiring them out.

Limitation of time and demography of the study

I started this study at the University of Strathclyde. However, due to some difficult circumstances, I had to move from the city of Glasgow, after I collected the main data. In order to start the analysis of the data and complete the thesis I joined another university, the University of Hull, where I had to follow their required time in the programme.

The data was collected in three schools in Glasgow, Scotland. This limited further generalisation of the results and specified it as a case study of children living in that particular area of Glasgow. As can be seen from the section of the ethics, working in a different culture meant it was a respectful for the participant's beliefs and religions (it will be discussed below in more detail). The limitation of this point was focused by the main aim of the study, which is the investigation of the scientific knowledge, particularly in the knowledge of astronomy and its relationship with the thinking of the concept of death. This is based on the early age of children between four and nine.

Limitation of investigating the subject in another society

While this study was done in the UK, this is not my nationality, so I did some things to help me with a new culture. To meet children, I needed direct contact with them in order to understand and to deal with their accents and phraseology. It supported me to focus on the ontological, axiological and epistemological stances. This was a strong motivation before collecting the data and I worked on that by communicating with a number of children, establishing a journal to improve the English language, using careful listening skills to understand accents and meeting children through the pilot study in which I practiced skills of listening, discussion skills and relationship skills.

3.3. Research Implementation

(1) Interviewing children

With consent from the schools and parents, I interviewed the children in their schools during the school day for three days a week. The children were in three schools. Meetings started at 9:30 a.m. but had to stop during two periods of break times. Two schools did not have a private room to provide for the interviews, so children were interviewed using a table in the corner of the class. The third school provided a private room.

Younger children were interviewed in the presence of their teachers. Each child was interviewed individually, three times for approximately 20 minutes.

In addition to the consent of head teachers, teachers and parents, I also asked each child's consent at the beginning of the interview. Two children did not continue the interview so their

data was excluded from the sample. The structure of the interview procedure was: welcoming the child and explaining the procedure, asking permission for video recording (it is the third important methods of the triangulation of this study because it supports the analysis. This can be seen in more details in the section of the observation and in a paragraph below), reading the story, asking permission to ask them questions, interviewing them, discussion, thanking the child rewarding his/her participation with stickers and returning the child back to the class.

Interviews based on the scripts of open-ended questions encouraged children to talk by seeking clarification questions like: ‘What else?’, ‘Why do you think that?’ The explanation of the story and designing the open-ended questions are found in the section of the pilot study. The scripts of questions are found in Appendix 5.

(2) Drawing conversation

The use of drawings is a second method of the triangulation aims to encourage children to keep talking about the concepts of death and astronomy. It is an important step helps the child to express their understanding of both concepts. So, it was important that the child understands what task from drawing they have to do; draw and talk. I informed each child about the task of drawing in a previous meeting. I confirmed it based on their consent. The following is the conversation with children about their drawing. Examples of children’s drawings are found in the Appendix 6.

1. I told them to “draw what you know about space”. If a child did not understand the question, it was repeated with these nuances: ”Draw what you know about the sky or space”
2. Each child had an enough time to draw and that usually lasted about 10 minutes.
3. The child’s drawing was video recorded, concentrating on the drawing and the child’s narrative
4. Each child had enough time to speak about his/her drawing, approximately 10 minutes.
5. The reason for the video recording is to capture gestures and the drawing at the same time in order to analyse the child’s expressions.
6. Each child’s explanation of his/her drawing was transferred to a transcript. The aim of this transcript is to focus on the child’s understanding in more depth through his/her explanation.

(3) Video Observation

In using the video camera to observe children during interviews, some procedures were used to follow the ethical policy. I asked permission from the children. I informed them about these video camera observations and reminded them of the important of their speech to the research field. Children reflected that they were happy to be recorded by the camera; which encouraged their motivation for speaking.

3.4. Analytical framework

In order to describe the experience of analysis I divided the description into five levels.

Level 1. Based on the aim of the study and the questions of the study, the purpose of the analysis is to evaluate the cognitive thinking of the children. This means that I needed to see if the data reflected a particular type of cognitive thinking or not. I also needed to see if there were similarities or differences between the pre-operational stage and the concrete-operational stage.

To interpret children’s responses about the concept of death and the questions about phenomena in space, it was important to carefully focus on the details of these responses. The reason was to find possible themes in sample to distinguish between the two stages. Initially, before I started the analysis, my view of possible themes helped me to categorise the data to answer the questions of the study. For example, I wanted to know

about children's thinking in regard to whether it was scientific or not. I wanted to know what kind of sciences they know and how they express their understanding in reasoning. Therefore, analysing the data of this study is based on this thematic analysis. It is a type of qualitative analysis that investigates themes in the data, demonstrates the themes in detail and supports/or does not support the researcher in interpretation. Thematic analysis guides the researcher to understand the relationships between concepts, and looks for the possibility for any link between concepts. It also helps to find similarities and differences within the data (Alhojailan, 2012).

Level 2. After interviewing the children, I transferred each interview from the video camera into a transcript shortly after the interview. Initially, I prepared and organised a form for this script in order to include all questions and every comment that I jotted down about each child (Appendix.4).

By listening to them many times and observing their gestures the form contained all the details that happened in the interviews. This created an enormous amount of data for each child and each group. This was the data corpus (Braun and Clarke, 2006).

Level 3. Reading the data took several steps since there were three scripts for each child, and there were groups of scripts by age group. This took a long time to organise data in several tables in order to make comparisons within the responses. Re-reading the data guided me to highlight similarities between responses and to make connections between concepts. Initially, the focus was trying to find out the kind of answers children gave.

When I started to write the findings, the first attempt used details of what children said. The main data included two parts: (1) analysis of the concept of death and (2) analysis of the concepts of astronomy. This reporting was organised in every part under each age group, initially. However, by the end of the first attempt, two points motivated me to develop another level of focus: (1) A repetition of the themes, sub-themes and responses among groups which reflected the age of development and what was not typical; (2) Reporting and repetition that ended up to be a new path of analysis and clear interpretation about the relationship between concepts.

Level 4: Having studied the data carefully, a deeper meaning encouraged me to look at the data from different angles. This reminded me to see more themes and sub-themes within the data. I began to reshape the data.

The themes and the sub-themes revealed scientific and non-scientific responses. Then I was able to see the links between responses under each of the four sub-concept and in relationship to the phenomena of space. Based on this linkage, the responses revealed a schema of cognitive concepts. The data was still massive and reflected much more information, which made me realise that I only had to focus on the study.

*Level 5 :*By starting a reduction stage, I chose to tabulate the data and reflected on new angles of the themes and sub-themes. According to Alhojailan's conclusion on reduction

(2012) tabulating data helps to prepare data analysis; so the researcher needs to read the data at least twice.

As I found data that answered my questions I took the step to produce it as it appears in children's responses. For example, the results reflected that children have similar schemas of cognition. Therefore, I decided to present their systematic order of reasoning in tables. In other words, by answering the questions, children used a schema, which I transferred into tables. In addition, focusing on the questions of the study motivated me to concentrate on the responses that answered the questions of this study. This was done in both the concept of death and the concepts of astronomy. More reduction was done especially on the concepts of astronomy since the children appeared to have a rich knowledge of astronomy (Braun and Clarke, 2006).

In the meantime, re-reading and re-writing made me become more familiar with children's responses. This made me concentrate more on their meanings and what pattern they used in their answers. Immersion within data usually gives the researcher familiarity and understanding to shape a particular pattern and start coding (Braun and Clarke, 2006).

The pattern I found in children's thinking became a schema based on several steps; this guided me to look back to the details of the responses and classify them in a new way. This schema made me concentrate on the evidence of the study. In the next section of results, this schema is found in each table under each sub-concept or knowledge. This schema appears in the tables which are divided into three parts. It starts with (1) themes and sub-themes, (2) inferences children derive from the information of the themes and sub-themes, and (3) the intrapersonal stage that children reveal based on the specific concept.

Alhojailan (2012) concludes that it is important to evaluate themes to ensure that they represent the data. It is essential to validate data in early and late stages of data analysis. This should be done by involving an outside reviewer to evaluate a theme's compatibility with the data. This allows the researcher to compare feedback with what has been done in order to improve the analysis. Under the supervisors of this study, who are doctors and experts in Education field

working in the University of Hull (expert in early childhood education and an expert in leadership in education), the process of analysis was revised step by step. This benefited the process with (1) critical vision that supported me to keep focus on the main aim of the study and (2) to assure that the process of the analysis was on course. Also, a third additional expert was involved in the theme of analysis for this study, who has a PhD in educational technology and worked on thematic analysis. He is a lecturer at a university in Saudi Arabia. His guidance and critical points were benefits to improve my work in analysing my data. All their three angles of readings of my analyses and their guidance were considered to improve an understanding of the data.

To conclude, this section described the journey of my analysis framework, which I divided into levels in order to interpret and reveal answers to the questions of the study. The following is the analysis which includes both results about the concept of death and the results about the concepts of astronomy.

Chapter 4

Analysis

Section (1)

Results of the Concept of Death

Introduction

This chapter introduces the results of the study to understand the concept of death (CD) and the concepts of astronomy (CA); it is divided into two main sections. In reporting the results, some of the children's responses (C'sR) are shown within the tables or sometimes quotations in *bold and italic type*. The initial letters of the name and the age of the child are provided with the content and are presented as tables. Responses, emotions and reactions of the children are studied in order to understand the meaning of what children are saying or drawing.

The results about death are divided into four sections. The data is about all the age groups in the sample; five groups. Themes and sub-themes are demonstrated in each age grouping.

The results about astronomy indicate children's responses about knowledge of (1) the sun, (2) the moon, (3) alternation (4) the earth and (5) life in space. Each part of this analysis includes tables of themes and sub-themes that come from the responses. The codes of the questions are found in the methodology chapter.

Schema of inductive thinking

In their responses, children have the ability to reason and make inferences from their understanding of death and astronomy. The first type of information in this schema is built on scientific observations either from the children's own observation or from educational interventions. The second type is derived from scientific observations and their own experience of human life. The third type appears as further developed understanding. This stage reveals inferences children make based on previous connections and reasoning that shape an intrapersonal experience about death and concepts of astronomy, in their mind. Two types of

connections are available in the reality, external world and internal world. The external world includes objects, actions and events whilst the internal world includes feelings, desire and judgemental attitude toward every object, things and events. All of these including inner and outer experiences can be related to collectively as intentional state. Children's understanding of inner states is called intrapersonal intelligence (Griffin, 1991). In his theory, Vygotsky believed that children gain the knowledge and tools held by their communities through an interaction between two planes of development, which are interpersonal plane and intrapersonal plane. It is a movement from interpersonal plane as child uses to behave as adult ask him to do so, into the intrapersonal plane. In the intrapersonal plane, child starts to behave as he is able to understand the information and make logical inferences that motivate him to act independently. This occurs in the zone of proximal development (ZPD) the famous stage is described by Vygotsky in his theory. Children's inferences in the sample of this study reflect that they are able to make relationships between objects and experiences shows intrapersonal stage of thinking.

(1) Results of the Sub-concept of irreversibility

This section introduces the results from the data that was collected from the question labelled *CDQ1*, which probes the meaning behind the term “forever”. All scenes in the story keep reminding the readers that the cat is dead. All children show their capacity in the following cognitive skills (1) linguistic expression, (2) logical inferences and reasoning, (3) scientific observations and (4) seriation.

(1.1) Linguistic ability

Only two children gave the answer that they didn't know. Another child chose to give no comments. All other children used developed language to express their understanding and explain their thoughts.

While children are trying to explain their ideas sometimes they are faced with finding suitable words. For instance if we look at Doug-6. By first glance he is trying to find suitable words. However, looking at the entire conversation, it seems it is not a weakness in his linguistic ability but it is a stage of developing an idea in his mind about death. When they did not know what to say, children would repeat some simple words in order to show their understanding of the idea, such as saying “. . .really, really” as in answer of **Doug-6** and “. . . very, very” of **Ha- 4.11**.

(1.2) Logical inferences and reasoning

Children in all groups based their answers on reasoning and inferences. From their responses it appears that they have a schema of thinking as they base their inferences on their observations or information they know about the question. Their responses are rich in showing different levels of

inferences. It appears as a schema of inductive (and deductive) thinking. Children attribute their understanding to information and arrive at an intrapersonal understanding about irreversibility.

(1.3) Scientific observations

Children's responses show that their observations are a combination of scientific and non-scientific themes. The scientific themes relate to the factor of time and biological functions. Moreover, time is the basis of all other themes, including biology. This is indicated in the themes of biological functions and the notion of spiritual life.

(1.4) Seriation

Seriation appears in understanding death as a process. From some children's responses, two points are recognized in the development of children's understanding about death. Initially, children reflect an awareness that death is a phenomenon that happens in some stages. Therefore, children's understanding of this phenomenon is based on a series of steps linked serially. These linked steps started with (1) the causes of death, (2) the need to get rest and then (3) what happens after death. Some of the examples are in **Li-5.8**, **Mo-6.7** and **Ju-7.10**.

In a secondary sense, children's use of a language as time phrases show that they are aware of the death process. They reflect an ability to use developed language to explain this process. However, I needed to focus on their reaction while answering. With **Fi-7.3's** answer to the question of irreversibility, sometime factors affect his answer. While answering the question he reflects some doubt that shows some conflict within his answer. But his linguistic ability indicates that he understands that Mog slept and then died, rather than if Mog is sleeping, that means she is dead.

Children show a similarity in their views, which are classified in themes and sub-themes. These words in the first column or themes are (1) FT - the factor of time, (2) BF - biological function, (3) SL - the notion of spiritual life and (4) E - emotion. The following table shows children's schema of thinking inductively. It is followed by themes and sub-themes, and what children inferred from their observations. Later, the results of each age group will be discussed. Finally, more focus on the third level of the schema - inductive thinking will be explained.

Table 4.1. Inductive thinking to understand irreversibility

Inductive thinking			
(1) Observations on the notion of <i>sleeping forever</i>		(2) Developed views based on observations	(3) Arrive at an intrapersonal understanding of the irreversibility
Theme	Sub-themes		
(1) FT	(1) Sleeping for a long time. (2) Using numbers in explaining: (2.1) the unlimited time of sleeping and (2.2) the period of a lifetime. (3) Limited time of lifespan (3.1) individual age and (3.2) the life itself (4) Long time after death.	-Sleeping forever means it is just a sleeping <i>sleeping for all the days</i> (Ra-4). -Death is not sleeping. It is something controlled by time. -Inability to survive death. -Inability to come back to the life.	- The cat is impossible to wake up again. - People or pet that died cannot come back again to life. - Death is irreversible
(2) BF	(1) Weakness in health (2) Old age (3) Functions of the body are active after death (4) People or pet die	-Exhausted body needs rest and sleeps forever. -Body becomes exhausted based on old age. -Retrieve good health in heaven (Ju-7.10) -After the end of the duration of life time, dead reverse back to life due to the feeling of hunger. This is because of the long sleeping and non-activity.	-Living things die. -Dead cannot come back to the life. -Dead could reverse back after long time when life end. -Dead is active biologically. -Dead people are not-existent in the reality. However, they exist physically somewhere else.
(3) SL	(1) Disappearing of the body (2) Notion of heaven (3) Separation between spirit and body. (4) Limitation of time for spirits living on earth and assumption to transfer to the heaven.	(1) Disappearing from the earth (2) Transference and existence in the Heaven, which is far distance from the earth. (3) Existence in heaven physically and spiritually.	-Death is irreversible. -Dead people are not-existent in reality. However, they exist spiritually somewhere else. -Based on the concept of time, it is impossible for dead people to stay on earth. -Understanding of concepts of distance and time.
(4) E	-Inability to see dead people or pet again. -Long-time of sleeping	Feeling of sadness Feeling of loss	-Death is inevitable, based on time. -Sadness from loss is based on inevitability and irreversibility.

First and second levels of inductive thinking

From the table above, in reading the data carefully, three levels of thinking are mentioned to arrive at an intrapersonal understanding of concepts. The following presents children's observations which include themes and sub-themes.

(1) Factor of time (FT)

Most reasons children give to explain their understanding that Mog will not come back again is based on the factor of time. This reasoning is shaped through several developed views on time. This shows that children use this reasoning of time to build an understanding on how time affects the phenomena of life and death. This can be seen in the second stage of the table which focuses on their observations. Some children suggest that death is sleeping for a long time, while others know it is not. In the meantime, the inferences from both sides show that they arrive into a developed level of thinking which it seems an intrapersonal understanding on the concept of death that it is irreversible. Moreover, it appears that the relationship between understanding the factor of time and irreversibility is linked with another meaning inevitability and at ages 5-7.

(2) Biological function (BF)

Children recognize that people and animals face similar situations. They answer the question about Mog but indicate their understanding about all living things. However, in their answers they focus on external functions. They relate the weakness in the body to old age. On one hand, they base the cause of death on weakness and old age. On the other hand, they base the irreversibility of dead people or pets on the length and the duration of the lifespan, for example

(Ju-7.10). Based on understanding that biological functions are active in death, children respond that after a long time dead people (or pets) return back from death due to the feeling of hunger.

(3) Notion of spiritual life (SL)

In all children's responses, the notion of spiritual life includes similar sub-themes. Children believe in the existence of heaven. They mention the notion of separation between the body and spirit, disappearance of the body and the transference to heaven. They have a developed level of understanding that appears in their responses, indicating that after death, dead people or pets disappear from the earth, and leave earth to live in heaven. This existence in heaven is spiritual and physical. Moreover, they reflect a belief that the dead will retrieve good health in heaven. These observations are found between ages 5-7.

(4) Emotion

Children described their understanding of the inability to see Mog, other animals, or dead people anymore. They show and reflect their feelings of sadness and sympathy related to this inability to see. They have sympathy for Mog; that the cat is unable to choose whether to stay or to go. Moreover, there is an awareness of the sadness of the cat itself in this predicament of deciding to stay or leave. These sub-themes are interrelated and show that children understand that no one is able to survive death (**Ca-7.3** and **Finn-7.3**). Moreover, they base this feeling of loss on the length of time that affects emotion.

- Results of Age 4

While some children answer that they don't know, **Ra-4**, shows that he understands the relationship between the term of sleeping forever and sleeping for a long time using the phrase *all the days*. However, in his emotion there is no sign of any sadness during the reading that Mog is dead. The oldest child in the group **Ha-4.11** talks about a relationship between the weakness in the physical situation and the need for getting some rest by sleeping. Both responses reflect an understanding that Mog is sleeping. **Ra-4** answers that Mog is sleeping and there is no sign of any sadness. The oldest child shows more awareness of this sleeping and relates it to physical exhaustion.

- Results of Age 5

Children make scientific connections between the idea of death and the idea of sleeping forever; which shows their understanding of the metaphor behind the scene of the story. They justify their scientific understanding about death through numbers as in the answer of **Ma-5.9**. In her responses, **Li-5.6** reveals a similar scientific view along with **Ma-5.9** through an unlimited time of sleeping. In addition, she answers the question with more complexity - a limited time of lifespan of pets or humans and the effect of illness. This means there is an understanding of universality. She relates old age to the idea of reaching an end, because no one can live a very long time; there is a limitation of the lifespan. She understands that death is inevitable and irreversible.

- Results of Age 6

Some children at this age explain their understanding by using numbers to show that the word “forever” means that there is no single chance for Mog to come back from death. This is a scientific understanding. This understanding of the limitation of time is based into two points: (1) using numbers about the limitation of the lifespan and (2) understanding a limitation of time for spirits in living on earth and transferring to heaven.

- Results for Age 7

Some children understand that death is sleeping for a long time. They reflect a feeling of sadness about loss. At the same time, a child **Ju-7.10** has an understanding that time is limited; not only about an individual age, but also about life itself. Her response reflects an awareness of the *duration of time*. (*Individual life* means the lifespan for each human, pet and plant. *The period of the life itself* means that the child uses the common meaning that life has a duration of time that started a long time ago and ends on an unknown day). The child is aware of the impossibility for this cat to wake up during the whole period of time. An idea of ‘*getting very hungry*’ shows that the child could think that the cat still exists as it is sleeping but unable to react even when people stroke her. Consequently, the child reflects an understanding of the idea of the limited time of the duration of existence. However, death means it is a long time period sleeping related to the duration of life itself.

- Results of Age 8

At age 8, children's reasoning that the cat will sleep forever is due to her death and she definitely will not wake up again. They give one direct reason which is the death of the cat. They understand that death is irreversible. Moreover, in **Ma-8.7's** response, she shows an understanding of the long duration of death. Children's answers at this age show they understand that dead pets or people never return back again. This is also an understanding of universality. The oldest child understood that death happens for the others as well ". . . *when you die you never wake up.*"

Third level of inductive thinking

Focusing on the responses children arriving at the third level of inferences, it appears that they view death shaped by their observations and the ability of their inferences. Since age four they have an understanding that living things die, cannot come back to life, and exist in another place peacefully. They show that they understand all sub-concepts of death. The following table concludes what children reflect by their third level of schema.

Table 4.2. Children's understanding irreversibility

The probe investigation point	Results of the themes	Children's understanding
Forever	<ul style="list-style-type: none"> -Time -Distance -Vision on existence in place beyond the earth -Notion of Spirit -Notion of heaven -Weakness of external bodily functions 	<ul style="list-style-type: none"> (1) Death is <ul style="list-style-type: none"> -Irreversible -Universal -Inevitable -Non-functional (2)Death is non-existence

By interrelated sub-themes children understand that (1) death is irreversible, universal, inevitable and non-functional; and (2) death means non-existence.

Death means non-existence

Not one of the children in the groups mention the cessation of internal organ functions (CIOF). Children relate death to the ideas of spirits. Children from ages 4-8 are aware of the effect of time in regard to irreversibility. They start by understanding sleeping a long time, that forever means uncountable time, and that there is a duration of time. The awareness of biological cessation remains weak among children until age 8. Children only focus on weakness of external behaviours in the body which is related to old age. Cessation is the separation between spirit and body. Instead of the idea of internal organ cessation, they understand that after death is a stage that could retrieve health in order to be physically and spiritually peaceful in heaven; and that they are at a distance far away from earth. With all these explanations using the factor of time, children reveal that death is irreversible. The dead become non-existent on earth, because they travel to exist in a healthy way at a faraway distance. Figure 4.1 depicts a suggested design

about children's thinking in relationship to irreversibility and the understanding of the death as *non-existence* (NE) as it appears in their responses. The six configurations create the meaning of irreversibility in a child's mind. This meaning creates a developed vision of death as non-existence:



Figure 4.2. The relationship between irreversibility and non-existence

(2) Results of non-functionality

As mentioned with irreversibility, children reflect a developed cognitive capability with non-functionality. It appears in their (1) linguistic ability, (2) logical inferences, (3) scientific observations and (4) skill of classification. The following is an explanation of the skill of classification as it appears in this investigation. Other skills are found in the section of the about irreversibility.

(2.1) Classification

Classification means that children try to give biological information about two different alive entities. For example, in group 1, 2 and 5 children compared between dogs and cats in regard to their food - two living entities - and also between two cats of different size - **Ha-4.11**, **Ma-5.9** and **Ru-8.2**.

The biological answer of **Hann.4.11** is clearer than the other children at age 4; she compares two different types of animals, dogs and cats, on what they like to drink. In groups 2 and 5 children classify between two entities on the basis of age; see **Ma-5.9**, **Ch-5.10**, **Lu-6.4** and **Ru-8.2**

Children's responses show similarity in their views of both cats. These views are based on two themes (1) a scientific view and (2) a non-scientific view - the notion of spiritual life. Scientific knowledge includes biological knowledge (BK) and the concept of time (CT). Biological knowledge is divided into (1) functioning and (2) classification.

First and second levels of inductive thinking

It seems that children imply a new view based on these observations. The schema of their thinking appears in their responses. Inductively, children reason and create justifications that develops their vision of biological functions. The following shows the results of the first and the second levels of the schema. The third level of inferences will be shown after introducing the table of the schema.

(1) Scientific knowledge

- (1.1) Biological Knowledge (BK)

Children talk about the small cat, Rumpus, and focus on its needs and feeling. However, it seems that children are divided into two sides in their understanding of the biological situation of Mog.

(1) Some young children at age 4 give correct answers. However, these answers or reasons are related to both cats without understanding the facts behind the scenes. This might be their understanding about both cats being alive without an understanding about Mog's death. (2) All older children starting at a later age, give different explanations, not just based on pictures in the story. Rather they give an explanation of personal understanding.

- (1.1.1) Functioning

Children in all groups answer with logical reasoning on who will drink milk and who will jump higher understanding biological functions (BF). Children apply their understanding of bodily function in regard to Rumpus and Mog. However, they indicate awareness that Mog is dead and invisible. This is can be seen in the following table between children between ages 4-4.11 and beyond. For example, **Hann-4.11** gives a biological answer and shows her understanding that Rumpus, the little kitten, is the real cat while Mog is invisible because she is dead. Other examples are in **Ju-8.7** and **Math-8.9**.

Table 4.3. Children's view on biological functions

Age	4 years old	4.11 and above
Understanding situation	Biological situation of <i>Rumpus</i>	Biological situation of <i>Mog</i>
Activities	Thirst, drink and jump	Active, able to move, drink, scare, creep, think, sad, jump and communicate with other cat.
Reactions	Real cat	Able to act invisibly, disappear from the real environment.
Physical and spiritual views	Alive and is existing	Dead, unreal, spirit and non-existent in reality

While younger children do not understand that Mog is dead, the other group of children think that biological functions are active even in death, **Li-5.8** and **Ma-5.9**. **Li-5.8** says that Mog, who is a spirit, is able to drink, move and act and to do any reaction biologically, like creeping near the milk to lick it. **Ma-5.9** indicates that Mog is able to think and react with the little kitten. Consequently, they think that Mog has a biological function while she is invisible. The children reveal their understanding of non-functionality as a disappearance of any physical reaction and invisible to other people. In the meantime, these are the same children who understand the factor of time in regard to irreversibility.

- **(1.1.2) Classification**

Explanation of this sub-theme was introduced in the beginning of this section. It is mentioned here to point out that children use the biological classification of living things.

- **(1.2) Factor of Time**

In group 2 and 5 children based the ability of both cats to drink or to jump on their age. They reflect that the older cat is the best to do the task physically. It appears that while they understand irreversibility using time, non-functionality is divided into two opposite directions. Children's

responses reflect a developed biological understanding about functions. However, they don't know biological reasons for death. It seems children give biological reasons about life but not the other way around.

The notion of spiritual life

The notion of spiritual life has gained children's attention. They use it in most of their answers; similar to their scientific observations. Apart from children at age 4, all of children in this sample say that the death of Mog is followed by a spiritual stage. In the story, there is nothing mentioned to the children about spirits or souls but children keep reflecting these words in their responses. For example, they use these words: *spirit, ghost, invisible* and . . . *if just tried it just will go through*. Moreover, some children confirm who exists and who is not-existent, **Li-5.8** and **Ro-6.6**.

The data reveals the effect of invisibility on the feelings and emotions in a death situation. **Doug-6** understands that Mog is dead but because she is invisible **Doug-6** became sad that the family cannot recognise Mog any more since she is not alive. So, **Doug-6** thinks that Mog is invisible to the family, not alive, and for him, Mog is non-existent in the environment. The following table shows this schema which is based on children's logical inferences they made in answering two questions: CDQ2 and CDQ3.

Table 4.4. Inductive thinking schema on non-functionality

Inductive thinking schema					
(1)Observations				(2)Developed vision about death is based on the observations	(3) Arrive to an intrapersonal understanding on the Sub-CNF
Scientific			Non-scientific		
FT	Biological Knowledge		Notion of SL		
	BF	Biological reasons of death			
Age	Understanding biological needs (drink and eat)	Active bodily functions after death (4.11-5.10)	Alternative to spirit	Stage1. Ability to act physically and spiritually. Ages 4.11– 5	Dead have an active bodily function and can express emotion. Dead means non-existence Death is universal
	Understanding classification	Non-functionality is related to the spiritual situation (ages 6-8)	Dead are invisible	Stage2. Ability to act only spiritually.	
	Understanding relationship between classification and age.		Invisibility affects the feeling of the dead since no one can see them.		

Relationship between non-functionality and spirituality

Children at age 4 do not reflect awareness on the notion of spiritual life. In the previous sub-themes it was mentioned that children give biological reasons about life but not the other way round. It seems there are two points here

1. Children believe that biological functions are active after death
2. They imply spiritual life to their justifications about biological functions (rather than the cessation of internal biological functions, CIOF).

This observation is seen in most children’s responses started with age 4.11 through ages 8.9. In addition, it appears that their cognitive development understands both notions of biology and spirituality. For example, children think of the notion of invisibility. Based on the failure to

understand cessation of internal functions, two stages emerge: (1) Children show an understanding of that dead people or pets are able invisibly to react physically and spiritually. This is because children show that they think that death has biological functions. This can be found at younger ages as well. (2) Children understand that the dead are able to react only spiritually. This start to doubt that death has biological functions due to spiritual situation. Examples are found in **Ro-6.6**, **Gu-6.11** and **Math-8.9**. Further explanation on non-functionality and spirituality is found in T4.4.

Third level of inductive thinking

Children arrive at an intrapersonal level of understanding Mog's death as invisible, a disappearance from the real environment and non-existence. This is based on their understanding of the spiritual life and the notion that the dead are active biologically, with functions and emotions. In addition, this happens *universally* and *inevitably*.

Li-5.8 and **Ma-5.9** use a scientific answer about biology and the factor of time. **Ju-7.10** has a similar answer. But in **Ju-7.10's** answer, she indicates that Mog has no biological functioning. At the same time, she has another view in answering the question about irreversibility. **Ju-7.10** reveals that death is irreversible during the lifespan. This means that dead pets or people are not part of daily life. However, she uses her biological knowledge to explain biological needs within the duration of life itself. So, she indicates that dead (cats or people) could feel hungry. This means that she does not think about cessation due to her naïve idea of biology related to the

concept of death. It seems that she has a fragmented idea of non-functionality when she understands that Mog has biological needs. Death means *non-existence*.

(3) The results of universality

This section is about universality collected from two questions - CDQ4 and CDQ5. The same cognitive skills already investigated are included as well as some new skills - seriation and universality.

Cognitive development of seriation and universality

Children show a developed understanding seriation and universality. An example of universality appears in the following response of **Li-5.8**: “. . . Because humans die like cats and pets and all pets”.

Other examples are found in **Ro-6.6**, **Mo-6.7** and **Gu-6.11**. However, there is no chance in this study to know whether children understand the death of plants. But it seems there is clarity that human and animals face death finally. Their death is related to the end of the duration of their age. This shows an understanding of universality and inevitability.

An example of seriation appears in the following response of **Li-5.8**:

G/ Why do you think a human has to die?

Li-5.8“ Because . . . you know . . . when they near a hundred like ninety or some seventy then get lots of wrinkles and having walking sticks and there’s problems with their bodies so they just may need to lay down and die. ”

The following table shows seriation in regard to death based on the meaning of the concept of time, the concept of life, and understanding biological functions.

Table 4.5. The effect of understanding seriation in regard to life and death

Concept	Children's understanding	Examples from questions
Time	Time is linear	Li-5.8 and Gu-6.11
Life	Life is a linear path	Li-5.8 and Gu-6.11
Biological function of both human and animals	Relationship between weakness in external bodily functions of the body and old age	Li-5.8

Both cognitive concepts of universality and seriation shape children's understanding based on limitation of time. This scientific side - as mentioned above - appears in the child's thinking about irreversibility.

What is interesting in this data is the limitation of time on entities' lives is a reason to understand several perspectives of death, such as understanding not only universality but also inevitability and irreversibility.

By using inductive schema, children use their observations to acquire much rich information. This observation is the basis of not only biological knowledge and the factor of time, but also it knowledge of the universe. The following is a general view of the results in each group.

Children at age 4 are similar in their views as they are focusing on what is happening in the house between both cats and the family. They do not reflect any understanding that Mog is leaving the whole environment. For example, they focus on the scenes of playing, hiding or running. In addition, there is no reflection of any emotion of sadness that Mog is leaving the family or life! Therefore, they reflect an understanding that Mog is alive (or exists) and react

normally with another cat; they do not understand the facts behind the story. Only one child **Lu-6.4** in group 2 shows understands that Mog is still acting in the environment.

The oldest child (4.11) has a different answer and gives a different view. Among five children who are age five, **Ma-5.9** understands the limitation of time non-functionality and irreversibility, when she answers why Mog is going. She says, after a long silence, “I am not quite sure”. She was thinking in the long silence.

From the responses of children at age 7, no answer implies that all living thing die. However, their responses show depth in another way of thinking. At age 8, all children answer that Mog is going to heaven. However, it is recognised that some children reflect doubt about the notion of heaven. Sometimes doubt is followed by a sentence such as “I don’t know”. In addition, there is long silence before answers are given. There is no answer among this group that indicates that all living things die. And yet there is an answer that shows the factor of time. They mention the difference between reality and what the pictures show. The following table no. 4.6 develops the schema.

First and second level of the inductive thinking

Based on interrelated observations on sophisticated scientific knowledge, in addition to the notion of spiritual life, children develop and shape their understanding of universality. The responses are interrelated yet children are able to express their understanding about factors of time, biological knowledge and knowledge of astronomy. This development is found in the table below no.4.6 in the first and second columns, which include children’s observations and their inferences.

(1) Factor of Time (FT)

Based on the factor of time, children understand duration of time, limitation of time and age. They use the factor of time as their justification to understand the phenomena of life and death and as a basis of biological knowledge. In biological knowledge children indicate two stages of thinking. First, they recognise biological functions, reasons, benefits or characteristics in the body support them and help them understand biological phenomena around them. Second, they only focus on the external biological functions. They understand external biological functions of living things die (or cease) which affect the body to lay down and start another new stage.

(2) Biological Knowledge (BF)

It can be determined that there are children do not understand the cessation of internal organ functions. Instead, children focus on the external biological functions that cease and oblige the body to get rest. For example, becoming ill **Ha-4.11**, getting and having wrinkles **Li-5.8**. Children understand that death is a barrier between two stages. The first stage is the life, which is a physical performance. Death is an alternation stage from physical performance to spiritual performance. Some of the examples are in **Li-5.8**, **Mo-6.7**, **Ju-7.10** and **Ma-8.7**. Therefore, children in all groups started to talk about death (by age of 4.11) as a physical disappearance whether spiritual or physical. In the meantime, this weakness in understanding the cessation of internal organ functions doesn't reflect a weakness in all perspectives of children's scientific knowledge, because they indicate that biological development is in progress. For example **Li-5.8**, talks about biological characteristics and functions in entities such as green eyes and a vision.

(3) Knowledge of Astronomy

The third scientific perspective is knowledge of astronomy. Children recognise phenomena of the universe. They show an awareness about the scientific information about the sun and separate that from a notion of heaven. They reflect an awareness of huge distance in space. They understand that earth is a place for alive people, and after they die they leave to another location. This location contains difficulties in communication between those alive on earth and the dead due to the huge distance and length of time. It appears that information about the universe is a part of the puzzle to support the whole meaning of death in children's minds.

(4) The notion of spiritual life (SL)

While children at age 4 reflect that Mog is alive; and couldn't give a reason for where and why it is going, the answer of the oldest child in the group **Ha-4.11** is quite a different view. She showed more awareness in her understanding of the facts behind the picture; that Mog is dead (or non-existent). The reason she gives is related to illness. In her answer, she immediately says that Mog is going to heaven. Her view on the reason of illness is the same as her reason for sleeping forever.

Children from age 5 and above have similar ideas among them. They show their understanding that Mog is dead and is going because she is invisible and no longer alive, and needs to leave the environment for alive people. For example, in the answers of **Fi-5** and **Ch-5.10**, Mog's death means non-existence in the real environment. Some of these responses are in **Doug.-6**, **Ro-6.6**, **Mo-6.7**, and **Gu-6.11**. They reflect an understanding that death is a disappearance from the earth, however this does mean that the dead are active spiritually. Therefore, Mog can find a friend in

heaven, as **Mo-6.7** responds. This understanding is found in the sample until group 5. At age 8, children answer the question of where Mog is going by simply saying she is going to heaven. However, in this group (5) most of the children answer in a questioning way, such as “*heaven?*” with long silences either before or after answering with a comment like “*I don’t know*”. There is no explanation about this doubt. However, the reason a child immediately states about why Mog is going is that “*Mog is dead*”.

The understanding that death as non-existing situation is collaborated with the understanding of the biological function as it is explained below. The following table no.4.6 shows the interrelated scientific views of children in creating the meaning that death is inevitable and universal.

Table 4.6. Inductive schema of understanding universality and inevitability

Inductive thinking			
Observations		Developed stage about understanding death based on observations	Arrive to an intrapersonal stage of understanding universality
The mes	Sub-themes		
FT	1. Factor of age	External bodily functions which happen gradually with old age. (Li-5.8)	Death is universal, inevitable and irreversible. Death means non-existence.
	2. Duration of time (limitation)	Impossibility to stay, or to keep beloved one forever because there is no choice to do it due to the limitation of time (Li-5.8), (Ro-6.6), (Gu-6.11 and (Ma-8.7)	
	3. Factor of time and external bodily functions	Using numbers to explain that lifespan controls life and death as they are natural phenomena (Li-5.8) -The notion of linear path in both concept of time and phenomena of life and death (Gu-6.11) -Phenomena happen to human and animals.	
BK	1. Understanding External bodily functions	- The benefit of the green eye in shining in the dark or sharp vision of the green leaf in the dark. -Problems with bodies; wrinkles and walking sticks. -Bodily function change in stages gradually and serially. (Li-5.80). -Life and death are natural phenomena. (Gu-6.11) -Phenomena happen to human and animals.	
	2. Weakness in understanding CIOF	-These stages of external changing biologically end by only laying down and dying (Li-5.8) -Belief in the notion of living physically (and spiritually) in heaven.(All groups)	

KU	1.Knowledge of the Sun	(1) Benefit of warm (Se-4). (2)Different location than heaven (All groups)	
	2.Big distance in the universe (All groups)		
	3. Impossibility of staying on earth after death and obligation to leave to another location. (Mo-6.7, Ma-8.7)	Phenomena happen to human and animals.	
	4. Earth is a centre for only living thing (Ro-6.6)		
SL	Notion of heaven, invisibility, unreality and need to leave the real environment	An alternation stage from physical performance to spiritual performance.	

Third level of inductive schema

Based on the development of children’s ability to infer logically from their observations, they show that they arrive at an intrapersonal understanding of the Sub-concept of universality and other concepts, which means that they reflect by their inferences that they believe death is universal.

(1) Death is universal and inevitable

The question of universality focuses on where and why Mog is going. Children’s responses show an understanding of inevitability among groups 2 to 5. This understanding turns up with the inability to avoid death and is related to the factor of time. Children are aware that people are unable to keep people (or pets) alive forever. This is found in answers of **Li-5.8, Ro-6.6, Gu-6.11** and **Ma-8.7**. Another example, **Ca-7.3**, shows that Mog is unable to choose whether to leave or to stay.

(2) Death means non-existence

All responses show that children are aware that death happens for people and animals; which shows that they understand the universality of death. The understanding of interrelated themes such as the notion of spiritual life and biological functions are active in the meaning of universality as non-existence.

(3) The results of inevitability

This section shows how much children could understand that Mog inevitably has to leave the family and the house. From children's responses to question CDQ6 there is a similarity between themes and sub-themes among groups. It seems that all children understand that death is inevitable. This understanding is based on a relationship between understanding the factor of time and the emotions related to loss. Sometimes this relationship is dual and starts by age 4. However, some young children at age 4 show an understanding of time but not the feeling of loss. Two children's responses are not clear since as they are silent for a time, and say: '*I don't know*'. Therefore, an attempt to understand both responses is needed. In order to find out what they could mean, the researcher needs to look deeply at their other responses and those of the whole group as well. A table of comparison (no.4.7) will be introduced at age 4.

- Age 4

There needs to be a comparison through between all answers of children at age 4, and a focus on each child's responses. In most responses of the four sub-concepts (except the oldest child) they do not show an awareness of what is really going on with Mog - why Mog is sleeping forever. They are not sure why Mog (or a dead person) become unable to drink or jump. Who could die?

Where they would go? How they would remember Mog? How do they understand the facts about Mog in their mind? The comparison focuses on four categories (1) *emotion*, (2) *scientific reasons*, (3) understanding the *location of Mog* and (4) the *reasons to remember Mog*. This can be seen in the following table no.4.7

Table 4.7. Categories of each child's responses

	Emotional reaction	Scientific reasons among answers	Location of Mog	Reasons to “remember” Mog	Situation of Mog in child’s mind
Eu-4	-Staring deeply once he knows that Mog is dead. -Focusing strongly during the story. -Showing upset during listening.	-Seems to understand that Mog has biological functions, and able to react normally.	-Focusing on the pictures of the story -No reason is shown	-Because “Mog is dead”	Mog’s death means non-existence; disappears from the environment and able to react invisibly.
Ra-4	-Does not show any upset or feeling sad in any part of the story. - Asking “why?” during reading the story, about many parts. -The story doesn’t grab his attention.	Applying the factor of time for the meaning of forever, e.g. <i>‘sleeping all the days.’</i>	-Up to the sky; but no more information	“I don’t know”	Mog exists; Mog is alive.
St-4	-Does not show any upset or feeling sad in any part of the story. - The story doesn’t grab her attention.	Focusing on Rumpus and her biological characteristic; but not Mog’s biological problem	-Going to ‘a high’. -Focusing on the disappearance of Mog from the real environment	Silence	Mog exists; Mog is alive.
Se-4	Does not show any upset or feeling sad in any part of the story. - The story doesn’t grab her attention.	Focusing on Rumpus and her biological characteristics; but not Mog’s biological problem	To the sun, or up above. Scientific reason focusing on the benefit of the sun.	-Realizing that Mog was there in the past; <i>‘she had Mog’</i> . -Locating Mog in a faraway area makes her unable to come back. -Reflection on the effect of the factor of time on the meaning of <i>‘remember’</i> .	Mog’s death means non-existence; disappears from the environment and able to react invisibly.
Ha-4.1 1	-Emotion appears in more awareness on what each cat faces. Says ‘really really tired’, ‘really really sleepy’, ‘really really ill’ and ‘used to be her pet’.	Weakness and illness are reasons for sleeping forever. -Focusing on Rumpus need; ability of differentiate between animals biologically -Shows that Mog is out of this comparison since she is dead.	-Heaven is the place for dead pet or people. -facing illness (and death) causes travelling to heaven.	Mog was living in the past; ‘she used to be her pet’. - Reflection on the factor of time, on the meaning of <i>‘remember’</i> .	Mog’s death means non-existence; disappears from the environment and able to react invisibly.

From the responses, Ra-4 and St-4 do not answer the question. In addition, they do not reflect any feeling of sadness about Mog's death. There is nothing special, about the story of Mog for them. However, Ra-4 raises a question of "why" many times during the story. Their responses are related to focusing on only the pictures of the story; they say respectively '*to a high*' or '*to the sky*'. St-4 gives a reason which is related to her understanding of the disappearance of Mog from the environment at rooms in the home.

A logical scientific reason appears in both children's reasoning. For example, Ra-4 answers the meaning of *forever* as Mog is sleeping *for all days*. St-4 talks about biological characteristics as related to Rumpus the new cat. Simply, they understand that Mog is alive; they do not understand her death. However, some other children in the same group do understand that death is inevitable but they understand it as non-existence in reality. This is shown in the following explanation of children's inductive thinking.

First and second levels of inductive schema

Based on (1) observations (scientific and non-scientific) and (2) the ability to make inferences, children show that they develop their understanding of the sub-concepts. These levels are explained below.

(1) Scientific observation

- (1.1) The factor of time (FT)

Each group shows some basic scientific thinking on the inevitability of death based on the factor of time, to explain that the cat (or person) has to leave. Interestingly, they talk about Mog as if she was living in the past. This is found in most responses. In their minds the concept of memory

is based on understanding the concepts of *time before* and *time after*. Understanding the factor of time is developed in more depth from this group to the next older group. The table below no.4.8 shows how the relationship between inevitability and the concept of Time (CT) is developed through groups.

Table 4.8. The development in the relationship between inevitability and time

Groups	The relationship between inevitability and time
(1)	- Understanding the concept of <i>past time</i> and <i>future time</i> .
(2)	1- Understanding the concept of <i>past time</i> and <i>future time</i> .
(3)	2- Understanding that there is a moment when pets (or people) die. 3- Understanding the effect of old age.
(4)	1-Understanding of the effect of old age. 2- Understanding the duration of time 2.1. Specific talking about a period of time. 2.2. Expressing feelings of sadness because of the length of time. 2.3. Knowing the length of time until the end of life.
(5)	1- Understanding of the concept of <i>past time</i> and <i>future time</i> . 2- Understanding the limitation of lifespan due to the limitation of time. 3-Death could happen at any time, even at a young age.

By examining the data it can be stated that children develop their understanding of inevitability parallel to their understanding of time. From the table it is clear that children are able to build this relationship in their mind at age 4.

At age 5 they are able to recognise that there is a moment that life ends - **Li-5.8**. They also start to recognise that old age is a reason for death.

At age 7, children express their understanding of the difficulties of the death situation over the duration of time. Three different views show how children are aware of the duration of time;

they appear in (2.1), (2.2) and (2.3) of the table above. Examples are found in **Fi-7.3** and **Ju-7.10**.

Interestingly, the justification at age 8 becomes more developed. The idea that old age causes death develops into another stage which shows the idea of death happens inevitably and irreversibly - *even in young age*. **Ma-8.7** says: "...when she died . . . because . . . because it hasn't big . . . and it seems to me that you are sad when someone in the family dies because we don't get them back".

There is also a stage where children understand the limitations of the lifespan due to the limitation of time. **Ma-8.7** reflects on this stage in her response: "...Well, I think no one can live forever".

- (1.2) **Biological knowledge**

Children reflect some scientific understanding through biological knowledge. For example, **Ha-4.11** shows an understanding of non-functionality through her biological knowledge, and an ability to differentiate between characteristics of animals. She also shows more ability of differentiate between dead and alive according to biological characteristics. However, in answering why Debbie (the child in the story) will remember Mog, there is nothing to show a relationship between the concept of death and biological characteristics. Instead, her answer focuses on the relationship between time and emotion.

Therefore, having considered all answers, the development of understanding the relationship between inevitability and biology happens in some stages, which are parallel with understanding the effect of spiritual life. This is shown in the following table no.4.9.

Table 4.9. A development of understanding the relationship between inevitability, cessation and spiritual life

Group	Effect of biological knowledge	Effect of understanding spiritual life
(1)	----	-----
(2), (3) and (4)	-Death is caused by old age. -Relationship between being tired and needing rest. -People and animals die	The dead rest in heaven, and meet others in heaven.
(5)	- Old age is not the only reason for death since death could happen at a young age. -Recognition of increasing population.	

In the table above (1) children do not make any relationship between inevitability and biology or spiritual life. At ages 5-7, children relate the inevitability of death to old age and weakness in the body which needs to get rest, and needs to stay in heaven. Moreover, they recognise that this happens to many living things (humans and animals).

At age 8, children’s reasoning is more developed about the causes of death. Particularly, old age causes death and death could happen at a young age. Interestingly, the awareness is even deeper and there is consideration of ecological phenomena such as the increasing population of the earth and the need for reduction. **Ma-8.7** says: “... We’re too many people in the world if everyone been born and no one get died. You can go up and you’ve got nowhere to go except to die”.

Consequently, biological knowledge is developing to recognise external phenomena but not yet the notion of cessation.

- **(2.1) Emotion**

In contrast to some children **Ra-4** and **St-4**, other children, base their emotions on the loss of the cat which was living with the family. There is also an awareness of the impossibility to see this cat in the future. Children reflect emotions about loss through the following examples: “love”, “like”, “they didn’t have that one, they have Mog”, “really close to her”, “she is forgetful”, “family pet”, “missed her”, “good cat for the family”, “they wanted to be together”, “upset that Mog died”, and “she never forgets the time that Mog died”.

In addition, it seems that some children relate the sadness of loss with two reasons that speak of the impossibility of live people to meet the dead: (1) the long distance between earth and heaven

- **Li-5.8** and **Ju-7.10**; (2) the long distance and the long-time to forget relationships, such as **Ju-7.10**. She says:

...because they are friends, and might see each other again and not forget her....Mog may forget who she is or she may forget who Mog is... because it been apart for such a long time... I think they’re gonna see each other again because they quite far away but still I think Mog will come back.

- **(2.2) The sub-theme of spiritual life (SL)**

From age 4.11 until age 8.9, children talk about spiritual life after death. Not understanding cessation motivates them to strongly transfer the idea of spirits and even bodies to heaven. This becomes a belief. In the answer of **Ma-8.7** she reflects that death happens in a process. However, this process is known but not understood. She knows something about the concept of burials and

graves but her own belief isn't strong enough biologically to understand the process after death.

She says

...Well we get buried in the ground and then and I think our soul goes up to heaven. I always think you have another life in heaven and our souls like us and forms a shape of us and everythingand you live in another life in heaven . . . and heaven as big as wants to be . . . souls as many people can be there. Well . . . because . . . well it just . . . I think . . . you know . . . you don't want to stay in the ground forever . . . and it just seems to me that what happens . . . and I don't want to die . . . but when I do . . . I will find out what will happen after you die.

She understands personal death inevitably. However, for her and for all children death means a disappearance only from the environment. But there is an ability to react invisibly. Death for some young children means non-existence, on the earth and an impossibility of returning back to earth. The following table demonstrates children's scientific thinking on inevitability.

Table 4.10. The relationship between children's understanding of inevitability and scientific knowledge

Age	Scientific thinking		Understanding death	
	Understanding the factor of time	Understanding cessation	Children's view on Mog's death inevitably	
4	Awareness of the concept of time	Weakness in understanding biology	Mog is alive	Exist
4 and 4.11	Awareness of the concept of time	Weakness of the body causes need to sleep and rest. However, the body is active biologically.	Mog is dead, but exists in heaven.	Death means non-existence.

To conclude, the table above shows the relationship between children's understanding of inevitability and their scientific thinking. Children from the age of 4 present scientific logical reasons in justifying their understanding. They see that the factor of time makes death

unavoidable. However, some children at age 4 do not recognise any relationship between death and biology. Some of them show a developed biological idea on the relationship between physical weakness and the need to get some rest. These two levels are explained in the following table no.4.11 about inductive thinking and inevitability. The third level is indicated after the table.

Table 4.11. The schema of inductive thinking to understand inevitability

Inductive thinking			
(1) Observations		(2) Developed understanding of the sub-concept, based on observations	(3) Arrive at an intrapersonal understanding of the inevitability
Themes	Sub-themes		
FT	Information in table 4.8	Information in table 4.10	Death is universal -Irreversible -Inevitable Death means non-existence

Third level of the schema

Children show that they arrive at an intrapersonal view by showing their belief in that death is irreversible, inevitable and it is the non-existence of the entity.

(1) Death is inevitable

In each group, children show an awareness that death is unavoidable. In most answers children justify their sadness by making a connection between the feeling of love for the cat and an inability to keep this cat alive and avoid death. This understanding is part of all groups. Three examples, **Ma-5.9**, **Ca-7.3** and **Ma-8.7** say:

. . . Because she loved her and because she didn't want her to die because she want it to stay.

. . . probably want to die or maybe she had to.

. . . I think no one can live forever.

(2) Death is Universal

Based on biological observations, most of the children talk about death that happens to animals and humans. For example **Mo-6.7** reflects on other people's death, ". . . *when you get too old you get tired and want to go up to heaven so you can rest*".

Ma-8.7 shows her understanding of what personal death is, and has an understanding of inevitability and universality ". . . *I don't want to die, but when I do*".

(3) Death is Irreversible

In group 3, there is an awareness of the impossibility for the family to meet Mog again. **Doug-6** indicates that the girl will only see Mog in her dreams, which indicates that the dead will be unable to come back. This is similar to an answer in group 5. **Ma-8.9** also understands the impossibility of getting dead people back, and this affects emotion. These examples show a type of understanding of time and emotion. Another child understands irreversibility, but though the meaning of that death means non-existence some children think that after a long time the dead can come back - **Ju-7.10**.

(4) Death means non-existence

This theme shows that children think that Mog is only non-existent. At age 4, a child thinks that Mog is only sleeping - **Ha-4.11**. Children at age 5 and above understand death as not sleep or a long sleep. The data shows that they deal with this understanding from several sides; such as emotion, time and age. They create stories on the location of dead pets or people and their active

ability in invisible situations. Consequently, understanding that Mog is non-existent is based on two views; death is still active biologically and the notion of spiritual life.

Conclusion of the results about death

The data show that children have a definite schema of how they think. It is an inductive thinking schema based on many observations. The main knowledge of children are found in the data - they understand the concept of time, biological knowledge, a notion of spirit and the knowledge of astronomy. Children show a cognitive capacity to develop an understanding of death through logical inferences based on their observation. They are capable of arriving at a general conclusion with an intrapersonal understanding of death.

The sample is divided into two main perspectives of thinking. The first perspective is about children at age 4. Some children show that they do not understand that Mog is dead and they show no sign of sadness or upset during the reading. They understand that both cats in the story are alive (exist) and able to communicate with each other normally. At the same time, it appears that two of the children reflect a scientific understanding for the factor of time.

The second perspective is about understanding the qualities of death, and these children understand that Mog is dead. However, this understanding appears shaped by the concept of non-existence. At age 5 and above they recognise that death is not a sleep or long sleep. Children give deeper explanations in a scientific way. Based on two scientific views, children build their own understanding of the concept of death. These two views are the factor of time and their biological knowledge. In fact, they think of the relationship between the concept of death and biological knowledge through the factor of time.

The data shows that children understand the three sub-concepts of irreversibility, inevitability and universality based on the factor of time. As children show a developed knowledge of biology

to understand life around them, they reflect that they do not understand the duality of the relationship between biology and death. Therefore, they don't show any understanding of the cessation of internal organ functions, or the decomposing phenomenon. Children in the sample of this study until age 8.9 understand the biological concept of death as a weakness due to old age. This is the reason for the body to cease and die. Interestingly, children by age 6 reflect wider biological view of life and death. Some children become aware that death is a phenomenon related to ecological reason and the balance of the population on earth. This is found in older children (group 5).

In the absence of understanding the cessation of internal organ functions, children depict death as a point of transference to another stage which is an alternation from an existence situation to becoming invisible to the real environment. They believe that death is a stage where dead people or pets can invisibly act spiritually and physically.

In another scientific perspective of children's thinking, their developed understanding of the time supports them for understanding all four sub-concepts of death. Through this base they understand life span, limitation of time, duration of time and that time is linear in relationship to life and death... They are able to use numbers in order to explain their understanding between death and the factor of time. It seems children understand inevitability initially, before understanding irreversibility and universality. However, there is an interrelated understanding between them.

Therefore, children understand that death is unavoidable due to the limitation of the lifespan. No one can reverse back to life again. Death happens to other people and pets. It happens to them. However, in death there is an ability to react invisibly as spirits but these spirits and bodies must

transfer to another location far away from earth. This location is portrayed in their mind due to the strong understanding of irreversibility and the weakness of understanding non-functionality. Interestingly, children show by their location of heaven as far away from the earth, that children could have another scientific view that supports them. As they differentiate between the entity of the sun and the notion of heaven, it appears that children have some understanding about astronomy.

Consequently, in investigating children's understanding of each sub-concept of death, the data shows an understanding based on scientific knowledge. This section is an answer to one part of the study. The next part is the investigation of children's understanding of astronomical knowledge, in order to shed light on what kind of relationship this is.

Section (2)

Results of the Concept of Astronomy

Children's knowledge of astronomy

The data appears rich because the questions are open-ended, which encourages children to reflect what they understand about space including earth. However, it is necessary to reduce much of this data in order to focus only on answering the questions that are central to this research.

Children in all groups show that they have some depth of understanding of the phenomena in space rather than focusing only on the pictures in the story. This depth is reflected by their developed linguistic ability, which supports them enough to explain their understanding of concepts through logical reasons. Interestingly, it appears that age is not an essential factor in their ability to learn about the moon, because some children aged 4-4.11 years are aware that the existence of the moon is in space, while some children aged 4-4.6 years are aware that the existence of the moon is in the sky.

Moreover, it seems that they have a schema in thinking about scientific phenomena in space, which is based on inductive reasoning.

Children's responses rely on the scientific dimension to observe the sun, the moon, the earth, and even space. This is classified as themes and sub-themes in the following tables (4.12, 4.13, 4.14, 4.15 and 4.16). As they answer questions in some depth, the themes interpreted from their answers belong to general information found scientifically about these phenomena. For example, the themes found in children's answers are the characteristics, distance, functions, alternation and features of the entity or the phenomena. These themes are based on sub-themes, which are classified as scientific observations. The explanation of the schema of inductive thinking, which

children use in their expression on the phenomena of astronomy, is found at the beginning of this chapter.

Knowledge of the sun (KS)

This part includes the results of two questions which focus on the knowledge of the sun, CAQ1 and CAQ7. This is explained in the Table 4.12 which shows three developed stages in the responses. It starts with the scientific observations of children. The second stage shows further understanding about the distance between the earth and the sun which protects humans from death; this distance is also important for the growth of living things. From these two scientific levels, children arrive at an understanding that this balanced distance is important for the life and death of living things.

From the responses children also reflect their knowledge about alternation. It will be shown separately in another section after their knowledge about the moon has been introduced.

Table 4.12. Results of the knowledge of the sun

Inductive thinking about using concepts of astronomy in relationship to concepts of death				
(1)Scientific Observation		(2) The effect of a scientific understanding of the sun on children’s view of human life		(3)Arrive at the intrapersonal level in understanding death through astronomical knowledge
Themes	Subthemes	Age 4	Age 4.11 and above	
Characteristics	-Big size(all groups) -Continuity of motion (Li-5.8) -Rotation of planets but not the sun (Math-8.9)	NA		Understanding that the balanced distance between <i>living things</i> and the sun is important for life and death
Distance	-Between planets (all groups) -Using numbers and measures (Mo-6.7, Gu-6.11). -Relationship with time(Ja-8.5)	NA	-Importance of the distance for living things life because - Heating causes death (M0-6.7) - Brightness causes sore eyes (Ca-7.3) - Important for the growth of other living things such as plants (Math-8.9)	
Functions	-Heating.and-Light	NA		
Alternation	Please see the individual table of the theme of alternation (4.14)			

Knowledge of the Moon (KM)

This part shows the results of six questions about the moon, CAQ2 to CAQ6. CAQ8 is found in the section about knowledge of alternation, Table 4.14. The main themes children use to build their knowledge of astronomy are existence, air, temperature, gravity, distance, motion, features and invisibility. The perceived phenomenon of alternation is one of the sub-themes of the moon, therefore it is discussed in a separate table later in this section. Based on scientific observations about the themes and sub-themes of the moon, children are aware that people could visit the moon in a limited way with rocket transport and special suits; but it is impossible to live on it without special equipment. By doubting or understanding that there is no man on the moon, this

could mean that children reached the intrapersonal level of understanding about concepts of life and death. These three stages are found in table (4.13).

Table 4.13. The results of knowledge about the moon

Inductive thinking about using concepts of astronomy in relationship to concepts of death			
Scientific observation of the moon		(2) The effect of a scientific understanding of the moon on children's view of life	(3) Reach the intrapersonal level in understanding death through astronomical knowledge
Themes (Characteristics)	Sub-themes		
Existence	- in the Sky (Ra-4 and Mo-6.7) - in Space (Eu-4, hann-4.11 and Math 8.9)	- People live on earth but impossible to live on the moon. - Possibility for visiting the moon in a limited fashion. - Possibility of visiting the moon, standing on the moon but not living there. - Aliens could live on the moon	Understanding that there is no man on the moon (common story among children)
Air	- No air on the moon		
Temperature	- Cold weather		
Gravity	- No gravity		
Distance	- Big distance between the sun, the moon and the earth. - Using time to explain distance (Lu-6.4, Ju-7.10)	Impossibility of travelling to the moon without specific transport.	
Motion	- Alternation - Motion of the moon (Math-8.9). - Recognise moon phase phenomenon (understanding shapes and the names related to these shapes).	- Please find the individual table of alternation (4.14).	
Features	- Light - Craters - Darkness around the moon - Reflecting light (Math-8.9).	Time of sleeping at night	
Invisibility	- The moon could be hidden behind the clouds or the sun (Lu-6.4 and Ru-8.2)		

Knowledge about Alternation (KA)

Investigating level of knowledge about alternation is one of the questions in this research. However, this theme also often appears within themes and sub-themes of the sun and the moon in space. It is separated from them in another table since it is another dimension. The results are derived from questions **CAQ7** and **CAQ8**.

The data shows that the phenomenon of alternation is part of children's awareness. They are capable of observing this aspect from a young age. It appears that children build abstract concepts in their minds through induction.

Amazingly, a child recognises the sometimes confusing phenomenon of an appearance of the sun and the moon at the same time in the morning. She connects this phenomenon to the factor of time

. . . It just like fades away and then all the brightness come out . . . and then . . . you can see the sun coming and the moon just hide behind the clouds sometimes . . . but sometimes you can see the moon in the morning, because it still shows a wee bit . . . it's quite dark . . . a little bit dark . . . so maybe the sun . . . you can still see the sun and the moon is out . . . and . . . you can just like see little bit . . . you can see the moon just goes down every minute and eventually . . . and you just see all gone away(**Ju-7.10**).

Table 4.14 presents children's observations (sub-themes in the first column) and how they interpret these observations to understand its relationship with their daily life. For example, some children connect this phenomenon with their daily life activities such as sleeping and playing outside (**Raul-4, Ro-6.6**), while other children develop their thinking to human existence on the other side of the world. In addition, a child says that the invisibility of the moon during

the night means that it is dead. She indicates that while she believes in the existence of the moon during the day, the concepts of invisibility and death have a similar meaning in her mind

... I think, while the earth turns round and the sun shines in the other side of the earth . . . so we don't really see . . . em . . . we see the moon is dead . . . so it kind of it's . . . not facing the sun, so we don't ever see it . . . there. Em . . . because I know that one half of the world is night time while the other half is day time, so maybe we don't (!!!) get the sun, we don't see it (Ma-8.7).

The responses show that children arrive at an intrapersonal stage to understand that alternation is based on lots of cognitive concepts such as concepts of existence and non-existence, appearance and disappearance.

Table 4.14. The results of knowledge about alternation

Inductive thinking about using concepts of astronomy in relationship to concepts of death			
(1)Scientific Observation of alternation (Sub-themes)	(2) The effect of alternation on children’s scientific view of human life	(3) Arrive at the intrapersonal level in understanding the concept of alternation	
-Appearance and disappearance of the sun and the moon.(All groups)	-Daily life activities are based on the phenomenon of alternation (Raul-4, Ro-6.6)		
-Day and night are related to the colours of the sun and the moon.(Doug-6)	The entity (sun or moon) is facing the other side of the world.	-A phenomenon includes the concepts of existence and non-existence, appearance and disappearance of two entities (the sun and the moon)	
- Motion of the sun and the moon as up and down causes day and night.			
-Hidden behind the sun, light, clouds or hill (Ru-8.2, Ca-7.3and Lu-6.4).			
-Goes to other countries (li-5.8, Ca-7.3)			
-Goes to the other side of the earth (Gu-6.11).			
-Location of the sun and the moon in relationship to earth (see figure 1)			
-Recognition of the appearance of the moon in the sky during the day with the sun. Relating this phenomenon as a factor of time (Ju-7.10).			
-Understanding the factor of rotation in the alternation phenomenon. (Math-8.9)			
-Invisibility. -Existence of the moon during the day. (Ma-8.7).		-The invisibility of the moon means it is dead. However, it is a belief that the moon exists somewhere else. “we see the moon is dead...”Ma-8.7	The meaning of the concept of non-existence in the environment is the same as the meaning of the concept of death

Knowledge about the Earth (KE)

This part focuses on the results of three questions - **CAQ9**, **CAQ10** and **CAQ11**. Children appear to understand the facts behind the question about Earth. Generally, they reflect their knowledge that the Earth is a big and that it exists in space. This emerges through the main themes of size, distance and features.

Table 4.15 shows the children's understanding of much astronomical information about the Earth which appears in the themes and sub-themes. Interestingly, numerical expression is one of their own ways to express their knowledge of astronomy.

Table 4.15. The results of knowledge of the earth

Astronomical reasoning on the metaphor of earth being a big ball	
Themes	Sub-themes
Size	Using descriptive terms, such as huge planet, round, giant enormous, round and has no corner. Using mathematical numbers in explaining the size of the sun 'thousands and millions times larger' (Math-8.9); and the size of space 'Just miles of space.' (Gu-6.11);
Distance	Using mathematical angles (Ru-8.2) and numbers in explanation, such as 'thousands and millions times larger' (Doug-6); Big distance between the earth, the moon and the sun (Ra-4, Ca-7.3) Information about the cosmos - explosion created earth (Gu-6.11); existence of other planets in space (Ro-6.7); and solar system (Ca-7.3); Awareness of the solar system, satellite (Math-8.9); Idea of weakness of technological function similar to earth such as reception in space (Ja-7.10, Ru-8.5);
Features	Earth is sphere (Gu-6.11, Ja-8.5); Formation of earth (Fin-5, Ca-7.3); People are living inside earth (Eu-6.4 and Ro-6.7) or living on earth;

Knowledge about life in space

Children's idea about life in space can be found in the answers from questions CAQ12 and CAQ13. Similar to other knowledge which children have, they understand three levels about life in space. This appears in the following Table 4.16. They basically use a scientific basis to answer the question about who could live on the moon. They understand that their intrapersonal understanding supports them in sharing this knowledge. For example, due to the children's understanding of the scientific atmosphere of the moon (or in space) they are able to decide who could live on the moon; the man and cheese, astronauts, aliens or no one. They inductively use this astronomical basis to build their intrapersonal view of the relationship between the possibility of a human being living away from earth and the concept of death. Table 4.16 shows that children arrive at the understanding that living in unsuitable environments inevitably causes death.

Table 4.16. The results of children's knowledge about life in space

Inductive thinking on understanding life on the moon				
	(1) Children's view on what it would be like on the moon	(2) Children's scientific understanding about life in space based on scientific phenomena	(3) Children's view on who could live on the moon based on their scientific understanding	(4) Children's intrapersonal view on the relationship between the possibility of living away from earth and the concept of death
(1) Non-scientific themes	-Cheese, cheese shops (Eu-4 and Lu-6.4) Caterpillar, dragon, giraffe (Ra-4)		-Man and cheese (Eu-4 and Se-4)	
Scientific themes	Environment on the moon Dark, aliens, strange (Fin-5) Bumpy (Lu-6.4), stony (Ch-5.10) and rock (Ru-8.2) Cold (Doug-6, Ju-7.10) Colour of the moon Holes (Gu-6.11), Craters (Math-8.9) Signs of first people arrived on the moon (Gu-6.11) A kind of magnet (Fin-7.3) No gravity (Gu-6.11) No air No food (Ma-8.7) It is just a space (Gu-6.11)	People should be provided with air in a ship (Gu-6.11 and Ju-7.10), or oxygen (Fin-7.3). -Space environment is dangerous for humans (Math-8.9)	Astronauts (4.11, Ja-7.10 and Ru-8.2) Aliens (Li-5.8, Ja-8.5 and Mary-8.7) No one (Gu-6.11)	Children doubt the common story of a man on the moon (Daug.-6, Ja-8.5). Children aware that people are unable to live on the moon because they will die. (Gu-6.11 and Ju-7.10, Fin-7.3 and Math.-8.9). Children could accept the notion that aliens could live on space but they do not accept the notion that humans could live on the moon or in space.

Conclusion

Children have a developed knowledge of astronomy; which answers part of the questions of this study. This knowledge comprises interrelated scientific themes and sub-themes about the sun, the moon, alternation, the earth, and life in space. Based on answers from these sub-themes children appear to demonstrate a connection between a human's life and death and astronomical phenomena. Moreover, they are aware that this connection affects not only humans but also all living things. This development basically appears in their ability to think inductively. They have a developed linguistic ability, including numerical expression which supports them enough to explain and answer open-ended questions in greater depth. They recognise the scientific phenomena in the sky and in space, combining their own observations with educational intervention. Through the astronomical themes and sub-themes it seems there is a dimension which reflects that they base their understanding on logical reasons. For example, children understand that there is no man on the moon because no one is able to live on the moon due to the lack of gravity and air. Children also build an intrapersonal view that while it is possible that aliens could exist, it is impossible for people to live away from earth. The unsuitability of phenomena in space makes death inevitable for people. They also show their understanding of abstract concepts such as existence and non-existence, appearance and disappearance. Interestingly, it appears that age is not a factor in their ability to learn about phenomena, because some younger children show more developed ideas than older children.

Reflection of children's drawing

As mentioned in the section of the methodology, drawing is used in the triangulation in order to probe children's thinking of the concept of death and astronomy indirectly. This means I asked children to draw what they know about space in order to encourage them to speak more about their knowledge. Much of the emerging data included information about astronomy and the results below are a confirmation of introducing what children reflect in their drawings and subsequent conversations about the concepts of death and astronomy. Therefore, I focus on their narrative and the themes in their drawing as a motivation of these narratives.

Based on that, their narratives on their drawings about space and its entities enriched the investigation of children's knowledge of astronomy. Children reflect similar observations between their drawings and their answers to questions. They drew happily and reflect imaginations which are similar to their ideas in their interviews. For example, they reflect their scientific understanding of the distance between the earth and the sun - showing how human life would be affected and how the earth would become very cold or very hot. Their comments are divided into two types of drawing. (1) Some children drew the sky, while (2) others drew space. Interestingly, it appears that children who drew the sky locate themselves as standing on the earth. So, they drew the earth including everything on the earth. They then drew a skyline and include everything between these lines. Children who drew space located themselves in space where they could draw the earth itself with space between other planets. Some examples of the drawings are found in Appendix 6. The code for each child's drawing is a drawing number followed by the child's first letters and age such as D(1)**Ra-4**. The following table presents the results of the children's drawings.

Table 4.17. Type of children's knowledge about drawing space

Themes	Type of drawings	
	Drawing Sky (Age of 4,4,4, 5, 5.9, 6.6, 6.7 and 7.3)	Drawing space (Age of 4, 4.11,5.8,5.10,6, 6.4, 6.11, 7.3, 7.10,8.2, 8.5, 8.7 and 8.9)
Drawing	Children draw themselves playing and enjoying the environment of earth and sky; this environment includes the sun, the moon, clouds, birds, aeroplanes, stars; one child draws God and another child draws a man on the moon;	Space includes planets, space shuttles, the earth, stars, the sun and the moon.
Children's reflections emotionally	Drawing the sun with a funny and smiley face	----
Children's reflections scientifically	Their daily life interaction is based on the frequent alternation between the sun and the moon, e.g. playing in park outside.	<ul style="list-style-type: none"> -Children view themselves as part of huge space including the huge distances between planets. -Ability to name planets such as Jupiter, Saturn and Pluto. Moreover, Math-8.9 shows more depth with awareness of names like galaxy and Milky Way. -Awareness about human's interactions with space, such as the notion of a spaceship and aliens. -Awareness about balanced distance between the sun and the earth as it affects human life. e.g. Short distance causes burning. -Understanding the function of the sun such as brightening the day. -Awareness of the stories behind creating the world (Finn-7.3). -Awareness of phenomenon of the moon's phases, (however, there is no scientific explanation)

As can be seen in table 4.17, the themes I focus on are (1) drawings, (2) children's reflection emotionally and (3) children's reflection scientifically. I explain each theme under two types of drawing, (1) drawing sky and (2) drawing space. The children who focus on the sky try to make a relationship between themselves and the sky or the entities in the sky, and reflect it in

interactions during daily life. Children who have a deeper understanding of phenomena in space reflect information about astronomy. This appears at ages 4-8.

The themes found do not rely on the age of the child. It appears that some children at age 4 have scientific knowledge about space, and some children at age 6-7 focus only on the sky and its relationship with the environment on earth.

When children draw the sky or entities in the sky, they usually like to draw the sun emotionally with a smiley face, as if it is communicating with children. But in some drawings their style becomes more serious and without emotion.

Chapter 5

Discussion

Introduction

This chapter focuses on the discussion of the results to answer the questions of the study: the relationship between understanding the concept of death and astronomical knowledge. Based on the findings which are presented in the previous chapter, the discussion states the major findings within three sections. The first section focuses on understanding the concept of death. The second section focuses on knowledge of astronomy. The third section focuses on the final conclusions of the relationship between death and concepts of astronomy.

As this study investigates the concept of death through cognitive thinking, this is explained in two parts. The first part is found under the discussion of the concept of death, which includes linguistic ability, logical reasoning, observation, seriation, universality, classification, existence, non-existence, appearance, disappearance and invisibility. The second part is found under the discussion of the concepts of astronomy, which includes concept of time, concepts of space, distance, features, functions and characteristics.

Section 1

Basis of understanding the concept of death

Cognitive development

Children in this study show a developed cognitive capacity to think logically based on scientific and non-scientific phenomena. This development appears significant; increasing gradually from age 4 until age 9. Children show an understanding of many cognitive skills and concepts which help them to answer open-ended questions about the concept of death and concepts of astronomy.

The cognitive capacity of children that includes a scientific understanding of the biological angle is acceptable. It is a capacity that children use in order to understand the environment. However, this is different with what Freud depicted in his theory. Freud's perspective is that human spends the journey of life with two dual instincts which start from non-existence moving to existing and ending with non-existing, which is to the life he called Nirvana. It is a biological situation that lies underneath the whole journey of human life. However, many psychologists do not accept his theory because they deny the relationship of psychological trauma with a biological base. Instead they claim that trauma during childhood motivates a person to release painful feelings in order to reach an understanding of the point of non-existence. Freud's theory is explained in details in the first chapter of this study. When returning to the point of the scientific knowledge, however, it would be better to start the discussion of this chapter with a clarification that the meaning of biological knowledge and the meaning of non-existence in my study is not similar to Freud's perspective.

This cognitive and scientific angle that I found in children's thinking is different from those who disagreed with Freud's scientific point. As I mentioned, the disagreement was based on denying

the scientific interpretation for psychological trauma. The results from my research reported here show that children have a scientific capacity to interpret the meaning of the concept death.

In regard to the stages of children's development outlined by Piaget, the results of this study show that, despite Piaget's assertion, it is possible for children at the pre-operational level to understand death. This understanding is based on their developed cognitive concepts in this stage. These findings are similar to some other studies, such as Mahon et al. (1999) who claim that understanding the concept of death is not related to the child's age because it could be related to their early experiences of war or learning at school. The findings from my research suggest that educational intervention provide children with a wide range of experiences. Their cognitive ability motivates them to gain knowledge at an early age and, consequently, children have the basis of cognitive concepts. The next sections describe this basis of cognitive development.

(1) The capacity of linguistic ability

Most children in the sample use a developed language to express their understanding. Two children at the age of four answer "*they don't know*". Another makes no comments on some questions but answers fluently for other questions. They may not have a developed linguistic ability that enables them to answer. There is, however, another possible explanation, that they do not have any information to communicate. Some children are faced by a lack of using suitable words. For instance, **Doug-6** uses these words "*. . . as I know . . . just . . . I don't know*" or "*I don't actually know*". *Sometimes I do*". At first glance this might be a lack in his linguistic ability, trying to find the suitable words. Looking at the whole speech again, he is trying to repeat

some parts of the story, but he is also focusing on the idea of physical needs that let the cat calm down.

Because she is really, really tired. Because she is really running so fast and really, really tired . . . she wanted to go to sleep forever but a part of her wanted to stay alive so She just felt a ghost way. I don't actually know. Sometimes I do **(Doug-6)**.

He also explains that Mog became a ghost in order to stay alive. It seems this is not a weakness in his linguistic ability, but it is a sign that he is developing an idea in his mind about death. Children might repeat some simple words in order to confirm their understanding of the idea, such as saying “. . . *really really*” similar to **Ha- 4.11** who says:

Because she really, really tired. She means she really, really sleepy. The thing is (!! she is a little bit tired. Because she really, really tired. She means she really, really sleepy.

There is also a capacity to use a variety of astronomical terms and to choose suitable scientific words to describe their meaning. Examples can be found in **Mo-6.7** and **Gu-6.11** in the section about distance (or in Table 4.15):

She means . . . it kind of like a big ball, but it's a giant, enormous . . . and it's got different parts on it (Dou-6).

I mean it's a sphere. It is a giant sphere (Gu-6.11).

These are some examples which reflect children's language ability. In their answers they often use abstract terms and concepts, whether in talking about death or astronomical phenomena.

They also use these terms in their narratives about their drawing.

Therefore, the findings of the current study are not similar to what Piaget illustrated in his theory on children's linguistic ability. He based his understanding of the concepts of being alive on four stages related to their animism (Piaget, 1951). Also, these findings are not similar to Carey argument that children have insufficient language to understand being alive or the biological concepts of living things (Carey, 1985).

(2) The capacity of logical inferences and reasoning

Children's answers to open-ended questions appear in several levels of reasoning and inferences. Their responses about death and astronomy are valuable in showing these different levels; they appear to be an inductive schema of thinking. The tables in Chapter 4 shows children's abilities to recognize and observe phenomena surrounding them. Within the process of inferences, children show that they are able to infer deductively. This sample shows that inferences are interrelated and woven between inductive and deductive strategies. However, the inductive strategy is a wider organized schema. This is because children show that they include many themes and sub-themes at the same time within the inference process. One of the examples of this combination is found in the discussion of the 'time and irreversibility'; which indicates a mixture of both strategies in children's minds. However, there is no study that mentions this interrelationship in children's thinking, but it is similar to what was found by Dias (1988; 1990); Richard and Sanderson (1999) in that young children are capable of making inferences deductively.

In regard to causation and intentionality (Piaget, 1951; Carey, 1985) both theorists believed that pre-operational stage children do not have a schema of reasoning except intentionality. This is

because they attribute the intentional state to active and inanimate objects. In this schema Piaget al.so indicates that children over-attribute animation to the sun and the moon.

Children in this study, however, reflect an ability to reason logically at an early age (if we name the stage as pre-operational). At the ages 4-5 children don't show animism thinking. Instead they show logical understanding of life phenomena based on rich observations on the environment around them. For example, the Table 4.14 shows that some children base their scientific observations of alternation on their daily life activities in day and night, while other children at the same age develop the same information in their mind to understand that alternation means that either the sun or the moon faces the other side of the world.

Some children use their understanding of numbers to explain deductively that unlimited sleeping means that death is not being asleep, but it is a situation that is controlled by time. Two children in group 2 (**Li-5.8** and **Ma-5.8**) reflect that death is irreversible because the sleeping is limited. They make a scientific connection between the idea of death and the idea of sleeping forever, which shows their understanding of the facts behind the scene of the story. They justify their scientific understanding about the concept of death through numbers. **Ma-5.9** answers with confidence and without any sign of sadness that:

She meant that she wants to sleep forever; I think it means sort of dead . . . because if you sleep forever of course you'll be dead. And of course if you slept for like sleeping for 100 years, will not be sleep for ever, because that will just be sleeping for 100 years, not forever.

This study is similar to other studies that disagree with Carey (1985, 1992) and Piaget (1951), such as the study of Slaughter and Lyons (2003) which explored children's mechanism of

biological causal-explanatory and vitalistic acquisition of understanding the phenomena of life and death, in finding that children have biological knowledge, but it only supports them to understand the phenomenon of life. This contrasts with Carey (1985) who claims (by investigating children's understanding of biology) that children at the age of 4 do not understand biology because of a lack in their reasoning. In my research, however, children answer questions using inferences based on inductive and deductive strategies. Their lack of understanding appears in the relationship between death and the cessation of internal organs functions. But, their inferences show a development with other perspectives in relationship to death: the concept of time.

(3) The capacity of observation

The observations of children include a combination of scientific and non-scientific themes. The scientific themes are the factor of time and biological functions. Moreover, it appears that the factor of time is the basis of the connection between biological knowledge and death and also the basis of feeling emotionally. What is interesting in this sample is that children reflect a high skill of scientific observation from the age of 4. As **Ra-4** states about irreversibility, the meaning for sleeping forever means '*sleeping for all the days*'. His understanding is simply a scientific idea about irreversibility which is based on the length of time. It also appears that children at age 4 are able to recognize the scientific phenomena surrounding them with more depth in understanding the concept of time than in understanding biology, but they do not understand the notion of spiritual life.

Another example is mentioned in the section about alternation. What is surprising is that, in addition to **Ju-7.10's** scientific observation on the existence of the entities in the sky causing day

and night, she mentions her observation of the appearance of the moon and the sun at the same time in the morning sky. This is evidence about observing a phenomenon which is not commonly seen. I believe that for many adults, the appearance of the sun with the moon in the same time of the day is a phenomenon that is eligible to be studied and understood.

In the tables in Chapter 4 there are many examples of scientific (and non-scientific) information which appears under the first and second levels of inferences. The information children gain is mostly correct and it appears that they are able to go beyond animistic thinking (Piaget, 1951). As explained in the Chapter 2, he depicted children's thinking in the pre-operational stage as being shaped by egocentricity and animism. Based on three types of causes they use their own symbolic viewpoints which makes egocentricity control animistic thinking. So, children attribute an intentional state to the active objects in a phenomenon, such as the sun and the moon. Also, their decision are based on contradictory facts or disconnected ideas, which he called *transduction* reasoning. More details and examples are found in Chapter 1 in the section on Piaget. Children in this study show, however, that away from their possible animism thinking, their ability to observe supports their ability to be active and to interact and participate in society. This ability develops individually or through educational intervention. By analysing her own children, in a longitudinal study, Lowe (2007) had an opposite view to Piaget's view about animism and does not see it as a problem. She claims that egocentricity exists in adults as well, as seen in their speaking and acting. She explains that animism is a child's own belief about the concepts of purpose and reason.

(4) The capacity of seriation and universality

Children show awareness that death happens in a sequential process, this means that it is a developed cognitive ability based on observing phenomena and arranging it in order in their minds. This is a capacity of seriation which is a concept and skill. Understanding seriation, represents chronological succession and relies on time (Baker, 1973). I mentioned in the section of the results that two points are recognized: (1) the awareness that death is a phenomenon which happens in a series of steps and (2) the use of verbal language with time phrases to express how death is a series of steps. This points appear in children's responses like **Li-5.8**, **Mo-6.7** and **Ju-7.10**.

Consequently, children in this sample use a developed language including mathematical skills to explain their understanding of the process of death. This appears from a young age. However, sometimes it is necessary to focus on children's reactions and gestures while they answer because this indicates contradictions about what they say. When **Fi-7.3** answers the question of irreversibility, it seems some factors affect these answers, due to the doubt he reflects in what he is saying. Due to the development of his own thinking about death, he may refuse to think about other ideas he might hear, such as understanding that the dead cat could return as a dog.

For instance, **Fi-7.3** assumes that Mog was a cat for a short period of time “. . . *just a wee bit.*” (limitation of time) and then she returned back as a dog. Then **Fi-7.3** changes his sentence immediately from returning as a dog to a ghost. However, his reaction and body gesture reflects his doubt because he is not confident with his answer. He hesitates: “. . . *no . . . weird. . . . she's dead or something . . . and she's like ghost (!! comes), because just a wee bit that she's a cat and she comes to dog . . . no . . . ghost . . . she . . . weird.*” He then put his little fingers on his eyes

to cover them, maybe because of his confusion. It might be that he has heard this idea, but he wasn't convinced. In addition to the several steps he mentions, and some words he uses, it would confirm, however, that he understands that Mog slept and then died, rather than understanding that Mog being asleep means that she is dead. For instance, as he says the word "*then*", it seems that there is a process that happened before death; the sleeping is caused by tiredness and then related to death finally.

Children in this study show a developed understanding of seriation and of universality. **Li-5.8** points out that humans and animals die. There is a clarity (among this sample) of the idea that humans and animals face death at the end of the duration of their life. This seems to show an understanding of universality inevitability based on understanding the concept of seriation. **Li-5.8** relates that the sequence of biological changes in the body is based on developing age and the inevitable stage of lying down and dying. However, her vision focuses on external biological phenomena. This appears in table 4.8 and 4.9. This finding supports the cognitive development of transitive inference (Baker, 1973) based on seriation. But at the same time it could be understood through the pre-operational stage - age 5, which is a finding that it is not comparable to Piaget who indicates that children in the pre-operational stage lack an understanding of seriation and universality due to the lack of understanding of the concept of time. More details about the concept of seriation will be mentioned in the section of the factor of the time (next section).

What is interesting about the children in this sample is that understanding the concept of a time limitation on any entity's life is a reason to understand universality, inevitability and irreversibility. Once again young children's observation in this sample goes against Piaget's

theory that serial order and duration is only part of the concrete-operational stage. Information about seriation in Piaget's theory can be found in the following references (Baker, 1973, White et al., 1978; Speece, 1995).

The finding of this study is the same, therefore, as Hunter and Smith's (2008) finding which showed a significant relationship between children's capacities to grasp the concepts of seriation and conservation and to understand the notion of inevitability in the pre-operational stage.

By using inductive schema which appears from the sequences of their inferences in children's answers they reflect their capacity of observation on much rich information about the universe. Besides their simple biological classification that living things include lots of species, they show an ability to connect these living things with phenomena around and beyond the earth. The inferences they make, which are found in every table in the results section, reflect a valuable capacity to understand the concept of universality and thus I can conclude that Piaget underestimated it in children at the pre-operational stage. Piaget confined his understanding of universality to the concrete-operational stage of understanding personal death and the fact that everybody died inevitably (Nagy, 1948; Speece and Brent, 1992; Speece, 1995). This is explained in Chapter 1. In addition, Piaget examined children's understanding of the sun and the moon as examples to explain the concept of egocentricity and causality, which does not shed light on the sun and the moon as independent knowledge. The findings of this study confirm, therefore, the perspective that children could have knowledge of astronomy, which is a wider area of investigation rather than focusing only on the concept of living things. This finding is not only one to show a perspective that young children have scientific knowledge. I include the finding of this study into the finding that shows that children are able to understand the death of

plants (Nguyen and Gelman, 2002), to make it clear that children are able to think scientifically about the sub-concept of universality.

(5) The capacity of classification

Piaget said that children in the pre-operational stage lack the ability to focus on several categories at the same time (Berk, 2000). In this study, however, children's responses reflect an awareness of different categories of living things and try to give biological information between these living entities, from a young age. **Ha-4.11** responds about drinking milk in the story of Mog:

. . . The kitten, because kittens likes milk; they don't like water like dogs. They don't see Mog because Mog is dead

This capacity appears in the data of each sub-concept including humans/animals facing the same situation of life and death. In non-functionality in group 1, 2 and 5 children compare two living entities - dogs and cats with their food; and also between two cats of different sizes - **Ha-4.11**, **Ma-5.9** and **Ru-8.2**. Moreover, in group 2 and 5 the children **Ma-5.9**, **Ch-5.10**, **Lu-6.4** and **Ru-8.2** show the capacity to make classification between two entities based on the relationship of the body growing and ageing:

. . . Mog is better, because Mog is older than the kitten, and because Mog is getting older legs than the kitten (**Ma-5.9**).

As mentioned in the scientific themes, biological knowledge is based on (1) functioning and (2) classification. Due to cognitive capacity children have to understand differences and similarities, and then children are able to make classification biologically. By using the biological

classification of living things, children show that they do have biological knowledge about phenomena which supports them in understanding life; however, in this study the classification appears due to external functions illustrated in Table 4.4 and Table 4.6. This finding contradicts Carey's argument on children's inability to understand the concept of life from biological functions, because as she argues their thinking is a naive framework of psychology (Carey, 1985; Slaughter and Lyons, 2003). According to Carey misinterpretation of the concept of death is based on children's lack of understanding of biological status (Carey, 1985; Slaughter, 2005).

There are many studies claiming the opposite of Carey's argument, however and such researchers think that the ability of young children is strong enough to understand the concept of death in relationship to biology (Solomon and Cassimatis, 1999; Springer and Keil, 1989; Keil, 1992; Hatano, 1994; Au and Romo, 1999; Springer, 1995; Kalish, 1996; Jaakkola and Slaughter, 2002). My findings also demonstrate a slightly different view from their claim that understanding concept of death is based on understanding the cessation of the functions of internal organs. Based on this study, children in this sample reflect a capacity to focus on the external biological phenomena affecting life and death. Children explain their understanding of life and death through the concept of time, which still remains under the investigation of biological knowledge.

(6) The concepts of existence, non-existence, appearance, disappearance and invisibility

By their inferences in their answers, children of the sample of this study show that they have a chain of interrelated abstract concepts which shapes the meaning of the concept of death. With

the concept of non-existence, children understand that Mog is non-existent based on two views, the activity of biological functions and the existence of spiritual life. Not one of the children in any group of the sample mentions the cessation of internal of organ functions. From the age of 4 to 8 they show their understanding of the factor of time in regard to the irreversibility of death. Moreover, the factor of time takes a developed shape gradually among children in the sample. Until the age of 8, children focus on the weakness of external behaviours of the body related to old age. After death the body retrieves health far away from earth. In all, it appears that understanding several perspectives about the factor of time creates an abstract concept such as the irreversibility of death; and through death, the dead become invisible, disappearing from real environments; they are not-existent on earth, because they travel to exist healthily faraway. For example, **Li-5.8** says about who is dead and who is alive:

Not Mog . . . because he is dead, but his spirit is still there . . . the kitten.

Her answer on who will drink the milk is:

. . . the kitten . . . still little bit as milk. But Mog drink(ed) it as well (smiling).

How?

When they are close there and no one was seen him because he is invisible. He would creep near the milk bowl and lick it all up

These answers illustrate the ability of the child to describe difficult differences between these abstract concepts. For example, she begins her answer by confirming that the cat that will drink the milk is *not Mog*; the not-existent cat. She repeats her confirmation at the end of her answer in that the cat that will drink the milk is the little kitten. But the child also understands that Mog, who is *invisible*, is able to drink, move and act normally. This indicates that **Li-5.8** understands that while Rumpus the little kitten exists, Mog doesn't exist physically. Mog is invisible but able

to do any action biologically such as creeping near the milk and licking. She is the same child who says

She was kind . . . it's too old to stay alive and she was very tired because that's like my grandpa . . . because when cats and dogs get very old.... their bodies aren't that healthy, so they just want to sleep. . . . and when they want to go to sleep, for a long time, that means they are dead . . . and their spirit comes out from their bodies . . . goes to the sun and keeps them healthy and their bodies goes up to heaven and spirit goes up the sun and then travels to heaven.

This child understands that dead people have time limitations, whether in their bodies or spirits, for living on earth. This limited period obliges them to leave the earth and exist somewhere else, which she calls heaven. Consequently, the clear idea in the child's mind is that the dead cat will not come back again at all, even if this cat has a biological reaction when she is invisible. This could mean that this child does not imply any idea of cessation of internal organs function while she is thinking about the concept of death. The child shows her understanding of non-functionality, that it is a disappearance of any physical reaction while becoming invisible to other people. **Ma-(5.9)** also focuses on a biological reason in deciding who will drink the milk. She says

Kitten, because they thought it is thirsty, and kitten actually stood in the milk instead of drinking outside . . . and . . . they used Mog's pot.

And what about Mog?

She is thinking. She might be should getting a different ball I think. That's only I can tell about that.

In describing the situation of both cats, the **Ma5.9** indicates that Mog is able to think and react with the little kitten. The child thinks that the cat who used to think is still active in Mog, even in

not-existence. This is the same child who understands the irreversibility of the death by understanding the concept of forever using numbers.

Hence, **Li-5.8** and **Ma-5.9** have the same understanding that Mog is dead and will not revert back to life even if she is able to react biologically and invisibly.

In all the tables in Chapter 4 at the third level children's ability to observe and infer supports them to arrive at an understanding of this chain of abstract concepts. This shows children's cognitive capacity to build an abstract understanding about the concept of death. It appears that children understand that death is irreversible, inevitable, universal and non-functional while invisible and non-existent in reality.

This vision appears to connect the concept of death with the notion of a location faraway from earth, distant in space and time, as a dual relationship. By the same chain of cognitive concepts (of existence, non-existence, appearance and disappearance), children in this study show a scientific capacity to understand that no living thing is able to return back to life and also cannot live in space, because it is dead.

This duality is supported by the third level of the inductive schema of thinking as well as appearing in the concepts of astronomy. In all tables of the concept of astronomy, children's responses arrive – through logical inferences – at an understanding of two main astronomical ideas: (1) Understanding that the location of the earth and the distance between living things and the sun are important phenomena which affect life and death; (2) Understanding the phenomena of space and doubting the story of a man on the moon, thereby understanding that it is impossible for a man to live in space. That is why children could accept the notion of aliens living in space, but they do not accept the notion of humans living on the moon or space.

In regard to the questions of astronomy, children in this study use the chain of abstract concepts as a basis for their scientific information about the phenomena of space. In the first level of the inductive schema, children indicate an awareness of scientific information - themes like gravity, air and distance because they understand existence, non-existence and invisibility. This guides them in building their knowledge of astronomy as well as extending this knowledge to life and death. In these inferences, children use the chain of abstract concepts and the concepts of astronomy to build a new vision about the concept of death. This shows an improvement in their understanding of death deductively.

From another angle, a child at the age of 8.7 has the ability to connect both concepts in her mind - that the concept of non-existence of one thing in the environment is the same as the meaning of death. However, this is the only response which mentions this relationship directly. **Ma-8.7** says:

...I think, while the earth turns round and the sun shines in the other side of the earth . . . so we don't really see . . . we see the moon is dead . . . so it kind of it's . . . it . . . not facing the sun . . . so we don't ever see it . . . there . . . because I know that one half of the world is night time while the other half is day time.

This finding supports the argument of this study about a children's depth of scientific awareness about death. They show their awareness of the changed situation from 'people exist' to 'people become non-existent'. This awareness is based on the cognitive concepts of invisibility, disappearance, and hidden phenomena. Many other studies similarly indicate children's understanding of these concepts like an invisible substance disappearing in liquid (Berk, 2000), or children's ability to distinguish between real physical objects and mentally represented objects

(Carey, 1988). However, these studies are different from Carey (1992) who deny that children are able to understand those cognitive concepts.

Thus by using a different perspective, this study focuses on the idea that hidden phenomena could be connected to the concept of existence. Therefore, knowledge of the sun and the moon can be used to investigate children's thinking in Piaget's theory and other studies (Cameron, 2008; Vosniadou and Brewer, 2003). However, the visions are different. In Piaget's vision, cognitive development about the sun and the moon is related to animism. In this study, there is no mention of these stages. Instead, children reason about the sun, the moon and alternation from logical and scientific observations. This is similar to other studies such as Vosniadou and Brewer (1994) who analyse children's explanations of appearance, disappearance and hidden phenomena. However, there is a confusion in some studies whether children have the capacity to understand the phenomena of astronomy. Yet this study finds that children's knowledge of astronomy is successfully used to understand the concept of death.

(7) The concept of spirit

In the sample of this study, spiritual life (SL) is one of the categories which children use inductively to build their understanding of death. The knowledge of spiritual life is similar in children's minds under each sub-concept of death. This knowledge includes (1) the notion of spirit, (2) a notion of heaven, (3) an alternative to spirit, (4) separation between spirit and body, (5) a limitation of time for spirits living on earth and the assumption that they transfer to heaven, (6) that the dead are invisible and (7) this invisibility affects the feelings of the dead in that no one can see them.

Similar to the lack of understanding cessation of internal organ function, none of the children at the age of 4 understand spiritual life compared to the older children. Consequently they show no understanding of the relationship between spiritual life, biological knowledge and death (Table 4.9). This may mean that they think Mog is alive.

In their inferences, lots of children believe that the dead disappear from the earth, they transfer to and exist in heaven, which is a long distance from the earth. This existence in heaven is not only spiritual but also physical. This is a reflection of interrelated concepts related to guided intervention and individual development. Some children use the words “my family” in their explanations. It may reflect the children’s cultural background. **Mo-6.7** says:

Some people in my family said that it comes back down as shadow follows you
People in my family said the spirit sometimes stay down . . . and they sometimes don’t want to go back up.

Other children in this sample say that the ghost should leave the earth and stay at heaven. **Ma-8.7** says:

Well Mog is going to the sun . . . This is in the back of the book. And she is going to heaven . . . I think

G/ Why do you think that?

Well, she is dead . . . well is not entirely dead . . . she is dying . . . and doesn’t have enough time . . . her ghost can’t stay alive forever . . . so she has to go to heaven because somewhere . . . not on the earth she can stay.

G/you said that she is not entirely dead . . . what do you mean?

I mean that a bit of her was left alive . . . and that’s what we can see in the pictures”.

Li-5.9 says “*. . . their bodies goes up to the heaven and spirit goes up to the sun and then travel to heaven*”. But in **Ma-8.9’s** answer she says that the ghost dies and can’t stay alive forever. In

her mind, travelling away from the earth is the next stage after death. She understands that death is inevitable. She understands that Mog and other dead people are unable to control their stay on earth. They definitely have to leave to go somewhere else, spiritually. Later, in another question for **Ma-8.7** about what happens after we die, she explains what happens physically to dead people.

Well we get buried in the ground and then . . .and I think our soul goes up to heaven, I always think you have another life in heaven and our souls like us and forms a shape of us and everything . . . And you live in another life in heaven . . . and heaven as big as wants to be souls as many people can be there.

G/Why?

Well . . .because . . . it just . . . I think you know . . . you don't . . . you don't want to stay in the ground forever . . . and it just seems to me that what happens . . . and I don't want to die . . .but when I do . . . I will find out what will happen after you die (**Ma-8.7**).

Some of her understanding of death is related to cultural background. However, another part of this understanding is related to her own thinking, cognitively. From her response there are two things to notice about her scientific development:

- (1) She does not have any idea about cessation of internal organs functions or decomposing. Otherwise, the body not wanting to stay in the grave and the idea of travelling to heaven would be changed.
- (2) She has an understanding of limitation of time which she uses to develop her understanding of life and death as existence or non-existence.

This shows that her cognitive and scientific development is dependent on time as the basis for understanding the concept of death. The lack of biological knowledge prevents those children from understanding the cessation of internal organs functions and decomposition as well as understanding the meaning of a spirit. Cessation is an abstract idea and the spirit is a more

difficult notion than cessation. In other words, based on a lack of biological knowledge, if it is difficult to understand cessation; it would be even more difficult to understand the notion of a spirit.

This lack in biological understanding does not mean that the child (Ma-8.7) does not understand the universality and inevitability, because she says “. . . . *And I don't want to die, but when I do*” which means she understands personal death and that it is unavoidable”.

In this study the children show the cognitive capacity to understand non-existence, disappearance and invisibility support them inductively and deductively to create a vision about spiritual life. They relate details about (1)the impossibility for dead people to stay on earth (based on concepts of distance and time); (2) the impossibility of coming back to the life on earth and (3) the vision that dead people are not-existent in reality, but exist spiritually (and physically) somewhere else. Two issues generally affect the vision of death as irreversible. These issues are the medical reversible and non-corporeal continuation. This assumes that people or children could change their vision from understanding that death is irreversible into reversible. The data support the argument made initially by this study that the linearity of time avoids a confused vision. Linearity is a fact supporting the impossibility of returning to a previous time and avoiding death in the future. Speece (1995) recommends putting greater focus on methodology to investigate children's understanding of death. This study confirms the importance of investigating children's reasoning through both inductive and deductive strategies because it appears that children hold many of visions. These many visions could guide investigators toward various perspectives about death. Besides what is found in metaphysics (Harris, 2006; Barrett et al., 2005) this study confirms that children have an ability to separate their understanding of the spiritual life and

scientific knowledge. This confirmation is based on both strategies of thinking which children use.

(8) The concept of life and the knowledge of biology

Looking back to all themes of biological knowledge in the results about death, there is a relationship between children's understanding of the phenomenon of life and their understanding of biological needs and characteristics. Children in this study know from the beginning of the story that Mog is dead. Their responses show two stages in understanding the concept of death.

1. Understanding death as sleeping for a long time
2. Understanding death as non-existence; this is because children understand that a dead (person or pet) still has active biological functions or characteristics and it is only non-existent physically - it is invisible, disappears from reality and exists spiritually.

Despite these advanced levels of understanding in terms of cognition, children have a lack of understanding the cessation of internal organs functions. This doesn't mean a lack of understanding about all perspectives of children's biological development as they have knowledge of classification, biological characteristics and external functions. Moreover, it appears that some children expand their biological observation to include ecological vision, inductively. For example in Table 4.6, **Gu-6.11** responds that life and death are natural phenomena and **Ma-8.7** states that the increasing numbers in the population on earth needs reduction (Table 4.9). Deductively, they use these ecological phenomena to infer that death should happen inevitably, universally and irreversibly. In addition to their ability to classify biological characteristics between entities, they are able to see the serial changes in the human body based on ageing (Table 4.6).

Consequently, biological knowledge has not yet reached the stage of cessation, which helps children gain an understanding of physically disappearing and performing invisibly whether spiritual or physical. This means that they do not understand non-functionality as being biological. Instead, they understand the concept of death from the point of view of unreality, invisibility and disappearance from life.

By the age of 6 and until the age of 8 some children in this study reject the idea of physical needs in a dead cat. However, for them, the reason is related to the spiritual situation of Mog which prevents it from drinking or tasting (Table.4.4). No child in this sample up to the age of 8.9 mentions anything about Mog's internal organs. Biologically, the children compare Mog and Rumpus in their ability to communicate. All the children focus on the notion of Mog's disappearance from reality.

Interestingly, the children's ability to infer and reason inductively and deductively supports them in using their biological knowledge and their astronomical knowledge in relationship to death. Under astronomical knowledge, children show that they have basic knowledge about the sun, the moon, the earth, alternation and space (Tables.4.11-4.15). This understanding helps them think of people's ability and their possibility of leaving earth to live in space on the moon. It is a dual inference between biology and astronomy. They infer deductively that the distance between the earth and the sun causes life and death. **Mo.6.7** says this about the sun:

She means that we are not at all close to it and it is a few thousand miles away. And . . . if it touches you, you could just die because it is so warm and it's really made from fire.

Also, distance affects the growth of all living things as Math-8.9 speculates:

It is not close to us . . . at all . . . if it was too close we die . . . burned up or something . . . because so hot and it also helps the trees and stuff to grow as well.”

Based on their scientific observations of the moon (Table 4.15) they develop inductively and deductively that it is impossible for living things to live on the moon, because they will die. This confirms scientifically to them as a third (developed) level of inferences that there is no *man on the moon*.

Relationship between non-functionality and spirituality

All children in this study relate their answers to the alive cat. In the previous section, it was mentioned that children give biological reasons about life, but not the other way round. Also, at the age of 4 they do not reflect awareness about spiritual life. The notion of spiritual life gains children’s attention (in this study) from the age of 4.11 (Table.4.9).

1. Children believe that biological functions are active after death
2. They imply a notion of spiritual life at their justification (rather than the cessation of internal organs functions) about the afterlife.

It seems that the developed concept of invisibility in children’s mind motivated them to make some connection between the knowledge of biology and about spirituality. For example, based on the understanding of the cognitive concept of invisibility and the lack of understanding the concept of cessation of internal organs functions, two stages portray a relationship between understanding biology and spiritual life:

1. Children appear to understand that the dead (person or pet) is able to react physically and spiritually though invisibly. This is probably because children think that death has biological functions, although the book ‘Mog’ may have influenced them unduly in this way;

2. Children understand that the dead are able to react only spiritually and invisibly. This is because they start to doubt biological function in death due to the spiritual situation. Examples of this thinking are found in **Ro-6.6**, **Gu-6.11** and **Math-8.9**. More explanation on the non-functionality and spirituality are found in Tables 4.3 and 4.4.

The development in these stages in the children in this sample could be justified by the ambiguity of both concepts to them. Whether they manage (or not) to understand the notion of burial (**Ma-8.9**) and the reality of death, it is very difficult for the imagination to create a clear vision about each of these concepts. Biologically, children need in-depth instructions to teach and to learn what could happen either in cessation of the heart and brain or in decomposition. Therefore, with starting to reject the notion of active biological function after death motivated children in this study to gain the faith of spirit, which may be create a feeling of confidence that releases sadness.

To create a clear vision of the concept of death means taking complicated steps ranging from observations to creative thinking strategies. The study of Harris et al. (1996), which investigates children's understanding of science and religion, focuses on understanding abstract concepts (God, spirit, brain, shapes of the earth and the function of hidden organs). Their investigation sheds light on the depth of children's ability to thinking carefully and logically to gain or ignore information (or testimony). It seems that children keep moving between using first-hand experiences, educational intervention, visual pictures and verbal explanation about phenomena. They then become able to analyse their pre-existing intuitions and generalize them to a new idea. Harris et al. (2006) use an example about the functions of the brain where children listen and then they build their own knowledge about various mental processes.

Therefore, the results of this current study support children's abilities to deal cognitively with all information, even abstract concepts such as things invisible or hidden. It is a confirmation of children's cognitive abilities to understand phenomena from several angles. This supports what this study is arguing - that there are dual inferences between biology and astronomy. This next section shows the discussion about children's knowledge of astronomy.

Section 2

Knowledge of Astronomy

Introduction

Between supporters and opponents on whether children have integrated or fragmented ideas about astronomy, the outcomes of this study demonstrate alignment similar to supporters' views. Children's responses reflect that their observations in astronomy are based on a developed stage of cognitive thinking. This reflection appears in their talking about phenomena in space, their relationships with the environment around them, what these mean to them and how they understand astronomical concepts. Therefore, this study shows that children have interrelated ideas about astronomy which are similar to those in the study of Vosniadou and Brewer (1994, 2003 and 2005). In addition, children in this sample reflect an ability to structure their thinking logically by using inductive and deductive strategies. This section thus discusses the concepts of astronomy that they use which can also show how they manage to understand the phenomena of life and death.

In Chapter 4, the results are organized in tables to show that the same structure of thinking appears in three sequenced levels about every theme of astronomical knowledge in relation to death: the sun, the moon, the earth, alternation and life in space. This section introduces, therefore, a discussion of the results through the similarities in thinking about cognitive and astronomical concepts with understanding of the concept of death. The structure of children's thinking can be found in the section labelled logical inferences and reasoning. The following sections discuss these concepts.

(1) The concept of time (CT)

The factor of time (FT) is one of the main themes found in this study among children's responses. As this confirms what I argue that each sub-concept of death is affected by the duration and life span of the entity. This finding in children's responses indicates that they understand the four sub-concepts of death. The concept of time is not only found under the science of astronomy, but also under the concept of death in regard to the distance affecting communication between dead and alive and the ability of living things to survive death.

From the age of 4 to 8 children in this study show their understanding of the effect of the factor of time on the irreversibility of death in that the dead will not come back to life. Moreover, understanding the factor of time was shown to develop gradually among the groups in the sample starting by an understanding of (1) a long time sleeping, (2) the definition of the term of 'forever' as uncountable time and (3) understanding the concept of duration of time. This understanding about time, which children rely on, is used to build their knowledge on how time affects the phenomena of life and death. As the tables in Chapter 4 illustrate, children are able to give deep explanations of time (and death) in a scientific way.

The effect of the factor of time on each sub-concept is discussed below.

- Time and irreversibility

As seen from Table 4.1, children understand some perspectives and connect the concept of death with time; this often appears in the responses as a direct scientific justification. In their explanation of the meaning of 'sleeping forever', the sub-themes present a scientific vision supporting the facts behind the scenes of the story. The understanding improves scientifically from the notion of sleeping 'for all the days' (**Ra-4**), into the notion that this length is not normal

sleeping (all other responses). However, both visions are an understanding that death is irreversible. For the youngest children, the simple explanation about death being irreversible appears as unlimited sleeping. Also, **Li-5.6** describes a similar scientific vision with an unlimited time of sleeping; however she knows that the cat is dead. In addition, she answers the question with more interrelated and complicated aspects, such as the limited lifespan of pets or humans and the effect of illness. **Li-5.6** says:

She was . . . kind . . . it's too old to stay alive and she was very tired because that's like my grandpa . . . because when cats and dogs get very old . . . their bodies aren't that health(y), so they just want to sleep. That's thing still . . . and when they want to go to sleep, for a long time, that means they are dead . . . and their spirit comes out from their bodies . . . goes to the sun and keeps them healthy and their bodies goes up to heaven and spirit goes up the sun and then travels to heaven.

It is probable that she relates (deductively) old age to the idea of reaching an end, because no one can live a very long time and lifespan is limited, and understands that death is inevitable and irreversible. The reason for death is to transfer a pet or a person to another stage and not to remain on Earth. In addition, it may be clear in her mind that the sun is not a place for dead people to stay. This idea is probably amended by her understanding of scientific information about the sun, while her lack in understanding the ideas of cessation or decomposition leads her to accept the idea of travelling to heaven. Again, however, it cannot be ruled out that these conclusions may have been made on the basis of what was in the books, rather than solely on her deductive capability.

Other children in their scientific justification use numbers to explain their understanding that the concept of forever is beyond limitation of numbers because it means death. One of the examples

is **Ma-5.9**. But **Ju-7.10** has a greater depth of understanding about the limitation of time, not only about individual age, but also about life itself. **Ju-7.10** says:

She means like she sleep for a very . . . well time . . . and She'll go to sleep and she won't wake up . . . it depends how old you are and how long life is.

This response reflects an awareness of the idea of duration of time, whether in individual life or in the period of the life itself. The child is aware of the impossibility of the cat waking up during the whole period. 'Individual life' and 'the period of the life' itself are two expressions mentioned under the age of 7, by many children.

There is a similarity in children's responses in group 5 in this study (8-9 year olds). Their reasoning that the cat will sleep forever is due to its death and that it will definitely not wake up again. This is described by using the sentences "*death is irreversible*" and "*the long period of death*". By the age of 5, children answer the question with lots of reasons and stories surrounding the idea of death. However, it is different for children at age 8, (who have similar responses) that the cat (and everybody) is dead and will not wake up again. For example,

She will sleep forever because she is dead (Ru-8.2).

She would die, she's going to die, and she was sleep forever where she dies, so where she dies she might sleeping? (Ja-8.5).

She means that's never wake up because she is dead . . . when you die you never wake up (Math-8.9)

Children tend to think of one direct (and deductive) reason which is the death of the cat. Moreover, in the response of **Ma-8.7** she alludes to the long duration of death and it is the same time for sleeping.

She thought she was going to die . . . for age while she is sleeping. She will never wake up.

Inductively, the themes of (1) biological functions, (2) spiritual life and (3) emotion are thus shown to be based on the factor of time in children's minds in this study. In emotion, their responses reflect a feeling of sadness that is based on a duality of understanding between death and the factor of time. This means that children could feel sad because they believe that when people or pet (they know) will die in a moment in the future it is impossible to see them again. Believing in the effect of the phenomenon of time on the phenomenon of death reflects their understanding of not only irreversibility, but also inevitability.

The children in this study thus indicate that time is one of the factors that creates a meaning for death. Therefore, children's visions show that they understand that dead pets or people never come back again, which means they understand death is universal, inevitable and irreversible. By this ability of logical and scientific inferences they observe the phenomenon of sleeping forever. Their responses reflect their ability to create developed stages of cognition that death is irreversible (Table 4.1 and 4.2). It appears, therefore, the sequence of inferences children make in this sample show an acceleration in these inferences, deductively and inductively; which reflects a developed cognitive and scientific dimension of understanding of the concept of death.

- **Time and non-functionality**

Table 4.4 indicates, therefore, that the factor of time is one of the areas of scientific knowledge which children use inductively to answer how they understand non-functionality in death. Based on the capacity of classification, children show that their comparison between the two cats (about

drinking or jumping) is based on their understanding of the factor of age; the older cat is better at doing the task physically. **Ma-5.9** initially compares the two cats, however she doubts something. She says:

I think Mog is better, because Mog is older than the kitten, and because Mog is getting older legs than the kitten. I am not quite sure which one is.

She knows that it is not possible for Mog to come since she is dead. However, she compares the cats biologically. Her doubts mean that her biological knowledge is starting to develop, not as biological information, but in understanding the relationship between the dead cat and biology. The idea that Mog is drinking and jumping may be unclear; that is why she says “I am not quite sure which one is” better at jumping. It appears that her vision of functioning is divided. This, I can conclude, is because some children’s responses focus on the need to be alive for functions to work, yet they don’t know biological reasons for death. This is different than Carey’s illustration (Carey, 1985) that young children do not have a coherent understanding of how biological phenomena relate to living things. It is in contrast also with Carey (1985) who said that children before 10 are unable to differentiate biologically between two living entities and unable to predict and explain the behaviours of these entities (Slaughter and Lyons, 3003) whereas I found that children in my study showed an ability to make this biological comparison between entities. But at the same time I found that these children do not use these biological knowledge to express their understanding of entities’ death. Children’s explanations reflect an understanding of a relationship between these entities’ lifespan and it ages with the duration of time, which introduces their focus on the subject of the existence and non-existence of these entities.

In the example of **Ju-7.10**, for example, she reflects an understanding that death is irreversible during the time of life. This means that the dead (pets or people) are not existent in life. She explains her understanding that biological needs are important during life. So, she shows that the dead could feel hungry, which means that she does not think about cessation, due to her naïve idea of biology related to death. Therefore, **Ju-7.10** has (as some other children) a fragmented idea of non-functionality because it seems that she understands that Mog exists biologically. In that way, my study is different from the studies which argue Carey's illustration that they find young children are able to understand life and death based on biological framework (Slaughter and Lyons, 2003) [see the section of contemporary perspective on children's knowledge of biology- Chapter 1].

- **Time and universality and inevitability**

In Tables 4.6 and 4.8 children in this study show they understand the factors of age, duration and limitation of time relate to the factor of time and external biological functions. They use the factor of time (and numbers) in their justifications about life and death as a basis for biological knowledge about humans and animals. **Ro-6.6** has a scientific view, for example, that is simple and funny. He tries to explain that the cat is too old and it seems that there are no more chances for Mog to live longer. He says

She is too old, and maybe she lived like ten . . . and she's very, very old and they had her for very long time. Like . . . if it was born in 2000 and this was 3000 century.

Responses are thus shown to be inductively developed to make a relationship between the concept of death and this factor of time. Each group shows that inevitably the cat (or person) had to leave; basically due to old age or limitation of time. Children serially talk about the

concepts of *time before* and *time after*. Table 4.8 shows that children understand the concept of linear time where they recognize that time and life are linear and that all people will die. For example, **Ro-6.6** and **Gu-6.11** say:

[Mog goes] To the sun, and it can't stay at the house for quite long, because he is a ghost . . . because people don't . . . ghost don't really stay in our centre. They are stay in heaven or hell . . . if bad people do bad things. That's all I can tell you (**Ro-6.6**).

Emm . . . heaven because she is dead.

G/ Why is she going?

Well everyone has to go heaven some day because you born and you live and you die.

G/Can you tell me why we have to die?

It just one of the nature decisions because you get quite old and then (**Gu-6.11**).

So these views that all people die reflect an understanding of universality and include a scientific idea. These responses thus demonstrate integrated meanings between universality and inevitability, with children understanding that all people and animals die and do not have the ability to avoid death. This means the children in this study appear to understand that death is universal and inevitable.

1. Understanding the meaning of limitation of time is a basis for children's understanding that *everyone* will leave the earth someday and will stay in heaven. In the responses, children's ideas about people (or ghost as **RO-6.6** differentiates) who have *already* died is that their ghosts (as they express it) are unable to stay long on earth because of the limitation of their time. Apart from the notion of spirit, children are aware of a scientific side as the effect of time: "*she can't stay at the house for quite long*".
2. Interestingly, however, children know that Mog is dead tired—in the very beginning scene—**Gu-6.11** states the reason for Mog's death is not an illness. Instead, his view is that "*everyone has to go*", "*it is just one of the nature decisions because you get quite old and then*." So, he understands that one of the phenomena of nature is the life span of (all) entities, and that they should end by getting quite old.
3. Moreover, the response of **Gu-6.11** reflects a developed seriation skill ". . . well, *everyone has to go heaven some day because you are born and you live and you die*". Cognitively, he is able to apply this skill to understanding an abstract idea about death. To be born, to live and to die is a view which reflects the ability of the child to recognise an abstract meaning of the lifecycle. It seems that this implication is based on a scientific

understanding such as understanding that time is limited and is linear. At the same time, the focus on existence in heaven could mean that the child(ren) use their biological knowledge to understand or to express their understanding of life, not their understanding of cessation or death.

4. However, in this study children talk about Mog; they reflect an understanding of the concept of death for people and animals, but nothing in the responses turns up with an idea that plants die. Their scientific responses as to whether everyone dies related to the idea of limitation of time, could mean that they understand universality.

Children at the age of 8 say, however, that they know that the story is telling them that Mog is going to the sun, but they mention that she is going to another place far away from the earth. Thus they try to use their imagination to locate dead people (or pets) in a place far away from the earth. However, they are aware that the factor of time, but not cessation, affects lifespan and causes death inevitably. **Ma-8.7** says

Em . . . well Mog is going to the sun . . . this is in the back of the book. And she is going to heaven . . . I think.

G/ Why do you think that?

Well . . . she is dead . . . well is not entirely dead . . . she is dying . . . and doesn't have enough time . . . her ghost can't stay alive forever . . . so she has to go to heaven because somewhere . . . not on the earth she can stay.

G/you said that she is not entirely dead . . . what do you mean?

I mean that a bit of her was left alive . . . and that's what we can see in the pictures.

G/Do you think it is true?

Yes

G/How?

Because I just . . . really . . . believe that (**Ma-8.7**).

Similar to other children, who usually mentioned spirit in their answers about death, many children in this sample say that a ghost leaves earth and stays in heaven, with this corresponding to the findings of other research (e.g. Anthony, 1939; Candy-Gibbs et al., 1984-1985; Kenyon, 2001). For example, **Li-5.9** says “. . . *their bodies goes up to the heaven and spirit goes up to the*

sun and then travel to heaven". **Ma-8.9** answers that a ghost dies and can't stay alive forever. In her mind, travelling away from the earth is the next stage after death. She says:

Her ghost can't stay alive forever . . . so she has to go to heaven because somewhere . . . not on the earth she can stay.

This response shows that the child understands that death is inevitable. She understands also that Mog (or) dead people are unable to control their staying on earth. In her view they definitely have to leave to go somewhere else, spiritually. Later, in another question for **Ma-8.7** about what will happen after we die she explains what happens to people physically:

Well we get buried in the ground and then . . . and I think our soul goes up to heaven, I always think you (??) another life in heaven and our souls like us and forms a shape of us and everything . . . and you live in another life in heaven . . . and heaven as big as wants to be souls as many people can be there.

G/Why?

Well . . . because . . . you don't . . . you don't want to stay in the ground forever . . . and it just seems to me that what happens . . . and I don't want to die . . . But when I do, I will find out what will happen after you die.

It seems, therefore, that some of her understanding of the concept of death may be related to stories she heard. However, another part of this understanding is related to her own thinking which is related to her cognitive development. This is because from focusing on her response above, it is also possible that two things appear in her scientific development:

1. She does not have any idea about cessation of internal organ functions or decomposition; she refuses to accept the idea that the body stays underground and accepts the idea of travelling to heaven.
2. She has an understanding of the idea of limitation of time which she builds through her understanding of life and death as existing or not-existing.

This could show us that in (her) cognitive and scientific development, understanding the concept of time is a first step to understanding the concept of death. This is because it seems that in this study children's knowledge of biology is naïve and prevent them from understanding either cessation or decomposition or the meaning of the spirit. This is because all concepts are abstract. Consequently I conclude that a lack in understanding some biological points does not mean a lack in understanding universality inevitability, because she says "*...and I don't want to die . . . but when I do*", which means she understands a personal death that it is unavoidable.

- Time and emotion

As mentioned in the sub-theme of emotion, some children as young as 4 do not show any feeling of sadness about Mog's death as some (older) children do. At this young age, they understand that Mog is just sleeping for long time. Once children start to look at this sleep as an unusual phenomenon, as the length of time affects communication, the sadness is prompted. From ability to inability, existence to non-existence and from the notion of sleeping into the meaning of death results in them feeling sad. Children show that their feeling of sadness about death is unavoidable and is based on their ability to understand time, which guides them to understand that by end of duration of time people are unable to control their staying in their environment and have to leave. So, it seems it is a cognitive basis about the concept of time. Children in this sample introduce it in order to express their understanding about the concept of death. This basis includes (1) understanding the moment when Mog (or a human) is unable to choose whether to stay or to leave, (2) understanding the length of distance and time of no longer seeing dead people and animals and (3) understanding the concepts of *time before* and *time after*. The

responses of the children reflect that they have an awareness of time starting with age 4 and, seemingly, much sooner than the awareness of cessation of internal organ functions. Time, it appears, lets younger children in this study think that Mog is only sleeping for a long time, but prompts older children to understand that death is irreversible and inevitable. It seems, therefore, that their psychological expressions of sadness are based on both linguistic and scientific development. This basis of understanding the four sub-concepts of death are thus affected by understanding of concept of time, confirming the cognitive capacity that the concept of time is understood at an early age.

The results in this study are similar to Hornblum's (1987) results – as appears in Speece and Brent (1984) - which showed that children in the pre-operational stage can understand irreversibility. However the results from this study contradict Hornblum's assumption that pre-operational children do not understand that the concept of time is linear. Instead this study confirms the meaning of sleeping forever and death being irreversible because time is linear even for children as young as age 4.

The factor of time is thus a very important path in children's understanding and is a combination of several perspectives in the data. This study challenges Piaget's theory, therefore, which suggested a lack of cognitive thinking in the pre-operational stage to understand irreversibility. This study also differs from other studies which claim that children in the early years think that dead people come back to life again (White et al., 1978; Hunter and Smith, 2008). However the study reflects the same conclusions as Koocher (1973) who claim that children in pre-operational stages are able to understand irreversibility.

By understanding this dimension of the concept of time it appears that children in this sample reflect a different vision of death based on the notion of time. This contradicts Piaget's theory, therefore, which indicated that pre-operational children fail to understand three operations needed to understand the concept of time (seriation, duration and temporal metric and analogous/spatial metric – see Baker, 1973). Conversely children in this sample, at an early age, used concepts of duration (start and finish, time before and time after), limitation, life span of age, and numbers.

Consequently, the data emerging from this study supports the argument that there is a need to clarify the definitions of death and this will shed more light on the clarity of the limited life cycle.

(2) The concept of space and life in space

Surprisingly the knowledge of astronomy, it appears, is part and parcel of children's cognitive thinking. Observations of the children in this study indicate that they have inductively developed the ability to separate their belief about notions of heaven from their understanding of scientific phenomena. Their responses include the example of a spirit's travelling to heaven and living there; they also reflect their awareness that this place is not the sun. This awareness, it is concluded, is based on their observations of astronomical phenomena, not only about the sun, but also about the existence of space and the existence of entities in space.

Similar to other knowledge children have they can reflect several stages of understanding and gradually build knowledge about life in space. As can be seen in Table 4.16, some children's responses are non-scientific, while most of the sample reflects a scientific understanding. The difference between the two visions is that the latter show logical and correct information about

space which appear that these correct scientific fact and information have been gained by educational intervention in addition to their cognitive development.

Children in this study basically used this knowledge about astronomy to answer the question of who could live on the moon; they compare the biological needs of living things and astronomical observations and arrive at an intrapersonal understanding. For example, since children understand the scientific atmosphere of the moon (or in space) they are able to decide who could live on the moon: the man and cheese, astronauts, aliens or no one. They infer inductively the impossibility of living away from earth because it is a dangerous environment for them due to the lack of oxygen, gravity and darkness. The great distance is also a factor and this environment causes death. Consequently, they understand that no one can live on the moon because they will die. In addition, they could accept the notion of aliens in space and the possibility that these aliens live on the moon while it is impossible for human beings (Table 4.16 which demonstrates an ability to think based on their concept of classification).

Consequently relying on the children's capacity to differentiate and make classification between the types of their observations, once they understand the scientific aspects of death their understanding, needs to be judged as a mature understanding of the concept of death. In this way, this study is different than some studies which argued that children do not understand irreversibility based on the notion of coming back to life (Kenyon, 2001, Noppe and Noppe, 1997; Brent et al., 1996; Candy-Gibbs et al., 1984-1985). For the same reason, this study is also different from the study of Slaughter (2005) in that children with highly religious beliefs were less mature in their understanding of irreversibility (in this case this is due to their ability to separate their understanding of scientific concepts and their belief of spiritual life).

The following section describes the astronomical concepts children rely on to build their knowledge cognitively.

(3) The concept of distance

Understanding the concept of distance is one of the main themes children use to describe their understanding that space is huge and has lots of planets. Children in this study were able to use it interrelated with other concepts such as the concepts of time, size, numbers, measurement and mathematical angles. Examples are found in Tables 4.12, 4.13 and 4.15. This understanding is found in all groups at an early age such as the response of **Ra-4**. With the possibility of taking a photo of the sun and the moon together (question 13), **Ra-4** explains the logical vision he has.

No, it is too long the moon, you have to get a spaceship and fly after the earth out the moon and take a picture.

It appears that their developed linguistic ability supports them in gaining deeper information. For instance, they relate that an explosion created the earth (**Gu-6.11**) and talk about the existence of other planets in space (**Ro-6.7**) using developed terms such as the solar system (**Ca-7.3**) and satellite (**Math-8.9**). Interestingly, it appears that through their understanding of distance, they inductively describe the idea of a weakness within technological functions in space as similar to reception problems on earth (**Ja-7.10**).

I don't think so really. Because it is not like .. I don't think there is a reception on the moon and doesn't work every things, like (snow) cannot work computers and the phones... I don't think so. Because I don't think the camera would work...

G/why?

J/ because of the gravity of the moon (Ja-7.10).

Their capacity of understanding the distance thus motivates them to create a vision of difficult communication between the dead and the living - between heaven and earth. At the same time, children's responses showed an ability to draw inferences deductively using scientific observation of time and distance to understand the effect on life and death. For example:

She means that we are not at all close to it and it is a few thousand miles away. And . . . if it touches you, you could just die because it is so warm and it's really made from fire. **(Mo-6.7)**

She means it's like millions and millions miles away up in space . . . and it's so far there is impossible thing to get to . . . (smiled like he is sceptic) you're possible to get there **(Gu-6.11)**

(4) The concept of features and functions

Observations of children in this study also include understanding of features and functions of the Sun, the Moon and Earth. They are aware of the function of heating, light or the developed of reflecting light by the moon **(Math-8.9)**. They are also aware of features such as craters, darkness around the moon, the earth as sphere **(Gu-6.11, Ja-8.5)** and the consistent motion of the earth **(Fin-5, Ca-7.3)**. Children also reflect their fantasy about how and where people live on earth, whether on or inside the earth. Some of them think that people are living inside the earth **(Eu-6.4 and Ro-6.7)** whereas others think that they are living on the earth (Table 4.10)

The second stage of inferences children build in their mind, (Tables 4.12 and 4.13), is that there is a relationship between phenomena they know in space and in the life of a living thing. They infer that the distance between the earth and the sun is important for living things to stay alive, because any defect in this distance, heating and light will cause pain in the eyes **(Ca-7.3)** or

death (**Mo-6.7**). Also, due to the large distance in space, they realise that it is impossible to travel to the moon without using specified transport.

(5) The concept of characteristics

Observations which are rich and valuable are thus found in the themes and sub-themes. They indicate the children's understanding of scientific characteristics in space and build a vision of effects on the lives of living things. These characteristics include air, temperature, gravity and alternation.

The interrelated knowledge about each of these concepts (Tables 4.11- 4.12) helps them to decide the possibility of humans living on the moon. They realize that human life must be connected with earth and that it is impossible to live on the moon or in space, because there is no air on the moon and it is very cold. They also know it is possible to visit the moon, to stand up on the moon, but not to live there which is based on the concept of limitation.

(6) The concept of motion

As I argued in the section of the alternation, children would be able to understand the concept of alternation as scientific concepts. Initially my argument about children's cognitive understanding of the concept of alternation was based on their understanding of the cognitive and scientific concepts of existence, non-existence, appearance, disappearance and the knowledge of the sun and the moon. This argument was the reason for me to include investigation on the concept of alternation within the questions of my study.

However the results show that children in this study appear to have a developed dimension in understanding the phenomenon of alternation, more than I predicted in my argument. Children

reflect that they have observations not only on the above concepts, but also have a vision on motion in more depth (Table.4.14). This understanding of alternation is developed in two stages.

(1) Some children in the sample in their inferences connect this phenomenon with their everyday life activities such as sleeping or going to schools in the morning. This is recognised through their understanding of the concepts of appearance and disappearance, existence and non-existence; (2) Some children connect this vision beyond the previous concepts with a higher level of cognitive and scientific concepts such as the concept of location, motion and rotation.

For example,

The sun comes out in the day . . . and the moon comes out in the night. And one when the sun out we can go outside and we can go out . . . we can go for a bicycle . . . we can ride a bicycle or motorbike. Well it's morning and we can't crash. While in there we can't crash. While in night time we can crash. We can crash and get hit it (**Ra-4**).

It goes to the other side of the earth . . . and the moon and the wheel ...?? . . . around the earth rotates and the sun goes to the other half of the world . . . and the moon comes around as well (silent) be . . . cau . . . se (meant because) . . . I don't . . . I thought that only. . . no . . . we . . . we . . . all planets move but the sun doesn't move and the moon move so we have to . . . we must have to round it as well.(S) . . . I'm not sure (**Math-8.9**).

These results in my study are similar to the results of Vosniadou and Brewer (1994) on children's explanation of the appearance and disappearance of the sun in that children have two types of understanding that are logical and accurate. (1) Young children's ideas are based on their daily experience while (2) the older children focus on the scientific models.

Vosniadou and Brewer (1994) suggest that children might need to work with concrete materials to help them understand the abstract concept, based on Piaget's theory. Also, in a study about children's ability to imagine the actual size of the Earth Cameron argues (2008) that children are

unable to understand the concept of distance, but even when they are taught information about the Earth they are still unable to grasp the information and continue to think it is flat.

The schema of inferences of the children in my study show different results than Cameron's results. In my study, children show their understanding of huge distances in space and the size of entities. In their explanation they reflect ability of observations inductively and deductively using the concept of time, numerical language, developed verbal terms and scientific classification to show their understanding of the concepts of size and distance. This finding, which shows a higher level of understanding in young ages, is the same as views of other studies such as Sneider and Ohadi (1998); Siegal and Surian (2004) who mention that young children are able to improve their concepts into a developed stage of cognitive scientific understanding.

A (third) developed stage of inferences to understand the concept of death based on astronomy

To conclude, as children in this study show their abilities to make logical inference and organized schema of scientific thinking it appears that they arrive to a higher level of understanding. This is an intrapersonal understanding based on the relationships between information and express it as a meaning they gained. The third level of inferences that children mention appears in all tables of astronomy in Chapter 4. They talk about phenomena in space and that distance in space is important for the life and death of living things. They understand that there is no man on the moon. They understand that living in unsuitable places inevitably causes death.

These are developed understandings that show that children have knowledge of astronomy and they are able to understand the concept of death scientifically. Moreover, they are able to see the relationship between understanding of the concept of death and the knowledge of astronomy.

This chapter has discussed the results of children's understanding of the concepts of death and astronomy. The following is the conclusion of the thesis.

Chapter 6

Conclusion and Recommendations

Conclusion

This study has argued that children are cognitively capable of understanding the concept of death through scientific knowledge. In order to investigate this understanding the argument was extended and discussed with a scientific definition of death. As I followed the same sub-concepts of death which was established by Piaget in his theory of cognition, this discussion in my study used all sub-concepts - non-functionality, inevitability, universality and irreversibility. It was also important to discuss the concept of time as the main basis that shapes this investigation scientifically. Time was the basis of a life span - that death happens inevitably, universally, irreversibly and non-functionally.

To find out how children could understand death and the concept of time it was important to probe their cognitive concepts. This study followed what was initially established by Piaget. (see Chapter 1, Section 1). The investigation reviewed cognitive concepts but disagreed with Piaget's underestimation of young children. Piaget claimed that at the pre-operation age, children lack cognitive capabilities (Piaget, 1951; Piaget, 1974; Piaget, 2006).

This study departed from the knowledge of biology, and used a different angle to argue that children could understand death through their knowledge of astronomy. Therefore, throughout this thesis I argued that the knowledge of astronomy would be a useful angle to probe children's cognitive concepts to understand the concept of death. From this point, the questions of this study were divided as follows:

- ***What is the relationship between children's understanding of death and their scientific knowledge, as demonstrated through the domain of astronomy?***

From the main question, four sub-questions are highlighted:

- How do young children understand the ***universality*** of death?
- How do young children understand the ***irreversibility*** of death?
- How do young children understand the ***inevitability*** of death?
- How do young children understand the ***non-functionality*** of death?

To illustrate the link between children's scientific understanding (and in particular Astronomy)

there are five further sub-questions:

- What is the children's knowledge ***of the sun?***
- What is the children's knowledge ***of the moon?***
- What is the children's knowledge ***of the earth?***
- What is the children's knowledge ***of life in space?***
- What is the children's knowledge of the phenomenon of ***alternation?***

The results from the data show that children are cognitively capable of understanding the concept of death from a scientific angle at an early age.

The cognitive basis of understanding death, which was established by Piaget is proved in this sample as young age as age 4 and this is a significant difference from Piaget. Children in this study show a developed cognitive ability to logically reason based on a wide scientific knowledge starting at age 4. This development appears significant between the ages of 4-9, based on their understanding of scientific phenomena such as the concept of time and the phenomena of astronomy.

Cognitive development appears through three weaved categories; concepts and skills, scientific knowledge of astronomy and biology; and non-scientific knowledge. These cognitive concepts

and skills are observation, logical inferences, linguistic ability, universality, classification, existence and non-existence, visibility and invisibility and seriation. Scientific knowledge includes the concept of time, space, distance, features and functions, characteristics and motion (alternation). Non-scientific knowledge includes ideas of a spiritual life.

Children in this study presented an organized schema of thinking that supports them to understand the environment and phenomena around them. To answer open-ended questions about an abstract concept such as the concept of death, they showed the ability to use abstract concepts to explain their answers. However, where the children did not recognize that cessation of internal organs functions causes death, they show an understanding of the concept of time instead. They show an understanding of death through various perspectives of time, such as (1) limitation of time, (2) duration of time, (3) time is linear, (4) age, and (5) length of time. Under the limitation of time children understand the limitation of the life span of living things, life span, using numbers, and the limitation of spirits living on earth. Under the notion of the duration of time, children have an understanding of past and future, and realise the end of life. In understanding that time is linear, children understand the cycle that people were born, they live and they die. Under the concept of age, children believe that death happens not only in old age but also in young age. With the notion of the length of time, children show an understanding of long distance and time between earth and heaven - affecting the possibility of meeting the dead. Through their knowledge of time they justify that death is irreversible, inevitable and universal. On the other hand, through the lack of understanding of cessation and an acceptance of the notion of spiritual life, children expressed the view that there is a limitation of time for spirits living on earth who should transfer to heaven; which places pets or people on another stage, and

not the Earth. Their responses also talk about the disappearing body, disappearing from the earth, separation between spirit and body, and life in heaven. Consequently, as children understand functions of the body as characteristics that support them in existence, they do not understand the problems of functions beyond life. Therefore, they do not show an understanding of non-functionality as biological. Instead, they understand the concept of death from the point of view of a different reality, invisibility and disappearance from life.

Children do understand a large base of knowledge about astronomy; this strengthens their responses in logical reasons about death. For example, children show an understanding of information about the sun, the earth and the big distance in space. They use it to understand and differentiate the phenomena of space from the notion of heaven. However, by this differentiation children understand heaven as a theological concept instead of a scientific concept. Children's knowledge of astronomy however has more depth when they talk about the phenomena of space. Children have a developed cognitive ability to think about death through their knowledge of astronomy. This appears through their ability to think inductively and reasoning logically. This is in addition to their mathematics skills and developed linguistic ability, as they skilfully answered open-ended questions. They recognise the scientific phenomena in the sky and in space, combining their own observations with the educational interventions they have received.

Children's knowledge of astronomy includes scientific interrelated themes and sub-themes about the sun, the moon, alternation, the earth and life in space. Based on these sub-themes, children present justifications for the connection between a human life and death and astronomical phenomena. Moreover, they are aware that this connection affects not only humans but all living

things. They also show an understanding of the abstract concepts such as existence and non-existence, appearance and disappearance.

For example, children understand that there is no man on the moon because no one is able to live on the moon based on the lack of the gravity and air. Interestingly, it appears that age is not a factor to learn about the moon, because some children such at age 4 and 4.11 years are aware that the existence of the moon in space, while some children at age 4 and 4.6 years old are aware of the moon in the sky. They build an intrapersonal view that aliens could exist and that it is impossible for the human to live away from earth. The phenomena in space, unsuitable for human, cause death inevitably.

In addition, through the activity of children's drawings which I used with children in my study in order to encourage them to talk about their knowledge, it appears that it indicate two types of drawings enrich children's knowledge of astronomy - drawing emotionally and scientifically. Based on what is pointed out in Chapter (4), Section (2) about these drawings, I found that these drawings and their narratives support their knowledge of astronomy; which is similar to their answers in the interview on space. In other words, these drawings and narratives prove that they have a knowledge of astronomy which they are able to explain whether they draw it or express it verbally.

The challenge of working on this subject was not easy because of the sensitivity of the working with children. Therefore, concern was needed, ethically, to release the fear from children's knowledge about death. Supportive listening was needed to support them as they talked about death. This sensitivity affected the number in the sample because only children were allowed to participate if they agreed to the protocol.

Consequently, cessation of internal organ functions, was avoided in the methodology. However, knowledge of biology was needed in the choice of stories and the concepts of astronomy. I chose the method carefully. The focus was on children's ability to infer and reason through interviews and two common stories about death and astronomy.

This choice supports the argument to be involved within the field of the research on children's understanding of death as a cognitive approach. Moreover, it sheds light on understanding from a scientific perspective. Specifically, knowledge of astronomy has a wide and rich basis of information which shows children's cognitive ability to understand the concept of life and death. In addition, this perspective of understanding the relationship between death and the phenomena in astronomy, as demonstrated by the sample of this study, supports children's ability to classify human ability to live and their understanding of spiritual life. This shows that young children understand the concept of death, from all sub-concepts; inevitable, irreversible, universal and non-functional.

Three points appeared significant in this sample. However, with some initial assumptions, these three points were unexpected. These points are (1) the schema of inductive and deductive inferences, (2) using numbers to explain an abstract concept and (3) understanding of the concept of death from the perspective of ecology. These aspects could use more supportive methodology to investigate children's cognitive thinking in more depth.

Now there is a valuable schema of cognitive approaches to support children in dealing with the concept of death. Educational intervention is a serious enterprise that provides young children with rich material included in their education. For example, educational intervention can encourage children's thinking by teaching the strategy of inductive and deductive inferences.

The key point is to use open-ended questions in building conversations about the fields of science. Educational intervention can help them use both strategies because they are basis skills for thinking about knowledge in mathematics and ecology, in order to improve their understanding of the concepts of (life and) death.

Children's who use numbers in explaining the relationship between death and the factor of time is a significant part in this data. This encourages educational intervention to use it as a schema of conversation with children. This schema includes the configurations of the concept of time such as the concept of duration including starting and end points, life span, and numerical perspectives of eternity.

Believing that a cognitive approach was gleaned from the data from the children of this sample, more curiosity was established. Due to the difficulties of including children at the age of 3 into the sample, future research could use this age as the focus of investigation. In addition, in order to participate in the field of research, more papers need to be published about this thesis; in order to realize that young children can understand death through astronomy.

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Glossary

Sub-concept of death

The concept of death includes sub-concepts - irreversibility, universality, inevitability and non-functionality.

Children's knowledge of astronomy

Children's views on the science of astronomy, such as entities in space, concepts of distance, size, time, environment and life in space.

Concept of existence

The belief that things, objects, concepts or entities are available in reality.

Concept of non-existence

The belief that things, objects, concepts or entities are absent in a particular space or time.

Alternation

The phenomenon of rotation of the earth around the sun, which creates day and night.

Acronyms

Concept of death		Concepts of astronomy	
Acronyms	Terms	Acronyms	Terms
CD	Concept of death	CA	The concepts of Astronomy
Sub-CD	Sub-Concept of death	CAQ	Concepts of Astronomy question
Sub-CIR	Sub-Concept of Irreversibility	KS	Knowledge of the sun
Sub-CNF	Sub-Concept of Non-Functionality	KM	Knowledge of the moon
Sub-CU	Sub-Concept of Universality	KA	Knowledge of alternation
Sub-CIN	Sub-Concept of Inevitability	KE	Knowledge of the earth
LS	Life Span		
CT	The Concept of Time		
BK	Biological Knowledge		
CIOF	Cessation of Internal Organs Functions		
C'sR	Children's Responses		

SL	Spiritual Life		
NE	Non-Existence		
LT	Limitation of Time		
BF	Biological Functions		
CDQ	Concept of death Question		

Appendices

Appendix 1: Consent from Schools

Name and address of the school

21st April

Dear

I am a PhD student in the Childhood and Primary Studies department of Strathclyde University. I am looking at a difficult but important subject: how young children understand the concept of life, what happens when we die, and how this links to their understanding of other concepts.

The study involves reading individual children two short picture books and asking some gentle questions about what they think has happened in the story. *Goodbye Mog* is a picture book written by the popular children's author, Judith Kerr and tells the story of what happens when a family's beloved pet dies and they buy a new kitten. *What is the Sun?* is another picture book, written by Lindberg and Lambert, and encourages children to think about what happens to the sun, the moon and stars when you can't see them in the sky. I will ask the children to do a drawing to show their understanding of why they can't always see the sun, the moon and the stars.

I am writing to ask if you would allow me to approach the parents of children in your nursery and request permission to interview their children in the way described above, and to conduct the interviews during the child's time in the nursery. Each book reading will take about 20 minutes and the drawing will also take up to 20 minutes.

To help my analysis, I would like to videotape the sessions with each child. This will allow me to focus on the child during the story-reading rather than having to write notes. Parents will be offered the opportunity to be present during the sessions. The children will only be identified by their first names, the nursery will not be identified and the videotapes will be used wholly and solely for analyzing the children's understandings for this project.

When I have finished the study, I would be very happy to share what I have learned from it with you, your staff and the parents.

I attach a copy of the letter I would like to send out to parents, the parental consent form, and a copy of my Disclosure Scotland certificate.

Many thanks,
Ghada Zamka
Primary and Childhood Studies,
University of Strathclyde

Appendix 2: Consent from parents or guardian

Dear Parents,

I am a PhD student in the Childhood and Primary Studies department of Strathclyde University. I am looking at a difficult but important subject: how young children understand the concept of life, what happens when we die, and how this links to their understanding of other concepts.

The study involves reading individual children two short picture books and asking some gentle questions about what they think has happened in the story. *Goodbye Mog* is a picture book written by the popular children's author, Judith Kerr and tells the story of what happens when a family's beloved pet dies and they buy a new kitten. *What is the Sun* is another picture book, written by Lindberg and Lambert, and encourages children to think about what happens to the sun, the moon and stars when you can't see them in the sky. I will ask the children to do a drawing to show their understanding of why they can't always see the sun, the moon and the stars.

I am writing to ask if you would allow me to read these stories to your child in the nursery. It would be very helpful if you would give me permission to videotape the sessions with your child - This will allow me to focus on the child during the story-reading rather than having to write notes. I would be very happy if you would like to be present during the sessions. In the project, your child will only be identified his or her first name, the nursery will not be identified and the videotape will be used wholly and solely for analyzing children's thinking about these issues.

On the other side of this letter, you will find answers to common questions about the study. My contact details if you have any further questions that you would like answered before giving your consent are Ghada Zamka, at the University of Strathclyde on 0141- 950 3707 or email me at ghada.zamka@strath.ac.uk

If you are happy for your child to participate in this project, please complete the consent form attached to this letter and return it to the nursery.

Many thanks,
Ghada Zamka
Primary and Childhood Studies,
University of Strathclyde

Below are some answers to common questions about the study:

What is the purpose of this study?

The purpose of the study is to describe children's understanding of the concept of life, what happens when we die, and how this links to their understanding of other concepts. A better understanding of how young children think about these issues will enable professionals to provide the most appropriate help, should children need it.

Why has my child been asked to participate?

I am sending this letter to the parents of all children in the nursery who fall into the age-group that I am studying.

Does my child have to take part?

No. Your child does not have to take part. Even if you give your permission, your child will not be made to participate if he or she does not wish to do so; children can leave the activity without giving a reason.

Will what my child says be kept confidential?

Yes. As explained above, children will only be identified on the video tape by their first names, the nursery will not be identified and the videotape will be used wholly and solely for analyzing their understanding for this project. If, to illustrate a point, I quote something your child has said, I will change your child's name.

What will happen to the results of the research study?

My findings will be shared with other academics in conference presentations and in peer-reviewed journal publications or books. You may request to see anything written for publication in relation to this study. I would also be very happy to share what I have learnt from the study with parents and nursery staff.

Who is organising and supervising the research?

I am Ghada Zamka, a PhD student and am supervised by Dr. Penny Munn of the Childhood and Primary Studies department, University of Strathclyde. The method I am using and the questions I will ask have been scrutinized in detail by the Childhood and Primary Studies Ethics Committee, and passed as appropriate.

Contact information

If you have any further questions about the study please contact me, Ghada Zamka, at the University of Strathclyde on 0141- 950 3707 or email me at ghada.zamka@strath.ac.uk

PARENTAL CONSENT FORM

I have read the parental information sheet about the study investigating how young children understand the concept of life, what happens when we die, and how this links to their understanding of what happens to the sun, the moon and the stars when they can't be seen in the sky.

I have had the opportunity to ask and have answers to any questions that I may have about the investigation.

I understand that my child's contribution will be anonymised and that s/he may withdraw from the study at any time, without giving reasons.

I agree/ disagree that my child _____ can take part in this research study.

I agree/disagree to my child being video-taped whilst discussing the stories *Goodbye Mog* and *What is the Sun?* with the researcher

Signed.....

Print name:

Date:

Appendix 3: Ethical Disclosures 1

STRICTLY PRIVATE AND CONFIDENTIAL

Disclosure
SCOTLAND

Mrs GHADA IBRAHIM SALEH ZAMKA
43 BURNCROOKS AVENUE
BEARSDEN
GLASGOW
G61 4NL

199680

ENHANCED DISCLOSURE
APPLICANT COPY

Disclosure Number: 120100052060236
Date of Issue: 12/10/2007
page 01 of 01

A copy of this Disclosure has also been sent to:
MS RONA MILLER
THE UNIVERSITY OF STRATHCLYDE FACULTY OF
DAVID STOW BUILDING
76 SOUTHBRAE DRIVE
GLASGOW
G13 1PP

Applicant Personal Details
Surname: ZAMKA
Forename(s): GHADA IBRAHIM SALEH
Date of Birth: 20/07/1968

Convictions

Date	Court	Offence
NONE		

Cautions

Date	Court	Offence	Disposal
NONE			

Other Relevant Information
NONE

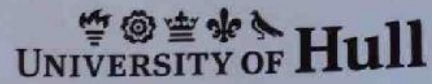
Other Government Information
Applicable information searched with no trace found.
END OF DISCLOSURE

Appointment Details
Position Applied For: STUDENT RESEARCHER
Name of Organisation: UNIVERSITY OF STRATHCLYDE

Countersignature Details
Registered Body: THE UNIVERSITY OF STRATHCLYDE
Registered Person: MS RONA MILLER
Disposal



Appendix 3: Ethical Disclosures 2



Centre for Educational
Studies
T 01482 465988
E j.lison@hull.ac.uk

ETHICAL PROCEDURES FOR RESEARCH AND TEACHING
IN THE
FACULTY OF EDUCATION

PERMISSION TO PROCEED WITH RESEARCH: ETHICAL APPROVAL

Reference Number:	10/326
Name:	Ghada Zamka
Programme of Study:	PhD
Research Area/Title:	The relationship between young children's understanding of the concept of death and the scientific knowledge
Image Permission Form	N/A
Name of Supervisor:	Dr Ioanna Palaiologou
Date Approved by Supervisor:	31 May 2011
Date Approved by Ethics Committee:	3 June 2011



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Appendix 4: The form for answering questions for each story -1

Name of child _____ Gender: Boy Girl Date of birth _____

Age: _____

Name of the school _____ Preschool Primary Class: _____

Date of meeting nom.1 _____

(1) The script of the story: “**Goodbye Mog**”.

Conversation in the beginning of meeting		
The Script of the story of Mog	Investigation points	Comments
(1) Mog said she will sleep forever, Can you tell me what does she mean? Can you tell me more?		
Debbie and Nicky poured some milk. (2) Who did they pour the milk for? Who will drink the milk? Why? Can you tell me more? (3) See this picture. It is beautiful. Mog and Rumpus are jumping. Who do you think is better in jumping? Why? Can you tell me more?		
Mog likes Rumpus. (4) But where Mog is going? (5) Why she is going? Can you tell me more?		
Debbie said: “But I’ll always remember Mog”. (6) Why do you think Debbie said that? Can you tell me more?		

The form for answering questions for each story 2

Name of child _____ Gender: Boy Girl Date of birth _____

Age: _____

Name of the school _____ Preschool Primary Class: _____

Date of meeting nom.1 _____

(2) The script of the story: “What is the Sun?”

Conversation in the beginning of meeting		
The Script of the story of the sun	Investigation points	Comments
-She said: the sun is far. Can you tell me what does she mean? -What happens to the sun in the night? -Why do you think that? Can you tell me more?		
-She said: the moon is a place. What does she mean? -Can you tell me how can we go to this place? What happens to the moon in the day? -The boy asked: Sometimes thin, sometimes fat? Can you tell me why she said The moon is like that? -Can you tell me what is the shape of the moon? -Can you tell me more?		
-Who could live on the moon? -What would it be like on the moon?		
-The boy is going up to see the sun and the moon in Space, do you think he can take a photo of the sun and the moon together? Can you tell me how?		

Appendix 5: The scripts of the questions in the interviews

1The script of the story: "Goodbye Mog".

16th March.

Pages	Investigation points	Script
P.1	(1)Irreversibility)	(1) Mog said she will sleep forever, Can you tell me what does she mean? Can you tell me more?
P.10 to P.11 (pictures of imitation)P.20 to P.22	(2) Non-functionality	- Debbie and Nicky poured some milk. (2) Who did they pour the milk for? Who will drink the milk? Why? Can you tell me more? (3) See this picture. It is beautiful. Mog and Rumpus are jumping. Who do you think is better in jumping? Why? Can you tell me more?
P.30	(3) Universality	Mog likes Rumpus. (4) But where Mog is going? (5) Why she is going? Can you tell me more?
Debbie said: "But I'll always remember Mog". P.29	(4) Inevitability	Debbie said: "But I'll always remember Mog". (6) Why do you think Debbie said that? Can you tell me more?

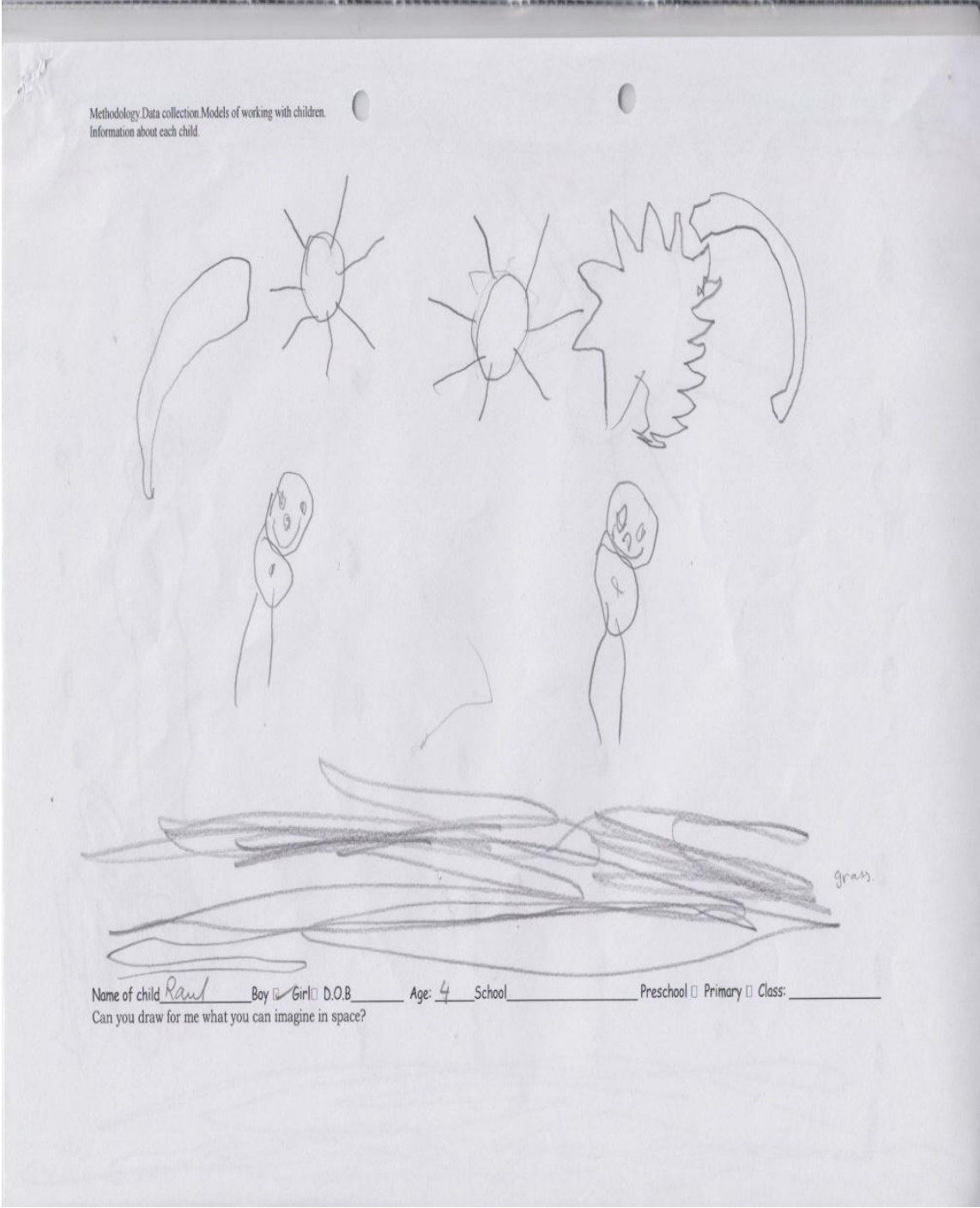
2The script of the story: “What is the Sun?”

16th March.

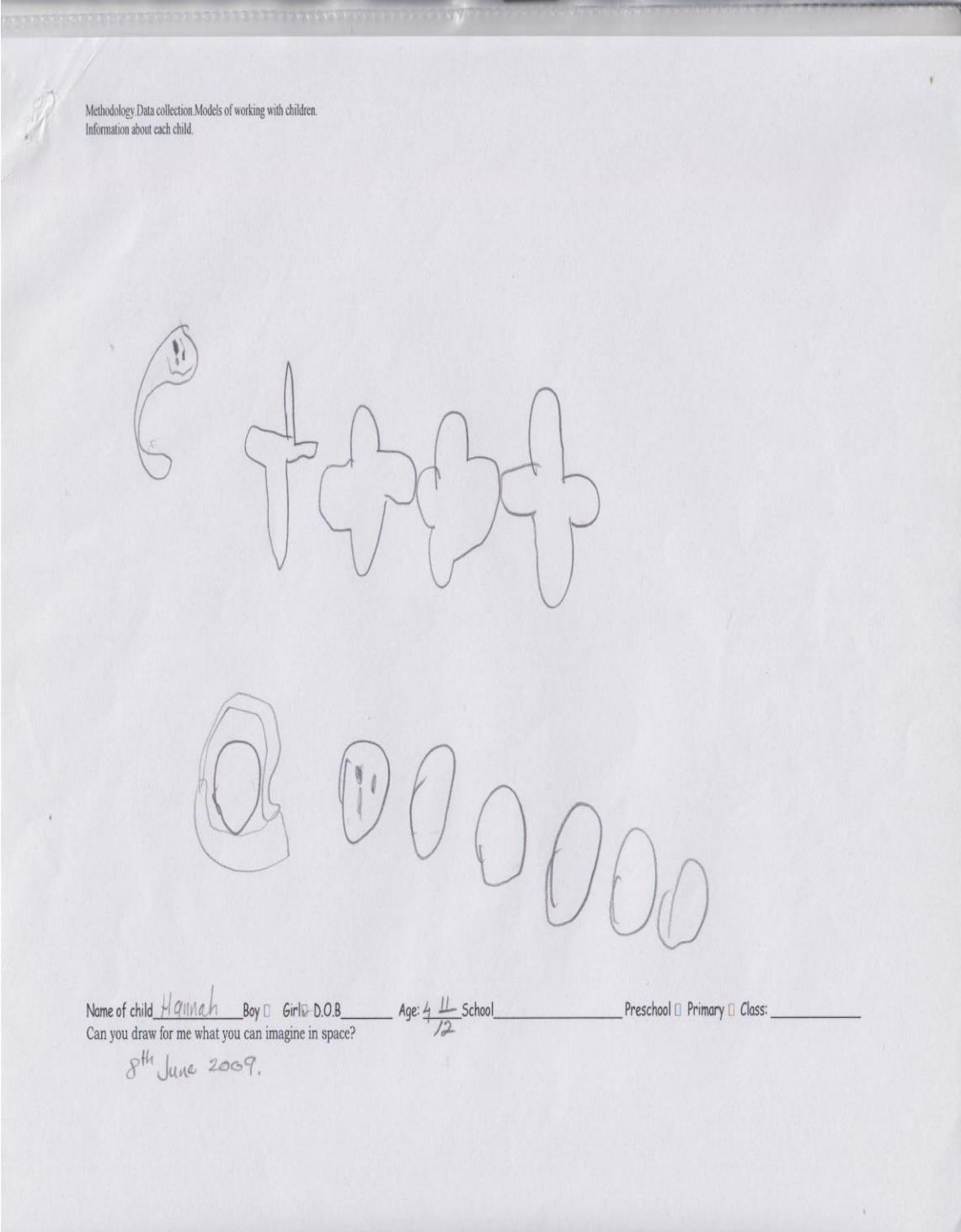
P.	Position of question’s investigation	Interviewer’s probes
P.2	Do children understand: -The <i>existence of the sun</i> in the space? -The <i>size of the sun</i> and the space.	<ul style="list-style-type: none"> - She said: the sun is far. Can you tell me what does she mean? - What happens to the sun in the night? - Why do you think that? Can you tell me more?
P.4 to P.11	<ul style="list-style-type: none"> - <i>The existence of the moon</i> in the space? - <i>The shape of the moon.</i> 	<ul style="list-style-type: none"> - She said: the moon is a place. What does she mean? - Can you tell me how can we go to this place? - What happens to the moon in the day? - The boy asked: Sometimes thin, sometimes fat? Can you tell me why he said the moon is like that? - Can you tell me what the shape of the moon look like? Can you tell me more?
P.12 to P.16	Do young children understand that there is no life in the space?	<ul style="list-style-type: none"> -Can you tell me what the wind is? -Can you tell me what where does it blow? -Can you tell me more? -Grandmother said: wind blows through the world everywhere. What does she mean by everywhere? -Can you tell me more about it? -Who could live on the moon? -What would it be like on the moon?
P.22 to P.25	Do they understand that earth is a part of the space? earth is sphere? the size of earth?	<ul style="list-style-type: none"> -She said: the earth is a big ball? Do you think it is true? -Can you tell me why? If you stand up on the moon, what can you see? -If you stand up on the moon, can we take a photo of the earth? How? Can you tell me?
	Do they understand the size of space, the sun and the moon?	-The boy is going up to see the sun and the moon in the space, do you think he can take a photo of the sun and the moon together? Can you tell me how?
		-Can you draw for me what you can imagine in space?

Appendix 6: Examples of children's drawing (D)

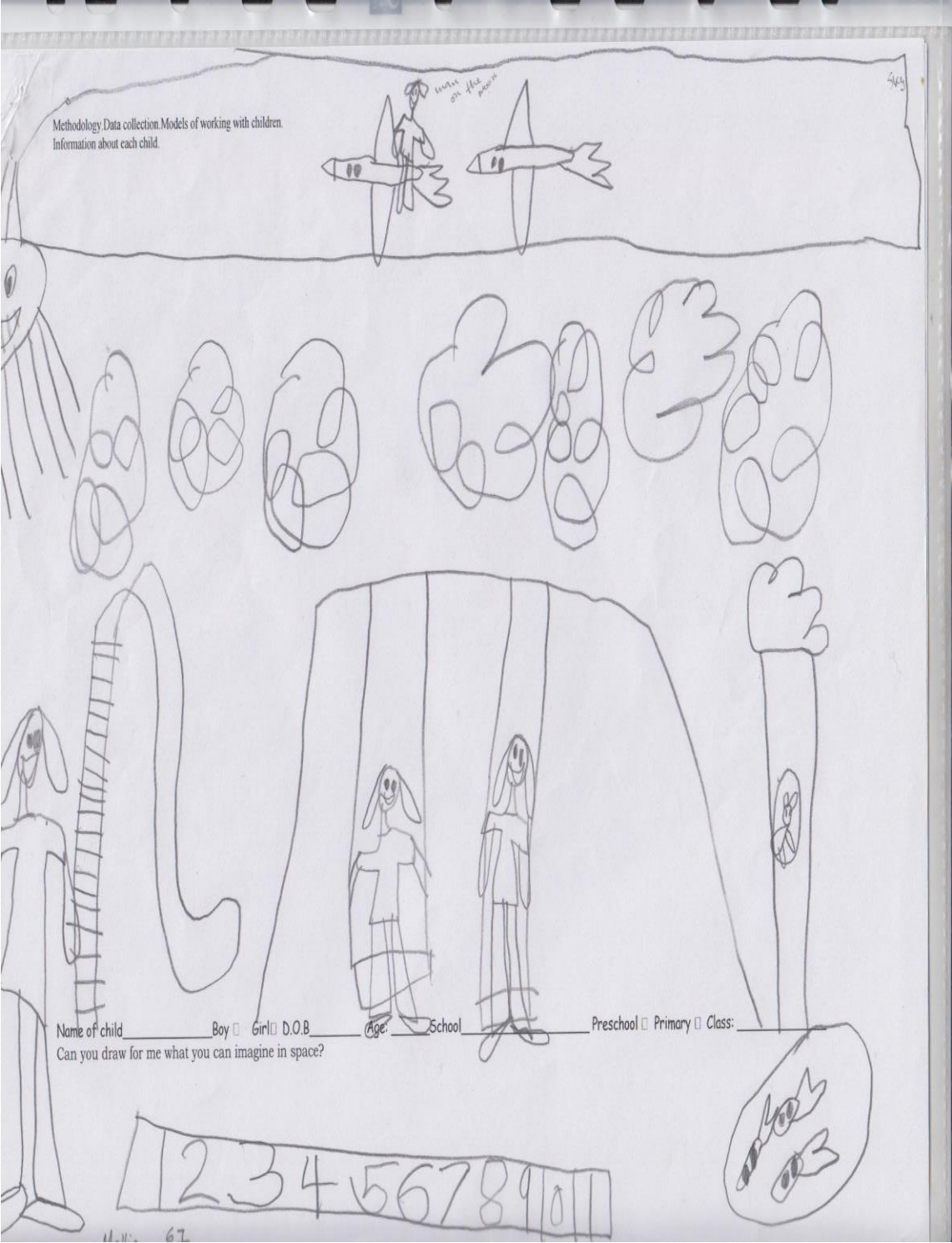
D1.Ra-4



D2.Ha-4.11



D3.Mo-6



D4.Ju-7.10

Methodology Data collection. Models of working with children.
Information about each child.



Name of child Juliet Boy Girl D.O.B _____ Age: 7¹⁰/₂ School _____ Preschool Primary Class: _____
Can you draw for me what you can imagine in space?

4th June 2009.

D5.Ja-7.10

Methodology Data collection. Models of working with children.
Information about each child.

Name of child Jay Boy Girl D.O.B. _____ Age: 8 School H Preschool Primary Class: _____
Can you draw for me what you can imagine in space?
8th June 2009.

D.6-Math-8.9

Methodology: Data collection. Models of working with children.
Information about each child.



Name of child MATHAN Boy Girl D.O.B. _____ Age: 8/12 School _____ Preschool Primary Class: _____
Can you draw for me what you can imagine in space?