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Enhancing Student Assignment Completion Through Gamified Mobile Applications: A Motivational Approach

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Farhan Rahman

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Abstract

This thesis explores the design of digital tools to encourage motivation for students in higher education. A design is proposed for an original prototype app that makes use of gamification techniques. Theories on improving motivation are discussed in the literature and those most suited to be implemented within a digital prototype are selected. To measure how well the prototype performs, we specifically use the delivery for coursework to be handed in a timely manner as a metric. User consultation in the form of a questionnaire is used to create part of the specification used in the prototype design. The prototype app is tested on a limited number of participants and the results reported. Results show that students using a mobile application with gamification features would be motivated to start their assignments earlier and be motivated to complete them on time however results also show that specific gamification features have more split opinions than others for e.g., the extrinsic rewards that users can earn when completing assignments and challenges. These rewards have very little tangible value to them so when earned by users, it doesn't provide much nor does it motivate them to want to achieve more, users would prefer rewards that have a direct impact on them for e.g., being able to extend assignment deadlines. The Thesis offers theoretical and practical contributions to research and design of motivation and the use of gamification in a mobile application.

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Chapter 1 - Introduction

This research focus relates to the design of a prototype mobile application that makes use of gamification aimed at assisting students with their assignments and help motivate them to submit them on time. To address this problem, this thesis defines what motivation is and how it works, its history as well as its effects on students. Gamification is a means of motivating people into doing mundane tasks. The theory behind gamification is researched as well as its real-world applications and suitable features to be implemented towards a prototype application. Users of the prototype form part of the design process and their feedback are factored into the iterative development of the prototype.. Current case studies that exist within the same market such as Trello and Asana will be researched for their Pros and Cons then feedback will be taken into consideration towards the design process.

1.1 Background Context

Submitting assignments on time has long since been a struggle for students who undergo university degrees, and the main contributing factors are procrastination and motivation (Chabaya, 2009). Motivation has been a debated and known topic for many students including me and is a main source of struggle when attempting to complete assignments (Lacy, Toon, Stocker, & Ford, 2022). Many mobile applications have been created (Trello, 2011; Evernote, 2004) to aid students with their scheduling and time management, but these apps lack the features and measures needed to help motivate students towards completing their assignments. Gamification is a concept used by employers to help motivate employees carry out their work and has been an effective measure for the employees' work rate (Bohyun, 2015). This thesis explores motivation and gamification whilst creating a mobile application for students to help start their assignments early and submit them on time. For the sake of this thesis, students between the ages of 18 and 28 will be considered university students.

Motivation is a complex topic that has proved difficult for psychologists to fully grasp and understand and within the context of education, it is an issue that still plagues students today (Lazowski & Hulleman, 2016). Many experts have researched different motivational strategies to try and increase motivation (Wlodkowski, 1978) (Pardee, 1990) however students still struggle to be motivated to learn and attempt assignments. While this topic has been widely researched from many over the last few decades (Alsawaier, 2018) (Bénabou & Tirole, 2003) (Broome, 1997) (Maslow, 1981), more investigation is needed into mobile applications and how they can help motivate and retain students' motivation in learning.

It is important to note that recent events and trends are also contributing factors towards student motivation and their willingness to learn (Khan, 2021). Covid-19 had a large impact on education as a whole and the way students learn has taken a shift from building effective working relationships with teachers within a supportive classroom setting to working from home and learning online via Microsoft teams and similar software (Howard, Khan, & Lockyer, 2021). This shift in teacher-student relationships may have contributed to further isolating students. This means that motivation levels are low, and quality of learning has been lost (Newton, 2021).

1.2 Aims and Objectives

The previous section highlighted the background and context surrounding the topic and identified the need for further research and investigation into the topic overall. The following section lays out the aims and objectives that will guide the research.

Aim: Creating a prototype application that makes use of gamification and motivational techniques to encourage university students to start working on their assignments earlier and submitting them before their due date.

The following research objectives will help achieve the current aim:

> Objective 1: Research motivation and understand the struggles students face when working on assignments.
>
> Objective 2: Investigate motivational techniques and identify how they can be implemented as features to help encourage students to keep working on assignments.
>
> Objective 3: Research gamification to learn about its application to gain a deeper understanding of the positive and negatives of gamification.
>
> Objective 4: Research existing case studies and user needs and identify features that would help promote a better user experience .
>
> Objective 5: Design a prototype application using a curated list of requirements from user needs research and literature review on motivation and gamification.

1.3 Methodology

In the previous section the aims and objectives that will guide the direction of the thesis was outlined. This section will investigate and compare different methods and provide a description.

Bhandari (Bhandari, 2022) defines Qualitative research as “involving the collection of non-numerical data such as text, video, and audio”. This type of data is commonly used to understand concepts that cannot be explained with numbers such as peoples’ opinions and experiences (Pedamkar, 2023). This form of research is seen in subjects such as history, education, and sociology. Qualitative research involves approaches that “focus on retaining rich meaning when interpreting data” (Busetto, Wick, & Gumbinger, 2020). Hammarberg et al describes the following approaches (Hammarberg, Kirkman, & de Lacey, 2016):

1. Grounded Theory – Researchers collect data on a topic of interest and inductively develops their theories
2. Ethnography – Researchers immerse themselves in groups or organisations to have a better understanding of cultures
3. Action Research – Researchers collaborate with participants to link theory to practice and drive social change
4. Phenomenological research - Researchers investigate a phenomenon and describe the lived experiences of participants

5. Narrative research – Researchers examine how stories are created and laid out to participants in order to understand how they are perceived

There are also research methods within Qualitative research that are involved in data collection such as (Oun & Bach, 2014):

1. Observations – Recording everything the researcher experiences from sight, hearing, and experiences in the field
2. Interviews – One on One Conversations with an individual
3. Focus Groups – Creating a discussion within a group of people
4. Surveys – Distributing a sheet of open-ended questions to a sample of people
5. Secondary Research – Collection of existing data such as video recordings, audio files and images

The pros and cons to using a qualitative research approach are laid out below (John & Johnson, 2000):

Pros

1. Flexibility – Data collection and analysis can change as new patterns and ideas emerge
2. Natural settings – Data is collected in the real world in a natural setting
3. Meaningful Insights – peoples' experiences and feelings can be dissected with great detail which can be used within the design and testing of new and upcoming prototypes
4. Generation of new Ideas – Open ended questions allow for participants to put forward a different perspective that the researcher either would have missed or would not have thought of otherwise

Cons

1. Unreliability – due to factors that are out of the researcher's control, data can change become influenced leading to unreliability
2. Subjectivity – useful data is down to the discretion of researcher, what they find helpful towards their research may not be as useful to another
3. Limited generalisability – generally small sample sizes are used to collect data for specific circumstances thus cannot be used to represent the wider population
4. Labour intensive – qualitative data is often checked or analysed manually due to the nature of the type of data

The main aim behind this thesis is to design a prototype therefore a design methodology to support this is required. Design thinking is a methodology that has continued to gain popularity over the past decade with countless articles (Gibbons, What Is Design Thinking, Really? (What Practitioners Say), 2018) written about the topic. While the method of design thinking has only recently been implemented, the idea that design thinking is new is a common misconception and has been "practiced for ages" (Johansson-Sköldberg, Woodilla, & Çetinkaya, 2013). In the last 100 years, many innovators of their time have created products through meaningful and effective solutions (Gibbons, 2016) such as Charles and Ray Eames who practiced "learning by doing" which explored people's needs and constraints which led to the design of the Eames chair. In the business world, this methodology was often overlooked and used towards the end of the product development process where designers' contribution was limited, this led to a failure of solutions that never met the customers' needs (Matthews & Wrigley, 2017). As a result of this,

some designers were moved to the beginning of the product development process and companies have “reaped the financial benefits of creating products shaped by human needs”. Design thinking is defined as “both an ideology and a process, concerned with solving complex problems in a highly user-centric way” (Stevens E. , 2023). The approach has evolved from a range of different fields such as business, engineering, and architecture and can be applied to any area. The user-centredness of design thinking seeks to understand people’s needs and create solutions to meet their needs, which is called a solution-based approach.

Design thinking is made up of 4 principles (Gibbons, Journey Mapping 101, 2018):

1. The Human Rule – All design activity is social in nature no matter the context
2. The Ambiguity Rule – Ambiguity is inevitable and cannot be removed or oversimplified, experiment at the limits of your knowledge and ability to see things differently
3. All Design is Redesign – While technology and social circumstances may change, basic human needs remain unchanged, and the means are redesigned to fulfil these needs or reaching certain outcomes
4. The Tangibility Rule – Prototypes help to make ideas tangible, enabling designers to communicate them effectively

There are 5 phases of Design thinking have been laid out by Gottlieb (Gottlieb, Wagner, Wagner, & Chan, 2017):

1. Empathise

Understanding the user and getting to know what they want is the first key step to design thinking, which means observation and engagement with the people you are designing a solution for on a psychological and emotional level (Rackstraw, 2021).

2. Define

After understanding your users and the struggles they have, the difficulties and barriers they face are investigated and the underlying problems can start to be defined. At the end of the phase, you will have a clear and single problem statement (Stevens E. , Stage 2 in the Design Thinking Process: Define the Problem, 2021).

3. Ideate

This stage is where creativity is given free reign and this zone is open to all and any ideas that are thrown out there. Different ideation techniques will be used to create all sorts of ideas from different angles and perspectives, exploring new alternatives as well as challenging existing beliefs.

4. Prototype

Once there are a few ideas that have been narrowed down, they can start to be turned into something tangible, a prototype. A prototype is defined as “a scaled-down version of the product which incorporates the potential solutions identified in the previous stages” (Beaubien, 2021). As the prototype is tested and iterated on, different solutions may be redesigned, scrapped entirely, or improved as the process goes on.

5. Test

Finally, a prototype that is accepted will be moved onto user testing where it will provide data from being used in a real world setting with a targeted user. Results from this phase can help researchers redesign the prototype based on new insights provided from the test. They can amend the problem statement with ideas that they had not thought of before.

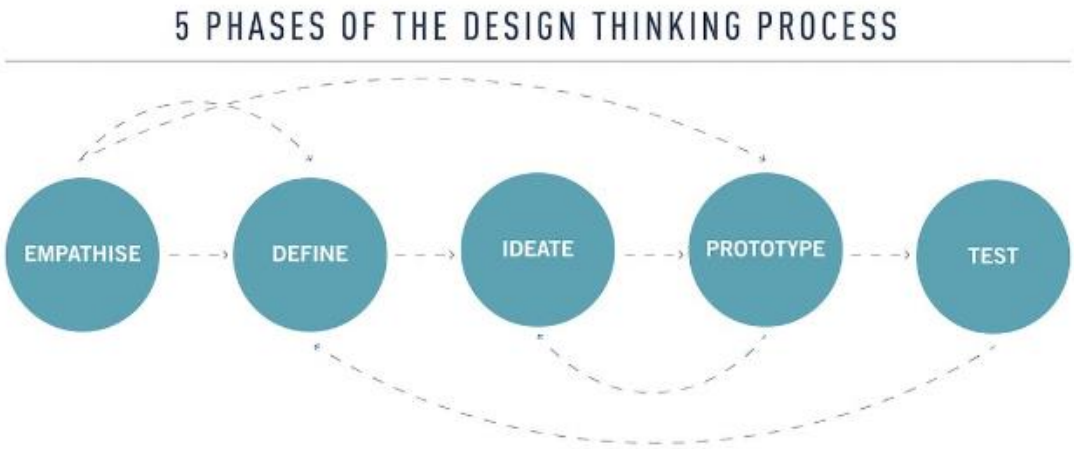

Figure 1 - Figure showcasing the 5 phases of the design thinking process

The benefits to using a design thinking methodology is as follows:

1. Flexibility – The use of design thinking should be thought of as scaffolding to help support you wherever you are in the process as opposed to a step-by-step recipe. It is not uncommon for you to end up at the beginning stages after you have built and tested a prototype, in fact this allows you to assess your product and acquire new data about problems you had not thought of before.
2. Scalability – The nature of design thinking allows it to be used in any situation regardless of experience and talent. It is simple enough to be practiced within a range of scopes including tough, undefined problems.
3. Improved customer retentions – Design thinking is user-centric therefore user engagement is boosted, and customer retention is often kept for the long term.
4. Cost savings and great ROI (Return on Investment)- From a business perspective, getting successful products to the market faster saves companies money and it has been proven to yield a very good Return on Investment (Powell, 2018).

This thesis uses a mixed methodology combining a qualitative approach with a design thinking framework. The research revolves around students who will use the designed prototype therefore using a design thinking approach will be most beneficial due to its flexibility in allowing the researcher freedom to explore different ideas and methods. The qualitative approach will allow the analysis of non-numerical data such as people's opinions and experiences using methods such as questionnaires and observation. This pairs well with the flexible and user centric design thinking.

This thesis presents a comprehensive literature review of motivation and gamification. Analysis of motivation and its effects in education was discussed, on students as well as theories and strategies to increase it. The researcher had further analyse gamification and different game elements that had been used to help motivate and encourage students.

After researching the topics mentioned above, data on the targeted user group was collected by creating an anonymous questionnaire for participants to complete. The researcher had learned more about their targeted audience as well as their needs and what they are looking for in a mobile application. Existing solutions such as Asana and Trello, was studied and compared while noting down how useful the applications are at motivating students.

When the researcher had gathered all the relevant information, it was compiled into one list of requirements which was used to steer the design of the first prototype. The prototype shared similar elements to existing solutions that were seen as useful and helpful to the user however elements of gamification were adapted into the prototype which added a unique layer that separated it from the rest.

When the prototype was complete, it entered the testing phase where the researcher had carried out an iterative process. The prototype was given to a targeted user who then rigorously tested the prototype and provided feedback to the researcher. With the feedback, the researcher iterated on the prototype and a new version of the prototype was created and then tested with another user. This feedback loop occurred until the final product was finished and evaluated.

1.4 Virtual Learning Environments (VLEs)

In 1.3, different methodologies was researched and discussed for use within this project. In this section, Virtual Learning Environments and their use in an educational context for promoting motivation is discussed.

A virtual learning environment (VLE) can be defined as “a computational system connected to a network with the sole function to structure and provide an educational space with access to content” (Adell, Bellver, & Bellver, 2010). It is a space that is designed and structured around teaching and learning with many tools and resources integrated for students to access and use at any time from any place (Firefly, 2005). VLEs are used to enhance the learning experience and educational practices by extending the space of the classroom to a space online that is accessible to anyone from anywhere, good quality VLEs can help students construct their own learning environments and allow them to carry out tasks without needing to rely on a one-to-one contact with a teacher for e.g. submitting finished assignments (Dillenbourg, Schneider, & Synteta, 2002). Teachers can make use of VLEs to give students a platform to access an infinite number of resources that would normally be difficult for a student to get themselves. Resources would include documents, power points, worksheets and more (Filcher & Miller, 2000). VLEs have seen widespread use in a number of universities for their online and blended learning (Onrubia, Colomina, & Engel, 2010). An example case study for a VLE is the Modular Object-Oriented Dynamic Learning Environment or Moodle, a popular platform that has seen use worldwide for its user friendliness, easy to use interface and access to many tools such as forums, chat rooms and tasks (Paiva, 2010). Various researchers have studied the relationship between intrinsic motivation and students using VLEs as part of their blended/online learning experience and results show that student’s intrinsic motivation can trigger and sustain their interest with using a virtual learning environment and positively increase their motivation (Lange de, Suwardy, & Mavondo, 2003) (Fırat, Kılınç, & Yüzer., 2017) (Aluja-Banet, Sancho, & Vukic, 2019). While VLEs have all the tools and are useful for students that are already motivated, they may not have features that are able to motivate students who don’t have the motivation in them already.

Students that procrastinate may not be motivated to use the VLE in the first place so the tools and resources that it can provide end up not being used.

Summary

This chapter presents an introduction and background context to explain the reasoning behind the thesis. The main aim of the thesis is achieved through the use of objectives and research has been carried out with different methodologies to see which one suited the thesis best. In the following chapter, an analytic review of the literature surrounding Motivation and Gamification will be carried out.

Chapter 2 – Literature Review

Chapter 1 provided an overview of the background context, and the aims and objectives were laid out. The methodologies for the thesis were also discussed in depth. The next section gives an analytical review on the literature surrounding motivation and gamification.

2.1 What is Motivation?

A motive can prompt a person to action in specific way or at the very least develop an inkling of inclination for a behaviour. Motivation can be defined as a force or several forces within an individual that push of propel him to satisfy basic needs or wants (Yorks, 1976). It is believed in psychology that motivation can be derived from a tension that results when one or more of our important needs are unsatisfied and a satisfied need creates no tension therefore no motivation. When motivation is defined there are always 3 common qualities that are included (Pardee, 1990):

1) motivation is a presumed internal force
2) that energises for action
3) determines the direction of action

Other definitions define motivation as a process governing choices made by persons among alternative forms of voluntary action (Hammer and Organ, 1978). Duttweiler explained a term, "motivators" and said they are factors that arouse, direct, and sustain increased performance (Duttweiler, 1986). According to Stanton (Stanton, 1983), he explains that there are essentially 3 factors that are the reason why some employees are motivated to work while others are not:

1. Motivation to work varies widely in people
2. In the past decade, there has been a significant change in many employee's attitudes toward work
3. The increase in various government social support programs has contributed significantly to the decline in work motivation in many people

Motivation is essentially a series of processes that can instigate behaviours, give direction to those behaviours, and allow those behaviours to prolong for a period of time (Wlodkowski, 1978). It is possible to derive a pattern that would simplistically explain motivation: ENERGY – VOLITION – DIRECTION – INVOLVEMENT – COMPLETION. On the surface, motivation seems like a simple concept to grasp, an idea that can be explained through reasoning and sense, however once you start to break it down, the complexity of the issue is shown in its entirety. A higher rate of motivation can lead to "better academic performance, a greater conceptual understanding, satisfaction with school, self-esteem, social adjustment, and school completion rates" (Usher & Kober, 2012). This rate of motivation however starts to decline as students' progress through high school as shown in a survey in 2004 by the national research council, 40% of students were "disengaged from learning, are inattentive, exert little effort on schoolwork, and report being bored in school" (Usher & Kober, 2012). In 2006, it was seen that 70% of high school students were unmotivated. These are only a few instances where poor motivation can lead to students giving up on their education (Bridgeland, DiIulio Jr, & Morison, 2006).

2.2 Known Theories on Motivation

In the previous section, motivation was investigated through the perspectives of other disciplines. In this section popular theories on motivation have been referenced and discussed by many authors and researchers.

2.2.1 Herzberg's Theory of Motivational Hygiene

In 1959, Herzberg created a 2-d paradigm of factors affecting people's attitudes about work. His motivation hygiene theory is often called the two-factor theory and focuses on sources of motivation that are pertinent to work accomplishment (Hall and Williams 1986). Herzberg concluded that job satisfaction and dissatisfaction were controlled by 2 different factors: motivators (satisfiers) and hygiene factors (dissatisfiers). The two factors had connected to them a number of elements that were considered strong determinants for job satisfaction and dissatisfaction:

- Satisfiers:
    - Achievement
    - Recognition
    - The work itself
    - Responsibility
    - Advancement
    - Growth
- Dissatisfiers:
    - Company policy
    - Supervision
    - Working conditions
    - Interpersonal relations
    - Salary
    - Status
    - Job security
    - Personal life

According to Herzberg, hygiene cannot motivate and can instead produce negative effects in the long run. An environment that's considered hygienic prevents discontent with a job however this environment cannot lead the individual beyond a minimal adjustment consisting for the absence of dissatisfaction.

2.2.2 Maslow's Hierarchical Needs Theory

Maslow introduced his theory on Hierarchical Needs in 1981 in "Motivation and Personality" (Maslow, 1981) where based off his observations, he saw a general pattern of needs recognition and satisfaction that people generally follow in the same sequence. He created a commonly used pyramid scheme to classify human motives. This system involves 5 categories arranged with lower-level needs on the bottom which much be satisfied first before higher level needs can come into play. The 5 levels are arranged as follows:

- Level 1) Physiological needs: food, water, sex, and shelter
- Level 2) Safety needs: protection against danger, threat, and deprivation. Behaviour which arouses uncertainty with respect to continued employment or which reflects

favouritism or discrimination, unpredictable administration of policy are powerful motivators of the safety needs in the employment relationship at every level (Hamner and Organ 1978)

- Level 3) Social needs: Giving and receiving of love, friendship, affection, belong, association, and acceptance.
- Level 4) Ego needs: need for achievement, adequacy, strength, and freedom. In essence this is the need for autonomy and independence. Status, recognition, appreciation, and prestige. In essence this is the need for self-esteem or self-worth
- Level 5) Self-actualisation needs: the need to realise one's potentialities for continued self-development and the desire to become more and more of what one is and what one is capable of becoming

2 postulates can be derived from Maslow's theory which are: A satisfied need is not a motivator of behaviour and the extent to which lower order needs become satisfied; the next higher order level of needs becomes the most prepotent determinant of behaviour (Ibid). The ultimate need category described by Maslow Is self-actualisation, this belief serves as the basis for the assumptions of McGregor's theory Y viewpoint on motivation which was based on self-direction, self-control, motivation, and maturity (McGregor, 1960).

2.2.3 McClelland's Need for Achievement Theory

McClelland's theory for achieving needs has a close association with the concept of learning, proposing that when a need is strong within an individual, it leads to them carrying out a motivating behaviour to satisfy those needs. In McClelland's theory, needs are learned through the coping of an individuals' environment and since they are learned, the behaviour that follows through is often rewarded and they tend to reoccur at a higher frequency (Gibson et al, 1979). The need for achievement often includes the desire to master objects, ideas, and people. Exercising an individuals' talent can also increase one's self-esteem (Wallace et al, 1987). McClelland's research developed a set of factors which shows a reflection for a need of achievement. The factors are:

1) Achievers like situations in which they take personal responsibility for finding solutions to problems
2) Achievers have a tendency to set moderate achievement goals and take "calculated risks".
3) Achievers want concrete feedback about how well they are doing (McClelland and Johnson, 1984)

2.2.4 Brehm's Motivational Intensity Theory

Brehm & Self (Brehm & Self 1989) discusses the intensity of motivation and goes into detail about 2 areas of motivation: Potential motivation and Motivational arousal. He first talks about past literature and their ideals on motivation. Ach had worked on the will to overcome task distractions and suggested that motivational arousal should increase with difficulty (Kuhl & Beckmann, 1985). Hillgruber noted that "motivation must increase to match the required effort" (Heckhausen et al, 1985). In 1972, Kukla (Kukla, 1972) theorised that a person's intention to try can be shown as a function of a cost-benefit analysis (where benefits are the outcomes) and with benefits held as a constant, the function of task difficulty would increase until a point is reached where the person decides the outcome is not worth the effort. Kahneman offered an

insight into how attentional effort increases proportionally to attentional demand (Kahneman, 1973) and the effects of motivation on attention was previously looked into by Eysenck.

The intensity of motivation can be thought of as the magnitude of motivational arousal at a specific moment. The magnitude of motivational arousal is related to the total effort expended by a person towards satisfying a motive, the effort expended could be spread over a certain period of time however the intensity would be related to a specific point in the magnitudes time. Thus, where you can have a high magnitude of motivational arousal over a large period of time, the intensity could be low however should the magnitude be concentrated in a brief period, the intensity would be great. A comparison they provided was the difference between "moving 100 pounds of books one book at a time or all at once" (Brehm & Self, 1989).

Brehm & Self (1989) discusses the idea of potential motivation; the factors that determine the magnitude of motivation or "the total effort one is willing to make" are to be understood as they set a boundary on the intensity of motivation. They adopt the idea that factors that can affect the effort expended by an individual to satisfy a motive should be considered as "determinants". These factors in general are internal states such as needs (like food deprivation), potential outcomes (such as food acquisition and experiencing pain) and the perception of the behaviours chance to satisfy the needs and outcomes should it be successfully executed. Like other models of motivation, the needs and/or potential outcomes will have varying magnitudes and values and the magnitude of motivation is a multiplicative function of need, the potential outcome value, and the chance of a behaviour to produce the desired effect when properly executed. The model they put forward is to be considered a simple representation of other theories on motivation and it depicts what they call "potential motivation". They call it potential as the conditions to specify motivational arousal are not sufficient or concrete.

The production of instrumental behaviour is what is considered a direct function of motivational arousal as opposed to the satisfaction of needs or the acquisition/avoidance of a potential outcome. The effort needed for the instrumental behaviour is simply not proportional to the needs and/or potential outcome values. They describe motivational arousal as the "mobilisation of energy" and under the assumption that an individual will conserve their energy, the motivational arousal should be no greater than is required to produce the intended instrumental behaviour. When the motive at hand requires little effort, no matter how great the reward or valuable the potential outcome is, the motivational arousal should always be low.

There are upper limits on the capabilities of individuals especially when it comes to instrumental behaviour. When an individual is able to perform the required behaviour, the upper limit is determined by how much the potential motivation justifies the energy required for the task at hand. An analogy they provide puts this point into perspective, an individual who has just eaten dinner, will do very little to obtain a burger however someone who has gone without food for a day would do whatever it takes to get their hand on one. In other scenarios, instrumental behaviour may call on for individuals to exert energy beyond their capacity in which case the motivational arousal would be zero regardless of the potential motivation level. No matter the reward or potential outcome for requiring people to jump 20 feet into the air, they do not have the capability or energy to achieve their motive.

They summarised as follows, potential motivation comes from the needs and/or potential outcomes and the expectation that carrying out a behaviour will have an effect on those needs

and outcomes. When difficulty in the task occurs, motivational arousal is created, and the magnitude of motivation justifies the energy spent towards that task. Should the difficulty of the instrumental behaviour be beyond the individual's capabilities, or it outweighs the value of the potential outcome then the energy expended is zero or very minimal. "The greater the potential outcome, the greater amount of energy that a person is willing to mobilise".

2.3 Intrinsic Vs Extrinsic

In the previous section, a discussion and analysis were carried out on known theories around motivation. In the following section two types of motivation are discussed: Intrinsic and Extrinsic.

It is often discussed that intrinsic and extrinsic factors are seen within job satisfaction (Wernimont, 1966). Since Herzberg's 1959 hygiene theory was released, there have been many attempts carried out to test his theory by the likes of Ewen, Peres, Rosen, Schwartz, Jenusaitis & Stark, 1963. He explains that the results found in their experiments were not supporting Herzberg's theory for example: Ewen's dissatisfiers behaved like satisfiers whereas his satisfiers would behave as intended but also cause both satisfaction and dissatisfaction. Herzberg's satisfiers have been confirmed more often than the dissatisfiers in the studies that took place. His methods and conclusions have been criticised by a number of writers, people like Brayson (1960) discounted his results on the basis of the method used (content analysis of interview data). In 1961, Kahn felt that defensive behaviours and displacement could account for their findings. Vroom and Maier (1961) questioned the legitimacy of his conclusion in that qualitatively different conditions act as satisfiers from those acting as dissatisfiers. They say "There is a risk in inferring the actual causes of satisfaction and dissatisfaction from descriptions of events by individuals. It seems possible that the obtained differences between events may reflect defensive processes at work within the individual. Individuals may be more likely to perceive the causes of satisfaction within the self and hence describe experiences invoking their own achievement, recognition, or advancement in their job. On the other hand, they may tend to attribute dissatisfaction not to personal inadequacies or deficiencies but to factors in the work environment, i.e., obstacles presented by company policies and supervision". Due to the deficiencies, Herzberg's study is questionable and follow up studies have been unable to shed much light onto which different factors of job attributes operate. The purpose of Wernimont's study was to test Herzberg's findings, the 5 major factors of the job itself are the primary determiners of the job satisfaction and the 5 major factors of the job environment cause dissatisfaction. Job related factors are considered "intrinsic factors" whereas environment factors are considered "extrinsic factors". He tests against 4 hypotheses:

- Intrinsic factors are higher than extrinsic factors when a person is exceptionally satisfied
- Intrinsic factors are lower than extrinsic factors when a person is exceptionally dissatisfied
- Intrinsic factors are higher when people are exceptionally satisfied than intrinsic factors when people are exceptionally dissatisfied
- Extrinsic factors are higher when people are exceptionally dissatisfied than extrinsic factors when people are exceptionally dissatisfied

The study found that satisfaction with the job can be high due to high levels on satisfaction with intrinsic factors, and dissatisfaction can be high due to low levels of satisfaction with intrinsic

factors. Extrinsic factors cause both satisfaction and dissatisfaction less readily than it does with intrinsic factors, but individuals are more likely to say they have bad or dissatisfied feelings about these extrinsic factors. Measures of satisfaction with salary and working conditions may show these 2 factors to be dissatisfiers as Herzberg claims but for different reasons than the ones he invoked.

Motivation in college students and them having self-determined and carefully thought-out goals can lead to intrinsic motivation, academic performance, and adjustment behaviours (Conti, 2000). Personal goals have the potential to give meaning and coherence to an individual's motivational experience (Little, 1983; Emmons, 1989, 1996; Klinger, 1996). Choosing autonomous goals to develop important interests and abilities and carefully thinking how to pursue these goals can direct people's lives in a manner that promotes mental health and well-being (Gollwitzer, 1996; Sheldon & Elliot, 1997; Taylor et al., 1998). Not all personal goals grow from interests and hobbies however but are instead rooted from the expectations that have been imposed by others. A study set out to investigate whether students' goals for attending a four-year residential college influenced their experiences during their first semester. In order to feel satisfied with college life, students need to adjust well to the personal and social changes confronting them while maintaining their motivation for their academic work (Astin, 1993; Baker & Siryk, 1984). Research on motivational orientation has suggested 2 types of motivation that underlie college students' academic efforts. Interest value and challenge inherent in their academic work motivates students who are intrinsically motivated. Students who respond to extrinsic forces are motivated by factors that are separate from the work itself, such as earning high grades or satisfying parental expectations. Intrinsic motivation promotes creativity (Amabile, 1983, 1996; Amabile et al., 1994), concept attainment (Grolnick & Ryan, 1987), and long-term retention of course material (Conti, Amabile, & Pollak, 1995). Students that are intrinsically motivated are more curious, more persistent, and show a preference for more novel and difficult tasks than when they are extrinsically motivated (Deci & Ryan, 1985, 1987). While extrinsic motivation may encourage academic effort at exam time, the enduring and genuine interest that come with intrinsic motivation more consistently sustain a students' energy toward academic work (Gottfried, 1985, 1990). These orientations may begin to develop during elementary and high school, but research has identified relatively enduring motivational orientations only in college students (Vallerand et al., 1993; Amabile et al., 1994). The less structured, more stimulating, and demanding college environment has the potential to spark a students' previously dormant intrinsic motivation or to heighten perceived pressure and lead to greater extrinsic motivation. The present study examines whether students' goals for their college experience influence the degree of intrinsic and extrinsic motivation they display toward their college work Results found that students who reflect on their goals for college report higher levels of intrinsic and extrinsic motivation. Students who feel autonomous in their goal pursuit are more intrinsically motivated, less extrinsically motivated, perform better academically, and show improvement in social and emotional adjustment.

There has been conflict that comes when discussing between intrinsic and extrinsic motivation (Bénabou & Tirole, 2003). It is a central theme of economics that incentives promote effort and performance, and there is a lot of evidence that supports this idea (Gibbons, 1997; Lazear, 2000). They are seen as positive reinforcers, however in psychology it is the opposite in that they are seen to impair performance making them negative reinforcers especially long term (Kruglanski, 1978). There is a substantial amount of experimental and field research that shows that extrinsic

motivation can create conflict with intrinsic motivation. In 1975, Deci performed an experiment when college students were either paid or not paid to work for a certain time on a puzzle, those that were not paid had interacted with the puzzle significantly more in a later unrewarded "free time" period than those who were paid. There have been many iterations of design and subject type for this experiment such as Willson, Hull and Johnson in 1981. In similar experiments, similar effects were found in school students in tasks involving verbal skills (Kruglanski, Friedman and Zeevi, 1971), preschool children in activities involving drawing with new materials (Lepper, Greene and Nisbett, 1973). A survey from Kohn (1973) aimed at getting people to lose weight, stop smoking, or wear seat belts, either offering or not offering rewards. Individuals in the reward group showed better compliance at the beginning, but worse compliance in the long run than those in the no reward or untreated controls groups These findings indicate a limited impact of rewards on engagement and a negative one on re-engagement. Other bodies of works have shown similar results in the workplace, Etzioni (1971) argues that workers find control of their behaviour via incentives "alienating" and "dehumanizing". Deci and Ryan (1985) devote a chapter of their book to a criticism of the use of performance-contingent rewards in the work setting. Baron and Kreps (1999) conclude that "there is no doubt that the benefits of [piece-rate systems or pay-for-performance incentive devices] can be considerably compromised when the systems undermine workers' intrinsic motivation.

2.4 External Factors that affect Motivation

Intrinsic and extrinsic motivation was the focal point of discussion previously, in the following section a discussion on the external factors that affect motivation is carried out.

Job performance according to Maier (1955) is a product of motivation and ability with opportunity added as a third factor (Blumberg and Pringle, 1982). He defines work motivation as "internal factors that impel action and to external factors that can act as inducements to action" (Locke & Latham, 2004), it is a key ingredient for creating high performance organisations. Authors such as Klein, 1989; leonard, Beauvais, & Scholl, 1999; Locke, 1997 and more have put forward models for work motivation but none have proven to be generally accepted. Some researchers have complied a framework consisting of many levels that show and discuss the external factors that affect motivation (Sternad, 2013).

Some external factors influence work motivation on the level of an individual. The extent to which a task is perceived as a challenge can often lead people into retaining their interest thus allowing them to learn and grow (Dinibutun, 2012). A central tenet of goal setting theory where peoples' performances are linked to setting specific and high goals. Social cognitive theory says that setting challenging goals and performance standards will create proactive discrepancy and people will want to reduce that through goal-oriented behaviour (Luszczynska & Schwarzer, 2015). A link was proposed between the degree at which a high goal is seen as a challenge rather than a threat and higher levels of performance and adaptation to change (Drach-Zahavy & Erez, 2002). Challenging work also helps people to fully realise their potential which is related to self-actualization, the highest-level need in Maslow's (1943) hierarchy. Challenges in the work itself were seen able to truly motivate people rather than demotivate (Herzberg, 1959). In an effort to more closely investigate the relationship between challenge and motivation, more recent studies emphasize the role of stress. Challenge stress defined as "stress associated with challenging job demands with actual or potential gain" (Boswell, Olson-Buchanan, & LePine, 2004). Positively related to the motivation to learn and subsequently also to learning

performance. Evidence for time pressure as one specific challenge related stressor being associated with more proactive behaviour at work was found by Ohly and Fritz (2010).

Another factor is autonomy, an individual's discretion in deciding on how to achieve a certain goal. A core job characteristic for Hackman and Oldham (1976) which they linked to achieving the critical psychological state of experienced responsibility for work outcomes. Spector (1986) attributed the positive effect of autonomy to employees' control. Latham (2007) emphasized that "the importance of designing jobs that allow autonomy for outcomes such as learning, performance, organizational citizenship behaviour, and satisfaction has been shown by a multitude of empirical studies". Research from action theory shows that autonomy in the form of discretion to influence working conditions and work strategies has significant positive effects on personal initiative at work (Frese, Kring, Soose, & Zempel, 1996).

An important factor to consider for influencing motivation on an individual level is feedback, information that is provided to the individual about his or her job performance. Several theories argue that feedback can have an effect on work motivation. feedback interventions which report on discrepancies towards the standard at task level and which contain cues that support learning were found to be likely to "yield impressive gains in performance" (Kluger & DeNisi, 1996). Feedback comes in 2 forms: task feedback which is directly observable from fulfilling a task, and social feedback which refers to what others communicate about one's performance (Leonard et al., 1999). Fried and Ferris (1987) observed that job feedback affected all 3 psychological states that Hackman and Oldham (1976) proposed in their job characteristics model. Meaningfulness of work, responsibility of work outcomes and knowledge of actual work outcomes. Action theory emphasizes the importance of feedback, especially non-threatening task feedback, and its positive influence on motivation. (Frese et al., 2003) A likewise positive effect of feedback on organizational citizenship behaviour was indicated by Podsakoff et al (2000).

2.5 Different Field Perspectives on Motivation

External factors that affect motivation was discussed in the last section, within this section are discussions on motivation from different perspectives.

2.5.1 Psychology

Researchers have discussed motivation in attaining various goals as well as differing dimensions of motivation. In pursuit of goals whether ordinary or extraordinary, people must perform or follow a series of steps over time to achieve these goals (Touré-Tillery & Fishbach, 2011). A question that has been posed forward and was thought to be important was "how (and why) does motivation change over the course of pursuing such goals?" This is in relation to goals that require the completion of multiple steps over a period of time. To put it into perspective, the example of a chef and a pianist was used to describe how they can stay motivated at the beginning, middle and/or end of their gourmet and musical pursuits. A goal is defined as "a cognitive representation of a desired state" (Fishbach & Ferguson, 2007; Kruglanski, 1996). Over the course of pursuit for a goal, the strength of motivation is studied and according to classic research, it is said that the motivation is strong towards the end of the goals pursuit as people want to finish what they have started (Brown, 1948; Hull, 1932; Zeigarnik, 1927). Recent research has found factors that have influenced the shape of motivation causing it to increase, decrease or create other patterns during the course of goal pursuit.

According to Lewin (Lewin, 1935), motivation refers to the "psychological force that enables action". It is suggested that motivation can manifest itself when a person puts in increased effort and persistence towards a goals desired state. They refer to this as outcome-focused motivation (Brehm & Self, 1989; Locke & Latham, 1990, Miller et al, 1960; Powers, 1973). Another instance for which motivation can manifest itself is when a person has an increased desire to use proper means over the course of goal pursuit. They refer to this as means-focused motivation (Higgins et al, 2003; Steele, 1988). They use an example of a student to put these motivations into perspective, a student needing to complete a series of assignments toward her course, she can invest high or low amounts of energy into these assignments, she can choose to take her time or get them done as quickly as possible, she might choose to put more effort into the details of the work or just cut corners. Each of these decisions that the student makes represents an aspect of her overall motivation and over the course of the academic term, her motivation could fluctuate.

Outcome-focussed motivation increases as distance to the goal decreases and this idea is "rooted in the origins of psychological research". This idea is referred to as "the goal gradient effect" or "goal looms larger effect" and it explains that people and animals will exert a larger amount of effort and persistence towards a goal as they get closer to its end state (Brown, 1948; Förster et al, 1998; Heath et al, 1999; Hull, 1932; Kivetz et al, 2006; Nunes & Dreze, 2006). One of the original tests of these hypothesis involved rats scurrying away in an alleyway, their speed of them running towards food that was left at the end of the alleyway was measured and it was found that they progressively ran faster as they got closer to the food (Hull, 1934). A more recent study showcased the goal-gradient effects on human behaviours. Participants who took part in an online song rating site to earn rewards increased their efforts as they got closer to the end. In doing so, they frequented the site more, rated more songs and the likelihood of abandoning uncompleted ratings were low (Kivetz et al, 2006).

These studies on the goal gradient effect have created a form of physical and mental motivation in which the effort exerted by people can be measured through their speed, strength, and perseverance. This was shown when the running speed of rats were measured for reaching their food (Hull, 1934), or participants persistence in rating songs online for rewards (Kivetz et al, 2006). Persistence was also used as a form of measurement in a study where an actor with a goal of doing 30 sit ups was expected to persist more as they reached the end state of their goal as opposed to be farther from it (Heath et al, 1999).

The ability for the end state of a goal to pull a persons' effort towards it is considered a basic characteristic of a goal-driven process. It was found that active goals can enhance the accessibility for goal related constructs and once the goal has been completed, accessibility is inhibited and the motivation drops below baseline (Förster et al, 2005). In a study where participants were tasked to look through several blocks of pictures to identify a picture of glasses followed by a picture of scissors, it was seen that the accessibility of words related to the goal (the goal being "glasses") was greater before they found the pictures and lower after they had found the pictures.

In "Motivation in Social settings", Brehm's motivational intensity theory and the Law of motivation was discussed (Ach, 1935). They explain that effort expended is determined on the task difficulty and assert that after 1 of 2 points are met, the effort expended is decreased (Gendolla & Wright, 2005). The first point is the difficulty level at which the task is viewed as

impossible, and the second point is when a task requires too much for what it is worth. Imagine a woman challenged to lift an amount of weight. According to theory explained above, if she sees the lift worthwhile and possible the effort, she expends will be proportional however should she see the lift to be impossible or too much effort for what is worth then her effort will be low. Brehm's MIT identifies the upper limit for a person's willingness to succeed and calls it potential motivation. Potential motivation should be a function of success importance which is also a function of 3 variables:

- The value of benefit associated with success
- The performers need for the benefit
- Strength of association between success and benefit attainment

The potential motivation for the female lifter would be greater if she could earn money completing the lift challenge than if she were to earn nothing, similarly if the woman were poor her potential motivation would be great than if she were wealthy as well as if she knew she were sure to be paid after completing the challenge than if she were not sure. There are implications to Brehm's MIT such as performance challenges eliciting greater engagement for moderate difficulty than mild or extremes due to effort corresponding to difficulty when success is worthwhile and possible. Another is the relationship between engagement and difficulty should be moderated by success importance, if importance is high enough to warrant effort expended towards a challenge, then engagement is proportional to difficulty however if importance is low then regardless of difficulty, engagement will be low. A third implication is success importance having no impact on effort when the challenge is considered impossible to carry out. The implications mentioned are all considered applicable to fixed challenges, challenges with a clear standard to reach. Brehm and Self (1989) came to an assumption that if people were presented with an unfixed challenge that had no set goal, then they will strive for the highest performance level. The effort expended should correspond to success importance until maximum effort has been achieved.

Presented in the book "psychology of motivation" the works by Wright and Wiediger (Wright and Wiediger, 2007) talk about motivated behaviours and its interaction with need states, memory and more. Motivated behaviours come from a physiological and psychological desire or need, and these directs an individual towards their desired outcome that would potentially result in satisfying those desires and needs. Desires such as hunger, sex drive and thirst have been studied upon heavily and mapped out (Bear et al, 2007). Higher order motivated behaviours have been found difficult to study such as wanting to achieve, belong, create and be happy. Theories have been formulated to help guide future research into these areas as well as research that includes cognitive theories, expectancy theories and social need theories (Lefton and Brannon, 2006). They use a figure to show off the relationship between need states, selective attention, and long-term memory with the higher the need state motivation, the more focussed the attention is on the stimuli that will provide the satisfaction of that need state and relevant information will be retrieved from the long-term memory.

The word motivation is defined as invigorating and energizing behaviour, with its root word being motion ("to move, a proposal for action"). Having long-term and short-term goals encourages behaviours that are deemed important to achieve specific goals. Behavioural scientists have spent years altering their definitions for motivation and during this process the notion of "what is and what is not motivated behaviour has evolved". In a study carried out by

Sigmund Freud (Freud, 1908), he believed that an individual's nervous system possesses libido or sexual energy and as this energy builds, it requires a release. If the normal outlet for sexual behaviour is frustrated or blocked, the release will take an alternative path which led him to believe that should a person be unable to release their libido energy in "an acceptable way, irrational and self-damaging behaviours may surface". Another researcher by the name of Konrad Lorenz (Lorenz, 1980) came to a similar conclusion and believed in a" reservoir of instinctional energy". Building up over time, the energy is released through normal outlets such as mating with a partner, and should the energy be blocked from release then it may be released through "displaced behaviours" which may look inappropriate. Both of them assumed that once the build-up started, the process could not stop however today it is understood that many behaviours can be cancelled and are never directly or indirectly expressed.

2.5.2 Economics

Previously a discussion on motivation was carried out from the perspective of psychology, in this section, the economic perspective on motivation will be consulted.

Brekke, Kverndokk and Nyborg (Brekke et al, 2003) take a dive into moral motivation and use their own model of moral motivation to collect data on consumers recycling behaviour and voluntary community work. They discuss how consumers self-image of social responsibility might not be akin to their actual behaviour and that economic incentives may have an adverse effect on contributions. Along the similar lines of extrinsic motivation causing adverse effects, Harvey (Harvey, 2005) sought out a similar theme in which he researched the effects of extrinsic compensation on intrinsic motivation and performance. In this article, he presents a principle-agent model incorporating insights from cognitive evaluation theory. He describes the effect extrinsic incentives have on intrinsic motivation as "crowding out" which in this context results in "individuals having greater satisfaction by not being intrinsically motivated". He comes to a conclusion that motivational crowding out (MCO) of intrinsic motivation can occur with 2 factors, the first being related to the object in which the motivation is tied with and the second being the size of the extrinsic incentive.

Transitioning over to motivation in students, Sandra (Sandra, 2002) talks about this topic from a socio-economic perspective, she discussed that efforts have been made to identify strategies for learning, teaching, and assessment but little attention has been paid to student motivation impacts from recent changes in the social and economic context of higher education. Her research took the form of qualitative interviews with 23 students from university who underwent an undergraduate course full-time. Her findings revealed that some students who suffered from family or employment commitments were able to find a balance in their academic life whereas others found little time to study. On the other hand, there were students who had very few commitments outside of their studies but still felt unmotivated or had little time to study.

Blaž argues about the concept of intrinsic motivation and how the concepts implementation has been inconsistent due to competing and mutually exclusive underlying theories that were imported from psychology. he discussed and analyses 3 different economic accounts in which intrinsic motivation had different meanings due to conflicting psychological theories and he discusses the implications this can have on empirical work and incentive-based policy interventions from these differences.

Intrinsic motivation is described as a “cornerstone concept” for economics and psychology and the concept was developed in psychology as part of a critique on behaviourism and was defined as “the motivation for activities that are not means to some further end but an end in itself” (Deci, 1971). Despite the positive relationship found between reward and performance, intrinsic motivation is built around the idea that when an activity is pursued, the rewards may have hidden costs that can in turn be ineffective or even deter performance (Lepper & Greene, 1978). He argues that this theory goes against the law of supply, implying that an increase in price may lead to less quantity supplied which poses an intriguing puzzle for economists. He goes on to use blood donation as an example claiming that the introduction of monetary compensation would result in less blood donations (Mellström & Johannesson, 2008; Titmuss, 1970). Areas that have helped push this hypothesis into economic literature include tax compliance (Pommerehne & Frey, 1992), environmental morale and public virtue (Frey & Oberholzer-Gee, 1997), principal-agent relations (Bénabou & Tirole, 2003) and more. he also described intrinsic motivation as having a role in a sorting mechanism where employers can offer lower wages that the competitive standard to intrinsically motivated workers (Bohnet & Oberholzer-Gee, 2002; Heyes, 2005; Prendergast, 2008; for a criticism, see Nelson & Folbre, 2006).

2.6 Procrastination and its effects on Assignments

In the previous section, different academic perspectives on motivation were showcased and discussed. This section will take a look at procrastination and its effects on students and their ability to work on their academic studies.

Santelli and others explore how procrastination affects assignment submissions, using the perceptions of students and teachers on policies regarding late assignment submission. Online education has seen an increase in growth over the last few decades due to advantages in flexibility, convenience, and having access to a classroom worldwide. The online learning environment can have a large impact on the ability or desire for a student to complete a task on time, and there are challenges they face that are piled on top of other challenges already faced by traditional students in schools and colleges. Feelings of loneliness, isolation and disconnectedness can be elicited from an online learning environment and to have a strong sense of community and instructor social presence can help with student retention which is hard to upkeep in an online asynchronous environment. Policies for late submissions to help students submit assignments on time have become a topic of discussion in higher education due to late assignment submissions being an early warning sign of students Non persistence. Procrastination can be generalised from late assignment submissions and is defined as the intentional delay of a task. This delay can come at any point of the action, whether at the beginning of the task or at its end and while it might be seen as a harmless trait, one of its main results are late assignments. Patterns for assignment submissions can be used as an indicator for at-risk students and course withdrawals.

Procrastination as an area of research has been studied in multiple contexts such as in general and specific for e.g., graduate students and in mathematics etc. (Steel, 2007) however there is little to no literature surrounding computing education. Automatic grading systems are an option that is available to students currently and are still used by teachers for e.g., free open-source Web-CAT (Edwards & Pérez-Quiñones, 2007) (Edwards & Pérez-Quiñones, 2008) provides online unit testing which can give students a testing report upon code submission. Another example is Submitty (Maicus et al, 2020), (Milanova et al, 2018) which is an online

grading system that offers testing of programming assignments with instant feedback for students. There are penalties for excessive submissions but in general students are free to submit as much as they would like. Another example is OK an open-source system that when provided a snapshot of the students code it provides targeted feedback (Sridhara et al, 2016).

Procrastination can lead to missed classes and assignments resulting in lower grades, additionally work quality and accuracy is reduced to the pressure associated with completing an assignment on time. it was found that students in an online environment procrastinated more on assignment submissions compared to traditional face to face environments. Online learning environments place a high demand of self-regulation onto students, a trait found in effective learners. Procrastinators not engaged in participation with studies is due to a lack of self-regulation. “Procrastinators in e-learning tended to perform worse than non-procrastinators but also that the negative relationship between procrastination and achievement in the e-learning environment was stronger than that in the traditional learning environment”. When students post late into an online class or submit assignments late, they have a higher rate of being unsuccessful overall as the onset of procrastination is formed early on. Research over the last few decades has shown there to be individual factors that contribute to problem of procrastination heavily. Although they vary from student to student, other external factors can cause additional challenges such as family and work obligations. The average age of online learners are typically 10-15 years older than traditional students, since online students have jobs outside of the educational life, the convenience of an online learning environment is far more appealing. Online students often face difficulty with juggling expectations at work, family responsibilities, personal time, and schoolwork; motivation within students can also fluctuate due to external factors such as financial problems, family distress, employment status and more. Some adult students feel that deadlines were not made with them in mind and are not supportive of them with their additional responsibilities, this leads to them reducing priority on their assignments and ultimately procrastinating from completing the work, feeling justified in doing so.

Another possible reason for procrastination is the characteristics of an assignment, this study related tasks that are given to students could elicit student delay in submission. Students starting on, working through, and finishing off assignments have a high predictor in task aversion which is defined as a degree of unpleasantness, having perceptions of boredom or uninterest that a student would associate with work. Guilt gained from students by avoiding necessary tasks can lead to individuals prioritising alternate activities and therefore strengthening procrastinating behaviours. Another factor associated with procrastination is the level of task difficulty, its believed that on both ends of the spectrum whether it is too challenging or not challenging enough, both can lead to procrastination. Additional factors such as fear of failure and insecurities can be linked to the relationship between student and teacher. The ability to teach or a lack thereof can also have a large impact on assignment completion, it was found that procrastination and teacher organisation have an inverse relationship to which effective teachers provided a learning environment that made it easier for students to organise and plan their work effectively. A lack of teaching ability and coaching can lead students with insufficient direction. Furthermore, teachers that set clear and fair deadlines reduced the likelihood of a student to procrastinate as opposed to students who self-imposed their own deadlines. Teachers that make them feel “absent” to the students can further the social divide between

them and make them feel disconnected as teacher presence and a lack of social interaction can have a negative impact on student persistence and retention.

There are perceptions toward leniency for late assignment submissions that have a dividing opinion, some teachers feel it is unfair to give leniency towards late submissions while other classmates work hard to submit their assignments on time. Some universities allow their teachers independence in how they enforce the late penalties however are requested to not be any stricter than what is already stated within policy, teachers may choose to deduct less points per day the assignment is late or allow students to submit late with no late point penalty. Teachers having different approaches to applying the late penalty and giving students "grace" on their assignments could potentially confuse students on their own personal assignment completion and submission practices. Teachers are often battling their own moral and ethical issues to which neither have an easy solution, one dilemma they have centres around whether they should accept late submissions, this is due to teachers at a collegiate level must always decide whether to accept late submissions and whether they should be graded the same as submissions that were on time. To support the teachers and students, universities have parameters in place on what work can and cannot be accepted as well as consequences but the topic of late assignments submissions at the collegiate level to this day still remains controversial. Policies for late assignment submission have purpose to provide transparency to teachers' expectations while also removing any ambiguity from specific situations; however, understanding the policy can be difficult for students as it was postulated that the number of policies surrounding late submission at one university numbered similar to the number of teachers employed there. The most common policy is allowing leniency in late submissions with teachers enforcing a small percentage penalty onto the late submission. In most cases, teachers will implement a 10% penalty per day for assignments that are submitted late after their due date. Additionally, there are policies that adopt views on both sides of the spectrum for e.g., teachers can adopt draconian policies and allow no leniency whatsoever therefore prohibiting late submissions, this approach is beneficial for teachers with large class sizes however this may be viewed by students as unfair and too strict. On the other side, some teachers choose to enforce no late penalties and therefore late submissions are accepted, this approach is believed to be effective in higher level division courses with smaller class sizes but its use in lower-level division classes should be cautioned as this can cause a rampant increase in late submissions and workload for the teacher.

Another policy put into place to deter late assignment submissions is a predetermined, university-wide, late point policy which will inform teachers and students on the deduction of points per day an assignment is submitted past its due date. Whether this will reduce the likelihood of procrastination is uncertain however this may motivate students to try and complete their assignments before their deadlines. This will also provide a consistent policy across all modules and courses for students to follow. It was found that students who do not miss an assignment deadline may also be more likely to continue on with the course and that early assignment submissions tend to lead to higher grades overall. Santelli et al. goes on to mention 5 key criteria that they have identified that should be taken into consideration when creating an effective late assignment submission policy: course material delivery, consideration of student needs, future preparation, grading that reflects mastery and the value of time spent on grading and assignment. The balance between these 5 priorities will change depending on the course and assignment given such as computer science assignments, they are prone to

unexpected complications such as errors in code that require a long time to resolve. He points out that while there are many available research studies on self-regulation and procrastination of online students, there is a lack of information available on late point policies that are used by teachers on college level students. There is also a lack of research surrounding the varying levels of perception on flexibility surrounding late point policies. He poses 2 questions: “What do online students think about a university late point policy and changes in instructor implementation of said policy” and “What ways do late policies influence self-regulation in online courses?”.

Martins and Shaffer sought out to research the effects of different interventions and solutions to try and tackle procrastination in programming projects. It is a common problem within courses that are programming intensive that students fail to complete their programming assignments by the end of the deadline. One hypothesis that’s being suggested by teachers is that students lack the time management skills, or the commitment needed to complete their assignments despite having all the necessary programming skills. Procrastination is often used as an excuse by students with 70-95% of undergraduates having procrastinated on coursework to some extent whereas 20-30% of undergraduate students have shown severe procrastination behaviours (steel, 2007). They defined procrastination as a way “to voluntarily delay an intended course of action despite expecting to be worse off for the delay” (Ibid, 2007). The term “negative procrastinators” is used to define those who procrastinate to the extent that they will experience negative consequences in their life due to those delays. Students that procrastinate in STEM-based disciplines with project-based learning activities may be at a greater risk, projects that are due in 2 or more weeks are more likely to see procrastination behaviours from students due to the deadline being so much farther away. This however makes it more dangerous to delay the work as that would lead to less available time to complete the work should the student find the project requiring more effort than expected and less opportunities to ask for assistance should unexpected difficulties arise. In programming courses specifically, it is said that a quarter to a third of students are unable to complete any multi-week programming project.

In a study previously undertaken by Edwards et al, they looked at 1101 Computer Science students over a period of 5 years (Edwards et al, 2009), and observed the academic performances of students who performed well and poorly in work. Using a within-subjects comparison, they looked at the differences between when students had started their work and found a correlation between the start point of students work and the quality/performance. The earlier a student starts their work; they are significantly more likely to achieve a higher-grade performance than if the work was started later. While procrastination has been a problem throughout education, it has still garnered a lack of understanding. The most notable research on this phenomenon was done by Steel in 2007 who published a meta-analysis of procrastination. He defined procrastination as a “prevalent and pernicious form of self-regulatory failure.” There has been some research that indicates procrastination as individual personality trait. (Steel, 2007; Lay, 1986; Norris et al, 2008) The procrastination scale created by Tuckman (Tuckman, 1991) was used in this study to measure students’ procrastination tendencies. Several potential causes of procrastination have been brought up however it is mainly seen as a failure of self-regulation. Klassen et al carried out a study involving 456 undergraduate students and found that each individual’s view of their own ability to self-regulate was a strong predictor for procrastination (Klassen et al, 2008). Tuckman found that the inability to overcome procrastination tendencies might be related to the transfer of

responsibilities between teachers and parents to the students over the period of their school years. This transfer peaks during the college years and so he theorises creating techniques that can assist students in their own learning such as providing them with the information that they need such as the appropriate progress needed to complete a task successfully.

Many solutions and techniques have been proposed to try and combat procrastination, the most effective solutions have been shown to be courses or workshops that focussed on time management strategies (Tuckman, 2005) however these are costly in terms of time and manpower. The ideal solution would be applicable on a larger scale and across a wide range of courses with hundreds of students. This paper focussed on 3 interventions that were designed to require very little manpower and class time, so they were able to be used in large courses. The interventions were Active reflection writing tasks, schedule sheets, and situational awareness alerts which would describe students' performance relative to their expectations. They examined the effect these interventions had on students' submissions times to an automated grading system as well as when students had finished all of their work. The results they had yielded shown that 2 of the interventions (the active reflection and the schedule sheets) did not provide sufficient evidence of a significant impact. However, the email alerts showed a significant increase in the number of early submitted assignments as well as a significant decrease in the number of late submitted assignments. Further examination of the relationships between time of submission and quality of work/performance re-confirms the fact that late submitted assignments score lower and will contain more bugs as opposed to work completed early which scores significantly higher.

Hussain & Sultan (Hussain & Sultan, 2010) provide an analytical view of procrastination among university students. Procrastination often leads students to postpone and delay their studies therefore becoming self-excusive and ignorant of their academic responsibilities during their entire degree. This behaviour seems to be a common practice: they delay in preparing and submitting assignments, presentations, projects and even examinations. The term procrastination is often described in education as "the delay in academic activities. It may be intentional, incidental and/or habitual but significantly affects learning and achievement of university students". There are however different types of procrastination that have been described by other scholars such as realistic, unrealistic, spiritual, chore, dream, behavioural, decisional, and meta-cognitive (Morelli, 2008; Schmitt, 2008; Letham, 2008). These all types of procrastination slow down the performances of students leading them to become careless, irresponsible, and lazy. At first glance, procrastination appears to be a tendency, attitude or behavioural trait which was described as an "indecisive state lacking in will power and vitality to do work" (Shah, 2000). Students end up leaving their work for another time as opposed to doing it right there and then, this may end up resulting in failure throwing students into a state of emotional disturbance (Milgram, 1991) affecting their personality traits and their learning. It was found that procrastination affects many aspects of students such as their self-efficacy, self-actualization, distractibility, impulsiveness, self-control, and organizational behaviour (Steel, 2008).

Students become lazy and over time they build this delaying behaviour within them; they will feel hesitation or fear when in a position to take initiative or to start work. A number of primary and secondary problems were found by researchers to be a result of procrastination for e.g., low performance and achievement as well as increased physical and psychological problems

(Ferrari & Pychyl, 2008), anxiety (Lay, 1995; Onwuegbuzie, 2004), irresponsibility (Rivait, 2007). There are multiple factors that have contributed to students procrastinating in their studies, particularly a lack of commitment, lack of guidance and encouragement, lack of time management skills, emotional stress, social problems, overconfidence, and illness. As an attitude or behavioural trait, these are commonly associated with a lack of communication skills, inappropriate learning strategies, low performance and achievement, low/high difficulty assignments, anxiety and emotional stress, low self-efficacy, and a low self-control (Elmer, 2000). Students often procrastinate when they are racing against the clock and are unable to meet performance expectations within a certain period of time (Ferrari, 2001; Ferrari & Pychyl 2008). Some students end up becoming accustomed to delaying their work with 20% of students having this behaviour become routine and turned into a habit (Kliener, 2008). This was further backed up by Goode (Goode, 2008) where longer deadlines allowing for leisure time and co-curricular activities actually promoted procrastination. Procrastination can have an adverse impact on students' personality traits, their willingness to learn and performance at almost all levels of study across all subject areas. It was concluded that procrastination at a high level can lead students being unable to regulate and organize themselves to achieve their academic goals which end up leading to depression, anxiety, and stress (Essau et al, 2008).

Procrastination is not affected by gender and has been found to be equally as effective on both genders at deterring from academic study (Akinsola et al, 2007). Williams et al (Williams et al, 2008) studied the psychological effects of procrastination such as emotional instability and mental stress, they found that there was a correlation between procrastination and academic stress with students and that as self-compassion increased their procrastination tendencies decreased. As well as not being gender specific, procrastination might not also be age-specific, or a trait picked up during your growth but rather it is a trait found in all individuals. University students in particular will often show this behavioural trait as found in a study by Schourwenberg et al (Schourwenberg et al, 2004) where over 70% of students in North America have shown some form of procrastinating behaviour. This is further backed up by a study from Goode (Goode, 2008) as they found that 70% of students and 20% of the general population had shown procrastinating tendencies in their daily routine. These tendencies may develop into a behaviour as the individual's age increases leading to associated problems. There is a close relationship between procrastination and increasing age as found by Yaakub (Yaakub, 2000) where younger students shown more procrastinating tendencies whereas older women showcased anxiety problems (Anthony, 2004). Different percentages of students who had shown procrastination tendencies had varied between 46% (Solomon & Rothblum, 1984) to 95% (Ellis & Knaus, 1977). Other problems that can stem from procrastination can be physical, emotional, and mental. Embarrassment and inferiority complexes can arise among students as found by Thompson et al (Thompson et al, 1995) who found a negative relationship between ego and procrastination. Students' confidence levels and their motivation to complete a task can lessen (Steel, 2007) which can affect sleeping habits, dieting and the motivation to exercise (Sirois & Pychyl, 2002). This can lead to increased rates of smoking drinking and other unhealthy conditions such as digestive ailments, insomnia, and the flu (Adkins & Parker, 1996). These can further lead to increased stress, fear and worry creating self-doubt and shame within the individual. This can raise anxiety levels and reduce their self-esteem to the point that it can affect their motivation to achieve goals (Hoover, 2005; Scher & Nelson, 2002). A lack of self-esteem and depression will continue the cycle of alcohol, cigarette and caffeine use which reduces the ability for an

individual to take care of themselves and maintain healthy habits such as exercising and dieting (Goode, 2008).

2.7 Motivational Strategies in Education

In the previous section the topic of procrastination and its effect on assignments was discussed and, in this section, motivational strategies used in an educational context are outlined and examined in detail.

Wlodkowski (1978) in "Motivation and Teaching: A practical Guide", shares his perspective on the topic and ideas on how the problem can be tackled. He explains that within students, it takes only one thing to go wrong for the entire process to come to a halt. He asserted that there are no "miracle methods" or universal answers to tackle motivation. He defined motivation as an "obstinate, ambiguous creature that stubbornly resists precise definition" but he further elaborated that it can be simply described as processes that create behaviours, gives them directions and meaning, allows them to persist and eventually leads to a choice of preference.

ENERGY -> VOLITION -> DIRECTION -> INVOLVEMENT -> COMPLETION

Wlodkowski talks about misconceptions and myths about motivation, there are many that surround the topic, but he singled out 5 specific myths and goes into detail about them. The first myth is:

- "Students that don't take part in activities or carry out assigned tasks, they are considered unmotivated"
    - Students have the motivated energy however the energy has no direction or is directed towards something else and more often than not they are directed towards talking with their friends or looking at their phones.
- The second myth is "Teachers motivate students"
    - No one can motivate anyone, incentives can be provided, allow development, and match students with their interests but we cannot directly motivate, people are responsible for their own motivation.
    - If teachers were responsible, students would become no more than puppets, dependent on their teachers that pull the strings and unable to take any responsibility or pride in their decisions
- The third myth is "making students learn is more important than getting them motivated to learn"
    - Students being forced into learning through intimidation, punishments or having their desires taken away can lead to more harm than good long term. The longer students spend in school, the more likely they will be turned off from school.
    - There are students of varying intelligence, some who want to learn but cannot and some who don't want to learn but can
- The fourth myth is "threats can facilitate the motivation to learn"
    - Teachers will use threats as a last resort and go back to the ways they had experienced and while threats do end up causing students to do the work, it ends in resentment and mistrust towards the teacher. This leads to a cycle of

slow learning, sloppy work and teachers are prone to threaten more and cause more frustration

- The fifth and final myth is “learning automatically improves with increased student motivation”
    - He claims there is no evidence to support this statement and that there are many factors that have an effect on student motivation such as type of learning, type of task, cognitive style of learning, type of setting and many more.
    - Learning is “not linear, there are peaks, valleys and plateaus”
    - The focus should be on the performance of the students rather than worrying about their end product

The views discussed above seem to share similar views with Lumsden (Lumsden, 1994) who also tackles motivation within students however they put forward strategies that they believe will help tackle motivation. The strategies Lumsden introduces are:

- Involving students in the learning process
- Relate content to student experiences
- Assess students’ interests, hobbies, and Extra Curricular Activities
- Work on verbal delivery and body language to show enthusiasm
- Make lessons more fun and relatable

Lumsden claims that children are often ability focused or task focused, the former focussing on the success of the performance and how well it compares to others whereas the latter focussing on the mastery of their task or “journey” rather than the outcome. Lumsden says future learning practises should prioritise teaching children on focussing on the journey rather than the outcome. Giving positive praise and feedback on students work despite not delivering what was required of them can be helpful but warns that too much of this or done for tasks that require very little could end up creating problems for them instead and show indications of inability. This is more prevalent in older children. Giving students too much choice in their tasks and activities can lead to students shunning challenging tasks as they are afraid of how they will stack against other students. This correlates with Gendolla and Wrights (Gendolla & Wrights, 2005) work on motivation in social settings where they discuss Brehm’s motivation theory on effort expended depending on challenge difficulty. When they see a challenge as impossible the effort expended is low. Being told to “try harder” can have the opposite effort as intended. Lumsden highlights 4 key points to help tackle motivation:

- **Maintain students’ expectations of success**: teach children that success takes time and will often include confusion and/or mistakes but persisting in your endeavours will lead to success and often mastery of the topic
- **Supply extrinsic motivation**: teachers can use extrinsic incentives to reward successful performance in tasks however they should be careful as to not be reliant in them as this could lead students into doing only the minimum for the rewards
- **Capitalize on existing intrinsic motivation:** try to create tasks that take into account students’ interests, give lessons a fun twist and allow students opportunities for feedback
- **Stimulate student motivation to learn** students often feed off the energy of their teachers, if they are not enthusiastic, the students will be less so. Treat them as if they

are already eager learners and be mindful of how you present your body language and delivery of information

Gregory and Garcia (Gregory & Garcia, 2009) say that students have an expectation of using coursework assignments to help develop their time management skills and should be using them to "measure indirectly the capacity to manage time and withstand chronic stress" (Brown 2001). They use Loughborough University as an example case and mention that its students are given freedom and independence from their first year onwards and with those freedoms, they are expected to manage their own workload and time. As students' progress with their degree, they are given even more freedom and independence and with this, they set deadlines accordingly to allow students flexibility in how they choose to approach their workload. Usually, these deadlines are set as late as possible. Students' experience suggests that they often struggle with managing their workload and the decision to choose which assignment is done first and when is controlled by the deadlines set. Coincident deadlines are often a source of problems according to students and they suggest that longer deadlines will lead to more late submissions due to students often forgetting that they have an assignment that is due.

A solution that has been suggested included assessment regimes that would push for smaller exercises to be submitted regularly to help with engagement and performance (Russell, 2005; Russell & Bullen, 2005) however this has several pushbacks. One pushback mentioned how this could reduce student responsibility for their own time management and could be "viewed as compensating for students' deficiencies" (Thomas et al, 1991). Another pushback suggests that this solution would lead to more coincident deadlines or less time for students to complete these tasks should it be implemented into multiple modules. Despite the pushback, there has been evidence found that supports the notion "fewer summative exercises can be beneficial" (Gibbs & Dunbat-Goddet, 2007). From this, 2 schools of thought can arise: summative assessments should be as little and often OR large and less often. Evidence from their experiments supports the fact that students will use deadlines to control what assignment is done first and when however overall students do prefer long submission deadlines as this will give them time to decide on their approach to the assignment. Some students mention that problems encountered during their earlier years of the degree give them motivation to improve on their time management skills. Late submissions according to students is due to the fact that they need time to evaluate and discuss with their peers about the problems they need to solve. In the long term, long deadlines are beneficial for the educational process however attention should be brought to supporting good time management and a culture of peer support.

Cavanaugh, Lamkin and Hu explored the use of a generalised checklist to see if it could improve student assignment submission times in an online course (Cavanaugh et al, 2012). While their focus is around online education, what they provide in terms of solutions towards late submissions is still valuable and relevant to this thesis. They explained that online education has become more commonplace within higher education and that it provides a dynamic and fluid environment for pedagogical innovation. Students who do not have much experience with online education tend to fall short of their deadlines and fail to submit all of their assigned work or are missing online elements from their assignment. Questioned around this topic, most responses from students were the same in that they had forgotten or overlooked these elements in the assignment. It was found in 2007-2008, 20% of undergraduate students and 22% of graduate students took online courses in the US [3]. Online learning environments require more self-control and need a proactive learning approach in order to gain knowledge and

acquire new skills. “An area that lends itself well to self-regulation is distance learning… self-regulation seems critical due to the high degree of student independence deriving from the instructors’ physical absence” (Schunk & Zimmerman, 1998). Students have many reasons to choose online learning courses such as convenience and better access, their needs extend beyond the content, however.

Elements that provided an effective online learning course were identified including learner-centredness and constructivist project-based learning activities [5][6]. Despite students reasoning for choosing online learning, there are problems they face such as lack of time and environment management skills or mismatch between their interests and the structure of the course (Osborn, 2001), (Chyung, 2001), (Kember et al, 1991). Researchers have identified strategies for self-regulatory as predictors for achievement in online education (Eom, 1999), (King et al, 2000). Self-regulation has been defined as “the self-generated thoughts, feelings, and actions that are planned and adapted cyclically to the attainment of personal goals” (Zimmerman, 2000). Additionally, it was identified within adult learning principles that adults value an economy of effort and like to use their time effectively (Knowles, 1984), (Knowles, 1992). In order for online learning to be effective, keeping up the habit of submitting your project on time must be maintained and failure to do so can be damaging to their learning and possible success on the course. Generalised checklists had the objective of helping students remember their online project elements of their assignments, assisting them in their planning and help them user their time more effectively to try and submit their projects within the allotted time frame.

There has been more research that supports the fact that self-regulation can be used as a predictor for academic achievement (Ley & Young, 1998), (Pintrich & Groot, 1990) and that it has had a positive effect on students’ motivation (Lan, 1996), (Zimmerman, 1996) including the use of learning strategies (Lan, 1996), (Schunk & Ertmer, 1999). He describes an experiment that was taken by Lan in which he examined the effects of self-monitoring on students learning strategies, motivation, knowledge representation, self-judgement, and the performance on the course. He split students into 3 groups: 1 for self-monitoring, 1 for instructor monitoring and the other as a control group. His results showed that the self-monitoring group had outperformed the other 2 groups in all course exams and the students had employed more self-regulating learning strategies and shown a better understanding of the course content. (Lan, 1996). This study’s purpose was to examine the effects of a generalised checklist on assignment submission times and the experiment was carried out with students in an educational leadership program targeting web-based sections only. The checklist was designed as a tool to help make it as explicitly as possible to the students of all the assignment components. The ideal solution should offer “the possibility of verification but also instil(s) a kind of discipline of higher performance” (Gawande, 2009). They will also explore the development of teachers’ personal practical knowledge on generalised checklists within an online educational context. The generalised checklists used in this paper were directed towards students as a self-monitoring tool.

Cavanaugh et al had found that students who received checklists turned in their work two to five times earlier than students who had no checklist and that the reduction to delay was meaningful to teachers as it had reduced their additional workload associated with late submissions. Students with checklists were on average one day late with submissions whereas other students in the control group were on average 5 days late, by the end of the 5 days,

teachers had moved onto other course material and having to return to previous content resulted in additional workload. The generalised checklist reminders had served as a way to break down complicated problems that students were facing in their online sessions into smaller, more manageable tasks. They go onto specify that more research is required to validate this solution by testing it with other age groups and degree programs. The focus target of this study were graduate novice online learners so other user groups such as online novice college and high school students would be beneficial. Another reference for future research was the use of generalised checklists as an action trigger, which is defined as "a plan to initiate an event, such as the time and place a student will complete an upcoming project." They have been found to be effective in motivating a student to action, a study found that the use of an action trigger resulted in 75% of students completing and submitting their assignments on time compared to 33% of students completing and submitting their assignments without an action trigger (Gollwitzer, 1999).

Sulik and Keys take a look at the policies surrounding late submissions and even though it is not the theme of focus for this project, it still provides information that is useful towards this project. The idea that deadlines will help students learn and grow are firmly rooted into the beliefs by teachers', and this is shown with late assignment policies being more prevalent in courses today (Sulik & Keys 2014). Despite the implementation of late policies everywhere, the problem with students submitting assignments late still persists and the opinions of teachers on late submission is divided and unique with each one shaped by their own experiences, teaching philosophies and institution. Some take a lenient approach and believe that assignment results should be reflective of ones learning journey rather than their ability to submit on time and each case should be considered individually (Aldrich & Lowman, 2015) (Sull, 2014), On the other hand, some teachers see time management as an important skill to learn for the future and professional work (Korstange, Craig & Duncan, 2019) and some prohibit late work altogether (Campana & Peterson, 2013).

There have been some solutions that have been suggested by others to create a fairer system such as using smaller penalties more frequently (Bosch 2020). Many teachers use the standard late penalty system with a 10% penalty applied on late submission and a further 10% added for every 24 hours that passes by before submission, some students have commented on this system saying it is being unfair and there should be leniency towards submitting an assignment a small time after the deadline for e.g., 5 minutes late. Students have a tendency to skip class altogether in order to focus on submitting an assignment on time, this decision can have a knock-on effect on later assignments as they will have missed important information in the lessons they did not attend. A modification was developed to the late policy to help offer students more flexibility and will better reflect their student engagement with the learning process. The "Life Happens Waiver" was added onto the late policy and was used alongside the first major assignment for each course, the LHW understands that in reality "sometimes life happens, and despite our best intentions we can't complete an assignment as planned". It will allow students up to a 48-hour grace period per student once per semester with no questions asked and is not linked to any specific assignment. There are reasons as to why this process has been formalized as opposed to considering each individual extension request, research on the experiences of college students have shown that universally, they are not likely to reach out to teachers for help (Soria & Stebleton 2012) (Winograd & Rust 2014).

Working class students and those of ethnic descent may experience stereotypical threat and are less likely to see teachers as "interested" in supporting students (Winograd & Rust 2014) (Terenzini et al, 1996). Acknowledging that "life sometimes happens" you de-stigmatize the notion of asking for an extension and you also remove any reasoning for a student to try and explain to the teacher any personal circumstances to justify an extension. Having the LHW in place allows for a students' ability to recognise and navigate through obstacles grow and this ability becomes more important than the obstacles themselves. The LHW also relieves late workload on the teacher and spares them from having to make the difficult decision of deciding which extension request was "good enough" to warrant. The LHW has been proven to be useful as shown by changes in student behaviour such as students coming to class despite not completing the assignment due that day, they avoid the risk of setting themselves back with future assignments. They have an open line of communication between student and teacher to communicate worries in the case of a student going off track, having a combination of the late policy and the LHW or as described "firmness and flexibility" provides students with structure and they are empowered to take charge of their learning journey deciding on a day to day basis whether to use the LHW or choose to hang onto it "just in case".

Bouvier et al (Bouvier et al, 2021) discussed his solution to reduce late submissions through the use of an overnight feedback system for students working on their programming projects. Computing teachers tend to lament their students' unwillingness to start on their programming projects early however there are many possible reasons for this type of behaviour. Some students prioritize other course projects due to earlier deadlines, other may prefer to attend recreational and social activities and some would leave it late due to overconfidence or fear of failure. Students that are new to computer science world would be under the misunderstanding of "its ok to have some grammatical errors in my work" or "its ok if I don't fully complete the work" however what they don't realise is a single grammatical error in a programming project could lead to a failing grade. With this in mind, it's understandable as to why students may struggle with submitting projects on time. in addition, students lack the knowledge of programming in a different language, they lack the experience of knowing how long it takes to write a program and when writing a program is fully complete. These factors often lead to procrastination which can lead to late project submissions and lower grade performance which in turn results in greater levels of stress for the students (Tice & Baumeister, 1997).

There are many commercially available tools that offer real time feedback on programming assignments with different scopes and capabilities. What they all have in common is to provide immediate feedback to students whenever they want with unlimited submissions. The downside to these types of systems is the ability to be abused by students who would knowingly submit random code edits for debugging purposes. Concerns were brought up on the fact that students can have unlimited submissions with immediate feedback on whether their work is correct or not and this can have a detrimental impact on the quality of their project. It was reported that "students do rapid fire submissions in response to errors reported by auto graders, largely ignoring design issues" (Kumar, 2018). This becomes more problematic closer to the deadline when students are rushing to get their work done on time. An investigation carried out by Edwards et al. (Edwards et al, 2015) showed a variety of different ways to motivate students to start earlier on programming projects. 2 of the solutions shown yielded no improvement towards student assignment submission times however one solution did. "Email situational awareness alerts showed a statistically significant reduction in late submissions (23% fewer on

average)" (Edwards et al, 2015). These alerts were emailed to students to inform them of their progress compared to previous student progress based off of Web-CAT data. An earlier discovery showed that "submission rates for students (using automatic feedback) go up dramatically as the clock runs out, and students end up not producing a well thought out solution" (Edwards & Perez-Quinones, 2008).

Motivated by this, Irwin, and Edwards carried out an experiment in which they throttled the availability of Web-CAT feedback to reduce procrastination. This was based off a "limiting consumption" technique found within the mobile games industry to promote engagement. They wrote "our experience suggests a modest but significant decrease in students turning in assignments late" (Irwin & Edwards, 2019). Bouvier et al attempted to experiment with a throttled-feedback system however a feedback system which they could control the availability was needed to try out this system. While little is known behind the efforts for students to procrastinate on their projects, there is little doubt in some students' project performance and consequently, learning is a victim of procrastination. On the other hand, there is little evidence to disprove that an earlier start could negatively impact a student's learning. When designing their overnight feedback system, they note down 4 goals: help students succeed in the project, motivate earlier starts, avoid encouraging "all-nighters" and not be a burden on the teacher despite the dozens of student submissions. Achieving the first goal can take multiple different paths including individualised feedback on their overall design and/or code however keeping the fourth goal in mind would limit the design to something with a level of automation whether full or partially. The second and third goals go hand in hand which will influence the timing of the feedback's availability. Making the feedback available only once per day will lead to a clear relationship between deadline and number of opportunities for feedback. the student will have a 10pm deadline for their submission in order to receive feedback by 10am the next day. Having an evening submission time as well as a delay to the feedback received should reduce overall all-nighter programming sessions. Their results found that late submissions dropped from over 30% to less than 5% achieving their goal however they don't claim this as the end of the discussion but "a step along what appears to be a promising path".

List of Requirements for Motivation

Previously a review of existing literature on Motivation and a wide range of topics within the subject was carried out, everything learned is believed to be useful in guiding the design process for the prototype will be compiled into a list.

From the motivation literature, the following ideas and values were learned:

1) Humans become motivated when they have needs that require satisfaction for e.g., Hunger
2) When people face adversity, they are motivated to become better than they were
3) When the adversity they face becomes too difficult, their motivation drops to nought
4) Having self-made goals can lead to long term intrinsic motivation
5) Monetary rewards and short-term gain can lead to extrinsic motivation
6) The closer people are to a goal, they more motivated they become to achieve it
7) People want to have feedback on the work they expend
8) Peoples' interests can drive their motivation

9) Having small goals that are incremental and easy to attain can lead them to be motivated

2.8 What is Gamification?

A study was carried out on motivation and the scope of the study was narrowed down until the focus was centred around education; within the next few sections, the literature on gamification will be studied and analysed.

"The application of gaming metaphors to real life tasks to influence behaviour, improve motivation and enhance engagement" (Marczewski, 2013). To simplify, it is making a task more interesting using gaming mechanics and gaining a reward for completing said task. Such rewards could range from trophies to the fun gained when undergoing the task. The concept of gamification was coined by Nick Pelling (2011) around 2002 however recently it has garnered more attention due to a generation of people who "grew up around video games entering the workforce".

The importance of gamification can be explained through the use of an example which involves a television programme called Super Nanny, a show about a nanny named Jo Frost to help bring discipline to families with kids that are considered out of control. Miss Frost introduced the concept of the reward chart and the naughty step. While negative reinforcement with the naughty step was frowned upon by adults, the reward chart was considered to be very effective whilst being "wonderfully simple". Children would be rewarded with stickers upon completing their chores, doing their homework and being tidy and should they earn enough stickers they will earn a treat. She had introduced to the world the concept of gamification of discipline. As children slowly learn that behaviour is linked with reward, they will grow an expectation of success being linked to reward. This will lead to a "generation of gamified workers".

The idea of gamification has garnered an interest from teenagers about how games could make a better work force. World of Warcraft, a popular online game can be used to explain about how games could relate to the real world. One of the main aspects of WoW is making money which can be earned in many different ways however initially it is earned by completing missions which are fairly simple and mundane. The money you earn can be used to buy or create new things which are then used to achieve more goals and make more money. The basics of business are being taught to these people through WoW, to put it simply, spend money to make more money. The difference in this however is that the simple and mundane missions are considered fun by the people playing. Gamification has always been an important concept, it's just that the name was never around and knowing the influence, motivation and engagement games can garner from people can be used for the current workforce today.

Gamification has also been adopted by the workforce to help encourage employees. Entering data into a spreadsheet is not considered fun nor interesting by many however should a reward be given to the person who has checked the most data by the end of the day such as free drinks for a whole weekend, all of a sudden people are hooked and its game on. Physical rewards don't have to be considered which is where badges, trophies and leader boards come in. Employers will pit departments against each other, split into teams and the aim is to earn points with correctly entered data. A leader board would show which team is in the lead and special badges

would be given for special achievements such as one thousand data entries. The highest score by the end of the week will win a trophy. This concept has been seen on websites as a way to motivate users to engage more with the site. Other review sites have a simple system that awards experience points and badges for tasks done by reviewers and editors.

Financial incentives can be seen as a great motivator; however, it does not help the user engage with the job in hand. Incentives can also be a financial concern. The use of gamification is not just “relying solely on incentives” but rather using behaviour that is engrained into human nature. People love to play and having fun will encourage our feelings of pride and meaning far more than the offering of money, “doing more is great, but if quantity is at the cost of quality, it is a false economy”.

2.9 Case Studies of Gamification in a Real-World Application

The theory on gamification was discussed previously in detail, in the following section a list of real-world examples of gamification is discussed and provided.

Gamification is a concept that has been adopted by many different companies in different sectors of the work force such as finance, technology, and education. A consulting company called Deloitte developed a gamified online training program called Deloitte Leadership Academy. Their main pillar around their game is leadership to which they define as “a function of *who* you are, *what* you can do and *how* you do it” (Bohyun, 2015). They found that by creating a user-friendly platform and integrating game elements such as missions, badges and leader boards into it they can enhance engagement from users, and they were more likely to finish the training programs This training program being gamified results in a 37% increase (Joy, 2018) in the user retention while also increasing the time people spent on the program and the number of programs completed.

IBM created a first-person 3D interactive simulation game called INNOV8 as part of their academic initiative programme, which puts players in different scenarios and make practical business decisions. This game has been used by over 1000 universities and colleges including overseas institutions such as Beijing (Pavaloiu, Neagu, Dragoi, & Rosu, 2016). INNOV8 teaches the complex idea of business process management and skills such as business problem solving, prioritisation and consensus building by helping players make decisions that impact their fictitious company. 3 different scenarios are given to teach the player different skills which includes Smarter Traffic, Smarter Customer Service and Smarter Supply Chains. Players can receive quick feedback on the decisions they make as well as how “practical process improvements can help meet profitability, customer satisfaction and environmental goals while addressing real problems faced by municipalities and businesses today”.

Gamification is also used at workplaces for recruitment and training such as America’s Army, a free first-person shooter released in 2002 that simulates training exercises and combat missions and was developed as a recruitment tool for young people aged between 16 to 24 (Michaud, 2008). The relationship between video games and the army have been developed since the 1930’s when the military created simulators to help train their recruits (Nichols, 2009) and even in the second world war “the army’s general staff were the first to use "wargames” and employed them to improve their image with the population”. The American military has also

relied on other commercial games such as id software's Doom (2013) and Operation Flashpoint (2001) from Bohemia Interactive.

Stack overflow, a popular question and answer forum for approximately ~3 million programmers launched in 2008 and provides answers to over ~7 million questions on topics within software development and computing (Novielli, Calefato, & Lanubile, 2014). It uses gaming elements such as points, badges, and privileges. Stack overflow users earn points and badges by participating in the forum, answering questions, and gaining votes from other users. The privileges are tied directly to the reputation points, so that users have to earn their privileges such as voting down an answer, creating a tag, or creating a chat room. Another reason for its popularity is the quick response users get to their questions, it was seen that 50% of questions that are asked on Stack overflow are answered within 15 minutes (Asaduzzaman, Mashiyat, Roy, & Schneider, 2013).

Two software companies' adobe, and Microsoft, used gamification to help users learn how to use their software. Adobe created Level Up, which gamified the process of learning the image-editing software photoshop by giving players missions to complete and rewarding them with badges and rewards. The support and development of LevelUp, however was discontinued in June 2014. Microsoft developed Ribbon Hero, a game that teaches people how to use Microsoft office software. Users are challenged in four different areas: working with text, page design and layout, getting artistic, and quick points. They are given different scenarios with a unique document that require them to use Microsoft office skills to solve problems and awards points and levels that are displayed in the corner of their office application. These challenges can be attempted in any order and will reward points on completion.

Codeacademy, an online learning website that offers free computer programming classes in several different programming languages such as Python, PHP, jQuery, JavaScript, Ruby, HTML and CSS (Havrilovskii, 2015). It also features a "sandbox" for users to test their code and it drew a lot of attention by rolling out its CodeYear program in 2012. CodeYear was designed to encourage people to learn how to code throughout the year. People who signed up for the programme earned points, badges, and trophies as they progressed and successfully finished courses on the track of their choice. (Phetteplace & Yelton, 2012) Codeacademy released new courses every week to keep learners motivated and encourage them to continue their learning.

2.10 The use of Gamification in Mobile Applications

In the previous section, gamification was researched as well as its real-world applications, in the following section, the uses and application within mobile apps are discussed.

Research has been carried out into enhancing engagement from users through the use of gamification in mobile applications (Bitrián, Buil, & Catalán, 2021). It has been noted that the popularity of mobile apps had surged in the last few years from 2016 to 2019 where worldwide app usage grew from 140.7 billion to 204 billion respectively (Clement, 2020). While the usage of apps has grown, they also show that engagement as a whole has been weak with a statistic that shows that "25% of mobile apps are used only once after being downloaded" (Localytics, 2019). Developers for mobile applications have been incorporating gamification as part of the design process to help enhance user experience (Hofacker et al, 2016) as well as using the concept of affordance (Gibson, 1977) which has been explored in fields such as marketing (de luca et al, 2020) and Human Computer Interaction (Huotari and Hamari, 2011). Affordances

were defined as “various elements and mechanics that structure games and aid in inducing gameful experiences within the systems”. Through the use of affordances, gamification along with user engagement can promote and induce psychological outcomes such as enhanced motivational behaviour (Koivisto and Hamari, 2019).

A model called the SSMMD, or self-system model of motivational development (Connell and Wellborn, 1991) was introduced that proposes contexts which satisfy the basic psychological needs of individuals which promotes engagement as well as investigates how gamification can “foster user engagement with mobile apps and positive marketing outcomes”. This model can be used to analyse how elements contribute to the satisfaction of an individual’s psychological needs. These elements can be categorised in 3 groups: Achievement and Progression, Social and Immersion.

User retention is another key factor that exists in gamification within a mobile application context. it has seen research into its improvements after people have downloaded an application (Law, Kasirun, & Gan, 2011). Users can download as many applications as they want however retention on these apps vary depending on user engagement (Suzianti, Avianto, & Larasati, 2019). In fact, mobile apps that are seen to be “useless” would be deleted soon after installing with no hesitation. Most applications offer a demo/trial period to give the user an insight into the app and help make them an informed decision. Getting users engaged however is a challenging task and individual retention is what sustains a mobile applications life (Tarute, Nikou, & Gatautis, 2017). They use gamification to drive sustainability after a mobile application is in use.

An application created by Law (Ibid, 2011) called “accident bucket” looks to help inform people on what to do next should a road accident occur. They talk about the idea of sustaining their user base and finding ways to stand out against the competition and gamification is the conclusion they came to on tackling that issue. Game mechanics such as points, levels and challenges help drive forward their app’s sustainability. They discuss the concept of a virtual community awarding virtual points for positive actions by the community. Being involved in community activities can also lead to points being awarded and there will be character roles that users can choose to earn free points should they complete tasks that are specific to their role. Long term loyalty is rewarded with free points which will encourage users to be engaged in using the application. A competitive system will be put in place to help retain engagement and will reward users with badges and statuses to distinguish themselves from the community as well as leader boards to showcase everyone’s scores. Activities that offer rewards and incentives will create an active environment; this will lead to longevity of an app’s life even without additional game mechanics. Having competition and rewarding people is what keeps people addicted and interested in the long term. In addition to creating a community, there will be community-sized challenges or “missions” for people to undertake together.

2.11 Gamification and its effects on Motivation

In the previous section, a look is taken at gamification and its application in education, in this section gamification and its use in motivation is deliberated.

The link between gamification and motivation can be shown in a table below the levels of engagement within students had significantly increased following the introduction of game

elements (Alsawaier, 2018). The table showcases a number of literature reviews on gamification carried out by other researchers. The majority of researchers had come to the same conclusion that the utilisation of gamification elements had a positive effect on a student's engagement and motivation as well as their overall performance (Kingsley and Grabner-Hagen, 2015; Leaning, 2015; Papastergiou, 2009; Seaborn and Fels, 2015; Koivisto and Hamari, 2014). Likeability ratings were also measured in some research studies and shown that students feelings towards introducing game elements into a learning environment were positive (Attali and Arieli-Attali, 2015). In a review of 24 empirical studies on gamification, it was stated that the majority of the studies yielded positive results regarding the relationship between gamification and learners' engagement (Hamari et al, 2014). A 32-study review on the utilisation of digital gamification elements pedagogically shown that 20 out of the 32 yielded positive results of gamification showing a connection to increased levels of engagement and motivation with the remaining 12 studies showing no correlation (Seaborn and Fels, 2015). There have been some empirical studies carried out that had produced negative or mixed results however gamification features that were introduced were limited and students were not given a choice when working with the options available (Leaning, 2015; Berkling and Thomas, 2013).

Reference	Gamification features	*R	Gamified content	Theoretical connections
Barata *et al.* (2013)	Badges, points, challenges, leaderboards, levels	P	Computer engineering course	n/a
Berkling and Thomas (2013)	Levels, leaderboards, points	N	Software engineering course	Motivational theory
Betts *et al.* (2013)	Levels, choice elements	P	Web-based collaborative learning tool called *Curatr*	n/a
Brewer *et al.* (2013)	Points and rewards	P	Children's learning	n/a
de Freitas and de Freitas (2013)	Rewards, points, levels	P	Computer science class	n/a
Eleftheria *et al.* (2013)	Points, badges, challenges, virtual goods	P	Augmented reality science book	n/a
Gibson *et al.* (2015)	Badges	P	n/a	Intrinsic and extrinsic motivation
Goehle (2013)	Levels and points	P	Homework WebWork	n/a
Hanus and Fox (2015)	Leaderboard and badges	P	Two college courses	Cognitive motivational theories,
Kingsley and Grabner-Hagen (2015)	Badges, points, quests	P	3D GameLab software	New literacies studies
Kumar and Khurana (2012)	Badges, points, levels	P	Teaching programming languages	n/a
O'Byrne *et al.* (2015)	Badges	P	Youth program	New literacies studies
Leaning (2015)	Leaderboard and points	M	e-media-course	Situated motivational affordance
Todor and Pitică (2013)	Rewards, points, badges	P	Course in electronics	n/a
Raymer (2011)	Rewards and progress bars	P	e-Learning software	Behaviorism
Thom *et al.* (2012)	Badges, points and status	**N	Social network service	Intrinsic and extrinsic motivation

Notes: *R, results; P, positive; N, negative; M, mixed. **The removal of gamification elements resulted in significant decline in participants' motivation

Table II.
Summary of literature reviews on gamification

Figure 2 - Showcases the number of literature reviews on gamification carried out by other researchers

An important note to keep in mind when designing a course with gamification is to introduce challenge where possible that is neither too easy nor too challenging, so the student stays engaged (Nicholson, 2015). "An overly complicated challenge leading to failure in a game setting can damage one's self-esteem and cause a lack of interest in reengaging the game" (Malone, 1980). The benefits of using extrinsic motivation alongside gamification is considered not enough as its positive effects will usually be temporary unless combined with principles from SDT (Self Determination Theory) such as autonomy, competence, and relatedness (Nicholson, 2015). The role of a teacher is seen as a way to "help create circumstances that would allow for intrinsic motivation to be born". In order for the long-term effects of gamification to be evaluated, there must be a longitudinal study that can study the long-term effects of a learners' behaviour and their motivation and task engagement (Zichermann and Cunningham, 2011). Carrying out a long-term study to study the effects of gamification within a pedagogical context requires a combination of quantitative and qualitative design and the majority of research done on gamification and its relationship with motivation has been either quantitative or mixed with some portions of qualitative research (Seaborn and Fels, 2015). Some qualitative studies such as one conducted by Banfield and Wilkerson in 2014 (Banfield and Wilkerson, 2014) had shown positive experiences with the introduction of gamification. This was also highlighted by Cheong et al (Cheong et al, 2014).

A discussion was presented (Aparicio et al, 2012) and analysed on gamification and its use in motivation. The driving force for motivations within humans were studied to see the effectiveness of gamification mechanics in satisfying these needs. Gamification is defined as "the use of game design elements in non-gaming contexts" (Deterding et al, 2011). A tool that can be used to improve participation and motivation of people carrying out difficult and diverse tasks that at first glance might not seem attractive to do. Its application is free to be used in any area and context especially as one as diverse as education (Lee & Hammer, 2011).

Video games are highly interactive and engaging, these characteristics can be used as a tool to motivate human behaviour (McGonigal, 2011; Reeves & Read, 2009). They reference the self-determination theory by Ryan and Deci (Ryan & Deci, 2000) which concerns itself with peoples' psychological needs and inherent growth tendencies. It uses intrinsic motivation as its core which associates itself with sports and gambling (Ryan & Deci, 2000). Activities that are intrinsically motivated are performed for the love of the sport itself as opposed for an external reward. Maintaining this level of intrinsic motivation requires satisfaction of the following psychological and social needs: Autonomy, Competence and Relatedness.

Autonomy refers to the will of the individual when performing a task, when motivated by their own interests the perceived autonomy is high. Positive feedback being used alongside providing opportunities has been shown to improve autonomy and the intrinsic motivation of individuals (Ryan & Rigby, 2006). Competence refers to the people's needs in participation in challenges and competition. Providing opportunities to improve competition, acquire new skills and knowledge (Csíkszentmihályi, 2008) increases the perceived level of competence in turn increasing intrinsic motivation. Relatedness refers to the social connection between people. Intrinsic motivation is increased with relations that provide security which becomes more robust (Ryan & Deci, 2000; Deci & Ryan, 2000), social networks integrated in games provides an interesting use for reinforcing motivation.

To carry out an effective process for gamification, they propose several activities:

- Identifying the main objective: identify the purpose of the task to be gamified
- Identifying the transversal objective: identify the objectives that are interesting to people, these objectives should capture their interest and they will be used to create a system based around game mechanics that will improve the motivation of the individual.
- Selection of game mechanics: select the mechanics that best match the objectives and supports the needs of the individual (Autonomy, Competence and Relation) such as profiles, avatars, positive feedback, challenges, levels, points, leader boards and social groups.
- Analysis of the effectiveness: quality of the fun and satisfaction will be measured and analysed using metrics that are associated with playability defined by Gonzalez (Gonzalez, 2010).

2.12 Gamification within an Educational Context

In the previous section a look at gamification and its effects on motivation was argued, in this section it is discussed on how the use of gamification can be used in an educational context.

It is important to understand the factors of target audience and the context surrounding the education program. Understanding who the student is combined with good delivery of the

educational context will allow the student to be empowered to achieve the objective of the program (Nah, Zeng, Telaprolu, Ayyappa, & Eschenbrenner, 2014). Analysis of students can help determine factors such as age, learning abilities/disabilities, current skill set etc whereas analysing the context can help determine details such as size of student groups, their environment, and the time frame (Bai, Hew, & Huang, 2020). An example to explain this is holding a learning program right before lunch time could lead to the students losing focus due to hunger or certain courses being a prerequisite to a course, they are interested in could motivate them to accomplish the prerequisite. The use of "pain points" which can be defined as "a factor that prevents a student from advancing through the learning program and/or achieving the objectives" (Huang & Soman, 2013). These points can differ among students depending on their age, background, or the field in which they are studying. Late submission of assignments that are of poor quality can be attributed to several pain points such as the delivery method of the course, lack of motivation, work-life balance, procrastination and more (You, 2015). More common pain points in education can include focus, motivation, skills, pride, physical, mental, and emotional factors and the learning environment and nature of the course.

Defining learning objectives, what does the teacher want the student to achieve in completing the education program. Every teacher should have a goal that they want achieved by their students, this can include general instructional goals such as assignment completion, exams, and projects (Sánchez-Mena & Martí-Parreño, 2017). There are also specific learning goals that include learning and understanding a concept, performing a task after training or completion of the learning program. Behavioural goals are goals that require the student to focus their attention on class, complete assignments faster and be less distracted (Wells, et al., 2014). Some learning programs can encompass multiple objectives at once however the success of the educational program is reliant on the ability of the teacher to clearly define the learning objectives that make up the program.

Structure is also another important factor when it comes to the experience, breaking down the learning program and understanding its pain points (Saleem, Noori, & Ozdamli, 2022). Milestones are powerful tools that can be used to quantify what a student needs to learn and achieve; they can also be used by teachers as a way of sequencing knowledge. Using milestones will help make the ultimate goal look more achievable and the obstacles faced along the way will be seen as more identifiable and measurable (Song, Kim, & Ko, 2017).

Resources are needed in order to gamify education, when the milestones have been identified the teacher can then decide which stages can be gamified and how. A teacher should ask themselves the following questions when considering gamification (Goshevski, Veljanoska, & Hatziapostolou, 2017):

- Can teachers track their students' progress at each stage?
- What would be the currency (a unit of measure for e.g., time) and what determines the achievement of a stage?
- Can clearcut rules being implemented to ensure a fair learning environment?
- Is there a feedback system in place to inform the students/teachers?

When gamifying a stage, using a currency can aid towards determining levels within the stage, some levels however can be considered as a whole stage within the education program. Creating currency-based levels and rules will help give feedback to students as well receiving it from them.

studies show that students perform better when they are given more opportunities to complete a task (Evans, 2011). This is why games are appealing to them as they are given quick feedback should they carry out a task incorrectly and are given the chance to try again. Another useful indicator that can provide feedback to the teacher is how much of the work the student has completed by the deadline which outlines possible pain points (Tóth & Tóvölgyi, 2016).

The application of gamified elements in an educational context comes down to the elements that have been applied to the learning program. Applying gamified elements or "game mechanics" can be split into 2 different classifications: Self-elements and social elements (Manzano-León, Guerrero-Puerta, Aguilar-Parra, Trigueros, & Alias, 2021). Self-elements can simply be points, badges, and achievements, they get the student to focus on themselves and help recognise self-achievement. Social elements are interactive with competition and/or cooperation. They will include some version of a leaderboard to display students' scores to each other. Using these elements can garner different reactions from students and when used incorrectly, it can backfire on the teacher (FerrazFabbri, 2021). If a student is required to achieve a certain level of skills to complete a stage but the stage itself is difficult then using a self-element may be more suitable as they may end up being intimidated from learning something new. Should they be put onto a leaderboard within a community, they may become discouraged as they are constantly being compared to others (Leaning, 2015). It is important to ensure that students stay motivated in order to be pushed onto the next stage, social elements can provide a community to help motivate students with healthy competition, having a leaderboard refresh weekly can give students the chance to participate whenever they want and will make them feel included as opposed to playing catch up. A table provided by Huang and Soman (Huang & Soman, 2013) shows the examples of game mechanics between self-elements and social elements. Self-elements include points, levels, trophies/badges, virtual goods, storyline, time restrictions, and aesthetics. Social elements include leader boards, virtual goods, interactive cooperation, and storylines.

2.13 Case Studies of Gamification in an Educational Context in a Real-World Application

Previously the topic of gamification and its use within an educational context was discussed, in the following section, different case studies of gamification that were used in an educational context in the real world is examined.

There have been several case studies of real-world applications of gamification in an educational context. The first case study was based around undergraduate education where Ben Leong, an assistant professor at the National university of Singapore created a game like course called JFDI academy. He applied game mechanics to a traditional scheme based introductory programming course and through it he was able to induce consistent engagement from the students and was able to identify knowledge gaps in his students learning. Before implementing his academy, he was able to identify several pain points including:

- Students would procrastinate and start their assignments 2-3 days before the deadline
- There were 7 assignments set with each taking 10-30 hours to complete hence optional assignments were ignored

- Feedback was slow – assignments were graded as a batch after the due date

To tackle these problems, the JFDI academy had structured its education program and broke down its assignments into smaller assignments as well as a “path system” to reinforce lectures. Along with a team of programmers and designers, he had created a system to track points, feedback, and leader boards. It also included an auto grading system which would provide immediate feedback upon submission of an answer and assignments would be graded within 24 hours. Other mechanics used involved assignments being labelled as “missions” with bonus questions labelled as “side quests”. A potential drawback to this system included students feeling embarrassed with their scores so to circumvent this, leader boards would only display the top 15 students.

Another case study was centred around consumer education, specifically educating consumers on the healthcare system. Healthcare university was introduced in February 2013 with the purpose of using gamification to teach consumers the basics of healthcare. It was structured as: watch a video, take a quiz, and play a game. Videos averaged 3 minutes long and students could take pop quizzes to test their knowledge, once they had achieved 100% completion they would be encouraged to hop over to the next topic. Each topic has a different game associated with it therefore providing a different experience as the student progresses. Apart from a video, students can also choose to learn about the topic from a pdf with a pop quiz at the end of the file. Progressing through the topics will earn the students points and reaching the end will award them with a badge. Students can also compete with each other on a leader board.

Researchers Derviú, Bora and Hüseyin (Kayımbaşıoğlu, Oktekin, & Hacı, 2016) discuss the use of gamification technologies in education. In today’s world, technology and social networks have become an integral part of human life from our early childhood into our elder years. Emerging technologies such as web 2.0 technology, new websites, social networking platforms and more are very beneficial. The earliest examples of ICT learning were created using CD-ROMS, DVDs and other forms of tape mediums. The increased presence of personal computers led to the more prominent use of computer games within learning. Learning basic skills through playing games have shown to be one of the most effective ways to learn (Miller & Almon, 2009), pre-schoolers have learned a variety of motor skills through educational games. Game based learning has recently emerged as a popular medium due to its exciting nature (Prensky & Thiagarajan, 2007), it attracts and motivates players however the success of the game depends on the “relationship between challenge, fantasy, curiosity and control” (Snow et al, 1987).

They describe a language learning system named CALL (Computer Assisted Learning Language) that uses multimedia combined with text, visuals, audio, and video files to teach a language through computer technology (Levy, 1997). With advancements in technology, the use of computers in language instruction have grown more prevalent in everyday teaching and teachers are relying more and more on CALL technologies which is leading to more studies being held in conjunction with this trend (Almekhlaf, 2006). The effectiveness of CALL was researched in tanzania by Ongoro and Mwangoka (Ongoro & Mwangoka, 2014) and were tested on children in preschool. The use of CALL was supported with tangible objects in order to make it easier for kids to comprehend and not lose interest in the game. Usage of letters, pictures and audio were merged with a point-based scoring system, different badges, levels, and competitions.

2.14 List of Requirements for Gamification

In the previous section, an in-depth analysis of gamification investigating the impacts on education and students submitting assignments was discussed. In this section, a list of requirements is curated utilising what was learned from the literature.

From the literature, many strategies that have been outlined to help encourage motivation within students as well as specific mechanics and features within gamification that have real world applications have proven to be effective. These requirements will be used towards the prototyping stage to help influence and guide the design:

1. Extrinsic Incentives
2. Focus on student performances during tasks not the end result
3. Increase the Fun in tasks
4. Task Mastery
5. Positive Feedback
6. Exercises broken down into small chunks
7. Task checklists
8. Task reminders
9. Quick and Instant feedback
10. Social Interaction
11. Time management
12. Visual representation of student progress towards a goal
13. Task difficulty
14. Rewards such as points and badges
15. Competition
16. Task missions/challenges
17. Milestones
18. Multiple tries to complete tasks
19. User profiles
20. Progression

Summary

The subject of motivation and gamification was reviewed extensively in this chapter and with the knowledge gained, a list of requirements have been curated that involve features and design principles that will help shape and guide the design process.

Chapter 3 – User Research

In the previous chapter, the researcher carried out an investigation into motivation and gamification, curating a list of requirements with the knowledge gained. Within this chapter, the user needs are researched as well as the strong and weak points for current and existing solutions on the market are examined and analysed.

3.1 Case Studies for Team Project Applications

Within this section, a study is carried out on multiple case studies that are categorised under team project management. The strong and weak points of each case study will be researched and features that would be considered useful for the prototype design will be added to the list for implementation.

3.1.1 Asana

Asana is a web and mobile application that is built towards managing multiple projects, tracking progress of tasks, and cooperating with large teams. It includes features such as task creation and assignment, creation of forms and team chat. There is a basic package that comes with limited features for free as well as 2 other packages for premium charge, Premium for £9.49 and Business at £20.99.

Features

- Built for iOS and Android
- Tasks can be broken down into smaller sub tasks, assigned an owner and grouped into sections or columns for organisation
- Custom fields for drop downs, text, or number fields
- Forms
- Start and Due dates as well as a timeline for better planning, able to see schedules
- Tasks can be duplicated in multiple projects as well as show dependencies, so people know when to start a task and which ones are waiting
- Task comments
- Project conversations
- Team page to house all current projects, conversations, and announcements

Features to be adopted

- Task management system
- Timeline and scheduling
- Overview main page

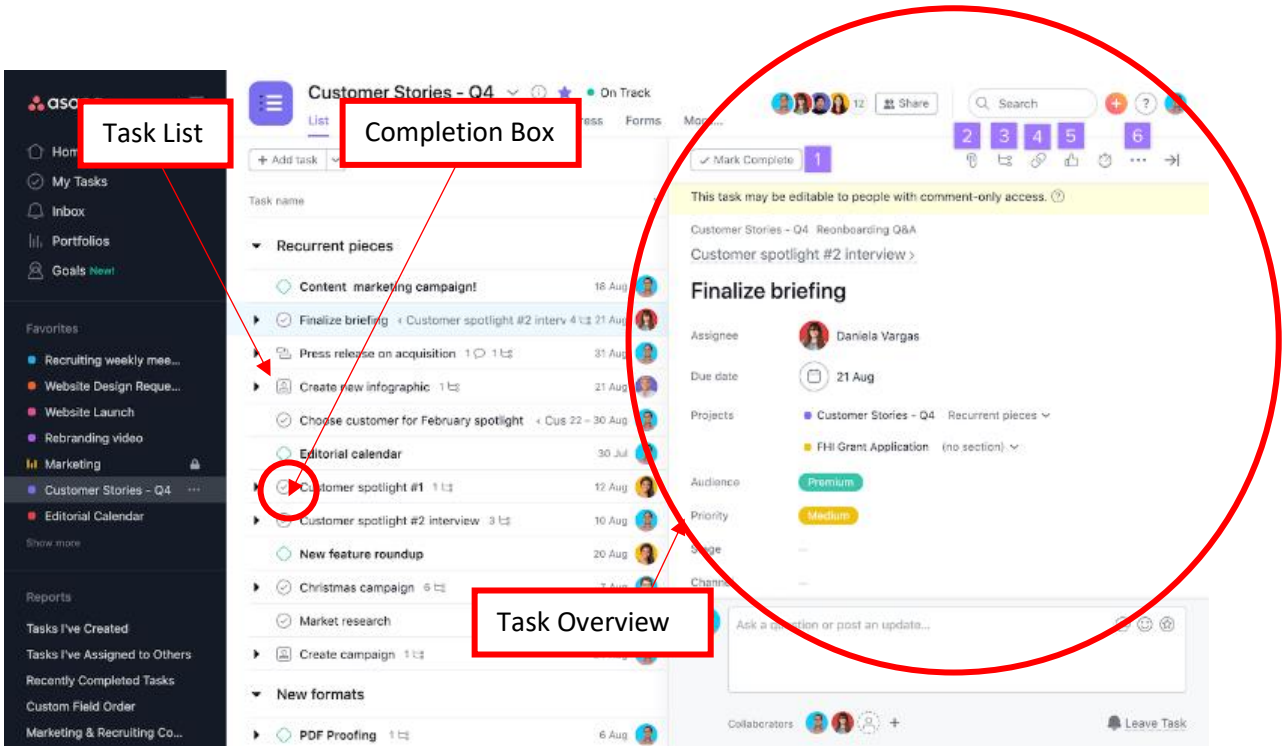

Figure 3 - Overview of Asana main page

3.1.2 Monday.com

Monday.com is a team centred organiser application for desktop and mobile, it allows the user to oversee projects and can track progress on assignments for individual persons. Features include scheduling capabilities, Kanban workflows and more. Monday.com offers 5 different packages with various price points. Individual is free and includes limited features as well as mobile app use. The next upgrade is Basic for £7 monthly and includes the individual benefits as well as more storage and customer support priority. The next up is a standard package for £9 monthly and includes the previous benefits as well as access to Gantt and timeline views, calendar view, automations and more. The second highest is the pro version for £14 a month and includes all previous benefits as well private boards, more automation actions and time tracking. The highest package is the enterprise package that does not have a price but requires contacting the Monday.com company. The benefits they include are increased security and governance, multi-level permissions, onboarding, premium support and more.

Features

- Customisable templates
- Able to get an overview of information on one screen
- Automations to send real time updates when a status changes
- Timelines
- Kanban
- Scheduling and Gantt charts
- Work Docs where you can co edit together
- Updated files with access to older versions

Features to be adopted

- Main overview dashboard

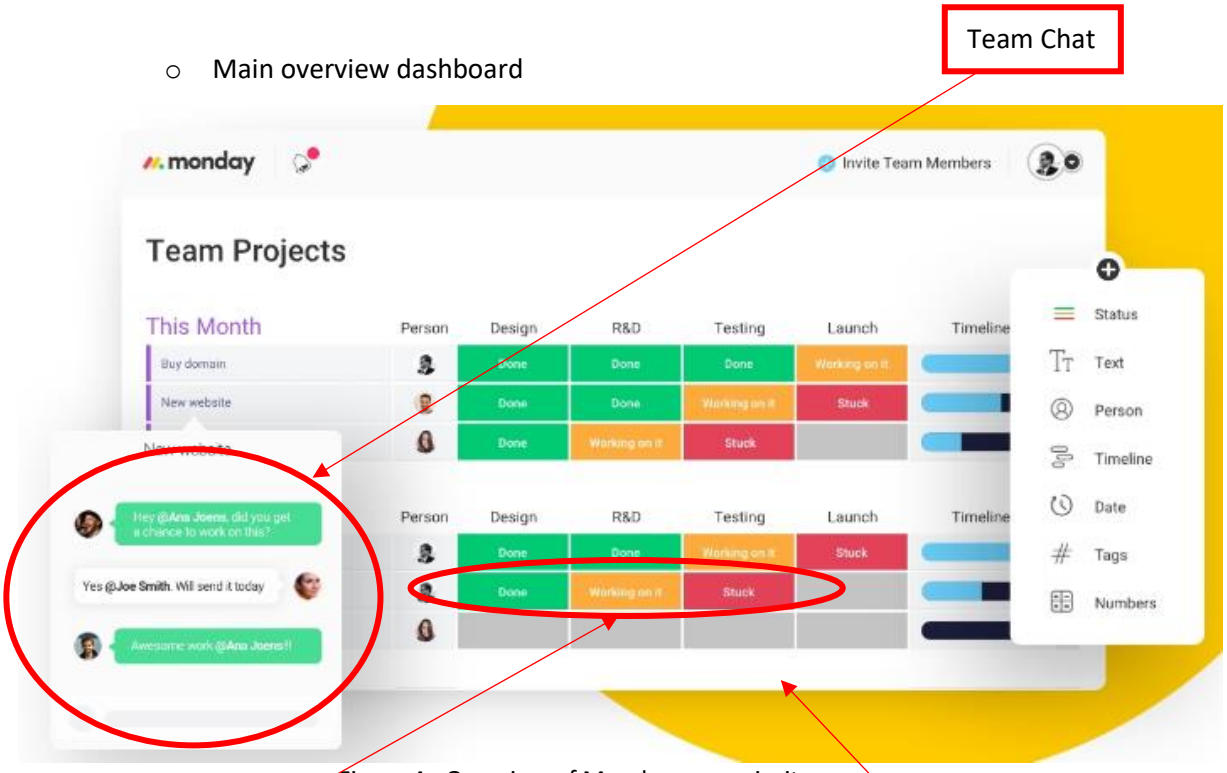

Figure 4 - Overview of Monday.com priority page

3.1.2 ClickUp

Clickup is a productivity software that is centred around saving people time and making people more productive with their time. it features all-in-one encompassing dashboards, automations, and time tracking. It features 5 price tiers similar to Monday.com with the first tier being free, features 24/7 support, whiteboards and more. The second tier is Unlimited for $5 a month with the previous mentioned benefits as well as more unlimited dashboards, integrations, and Gantt charts. Tier 3 is the Business tier for $12 a month which includes advanced automations, time tracking, and dashboard features as well as the previous benefits from the other tiers. Tier 4 is Business plus for $19 monthly which includes custom role creation, permissions, and priority support. Enterprise is the final tier that encompasses all the benefits in the previous packages as well as including live onboarding training, a dedicated success manager and access to an enterprise API. This tier requires contacting the company direct.

Features

- Everything views, a birds-eye view of all tasks and everything else in one hub
- Things can be organised from teams and departments to group projects and tasks
- Customisable tasks, automations, sprint points, and custom field data
- Complex projects can be broken down into subtasks and checklists
- Collaboration made simple with streamlined features to make teamwork easier for projects
- Time management, can track tasks, time estimates for tasks and see how long people have worked on a task for

Features to be adopted

- Tasks, Subtasks, and checklists
- Track time estimates for tasks and progress

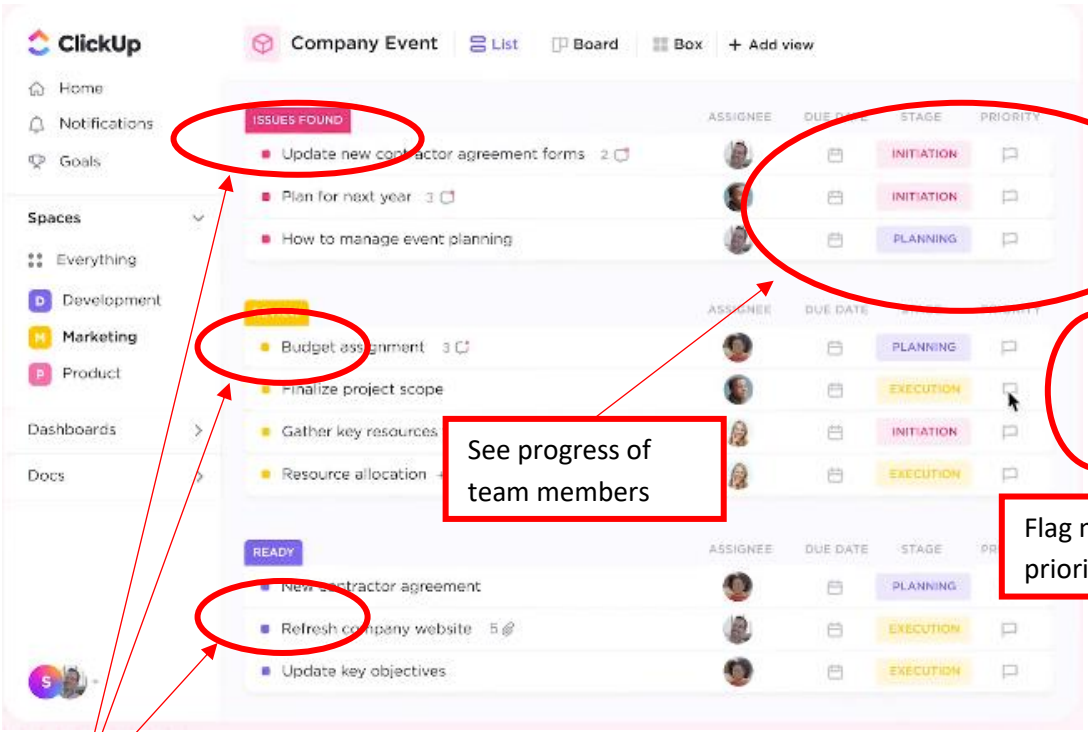

Figure 5 - Overview of ClickUp main page

3.1.3 Trello

Trello is a work management tool that's offers flexibility for teams that can ideate plans, work on project collaborations, create organised workflows, and provides a visual aid to track progress. Features it provides include a progress checklist, task assignments and logs to track activity. There are 4 price tiers with the first tier being free, the free tier includes unlimited cards, storage, activity logs and a custom backgrounds and stickers. The second tier is the standard edition for $5 a month which includes all benefits from the free tier plus unlimited boards, advanced checklists, and custom fields. Tier 3 is the premium tier for $10 dollars a month and includes a dashboard view, a timeline view, calendar view, map view, and more. The last tier is the enterprise tier that costs $17.50 a month which includes everything in the previous packages as well as unlimited workspaces, organisation wide visible boards and permissions and multi-board guests.

Features

- Detailed overviews
- Progress meter checklist
- Automated email notifications
- Individual/group task assignments
- Easy drag and drop editing
- Simple organisation with labelling, tags, and comments
- Deadline alerts and notifications
- Activity logs
- SSL data encryption

Features to be adopted

- Overview dashboard of tasks
- Calendar

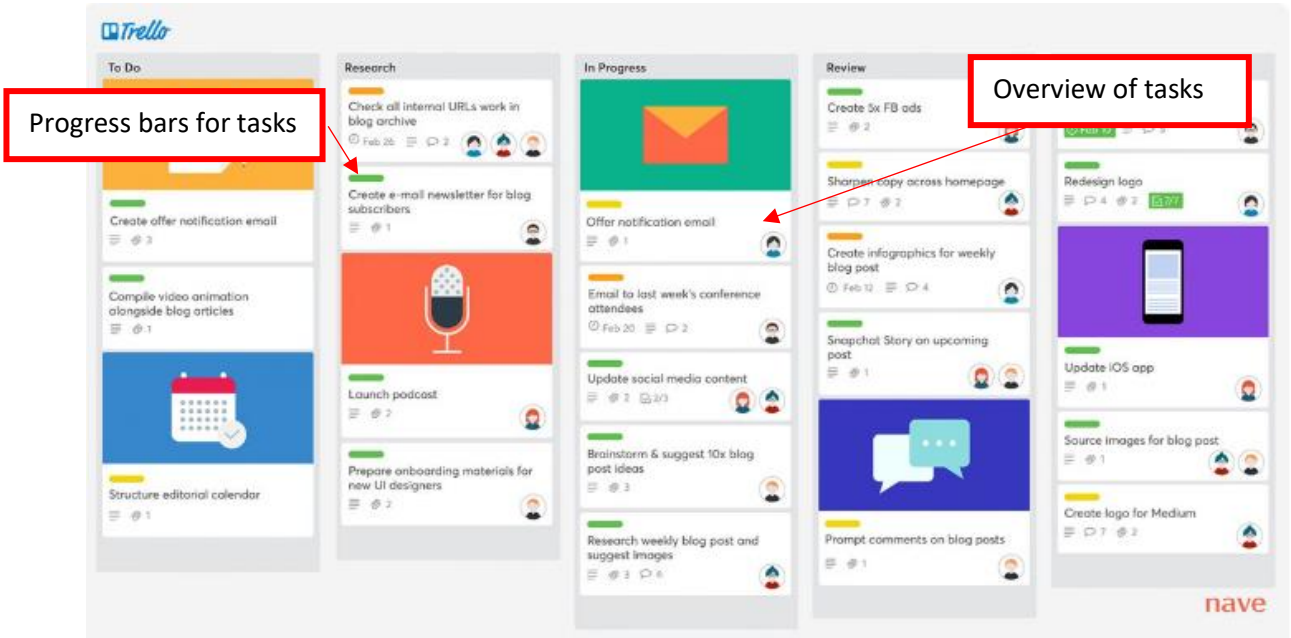

Figure 6 - Trello's main overview and status update page

3.1.4 Profit.Co

Profit.co is a task management software with employee engagement and development integrated within the application. The software tool is based around objectives and key results and producing those at every stage within an organisation. Features it provides include real-time reports and dashboards, progress tracking for teams and integration with popular business applications such as Microsoft teams, Jira and more. Profit.co provides 3 tiers of pricing, the first tier being free called Launch. The second tier is called Growth for $7 a month and the final tier is called Enterprise which requires calling the company for custom pricing.

Features

- Showcases Alignments, see how your input contributes to the overall goal
- Goals can be tracked using key results such as percentage tracked, milestones etc.
- Company dashboard to show progress
- Heatmaps to show progress on task

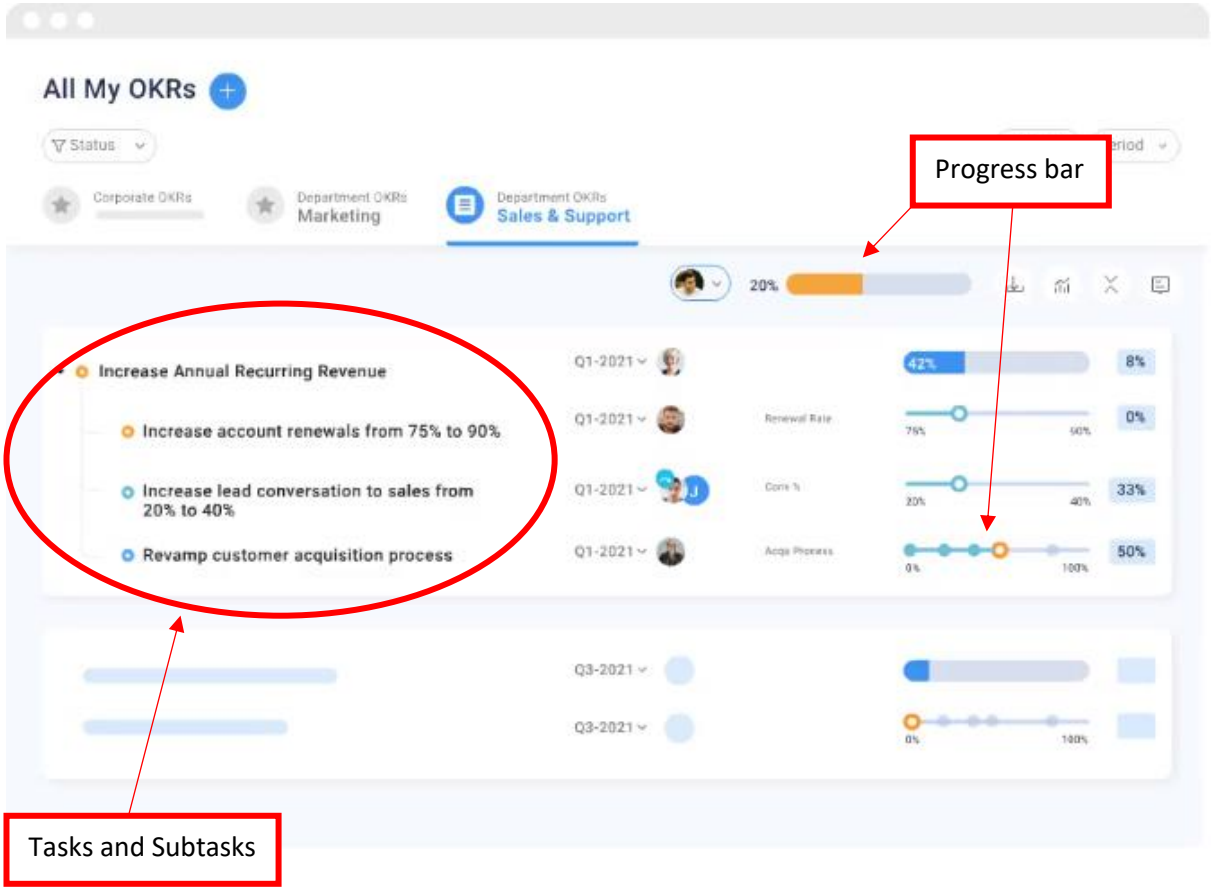

Figure 7 - Overview of Profit.co main page

3.1.5 Connecteam

Connecteam is a team management software that allows for easy communication, operation, and training for deskless teams. It offers simple communication between employees, scheduling calendars, and task management. It offers 4 pricing tiers with a free tier, a basic tear, an advanced tier, and an expert tier. The free tier is free for 50 users and includes a clock in and out system, job scheduling and unlimited checklists. The basic tier includes the previous benefits as well as time tracking for all report types, GPS and jobs and a payroll integration. Tier 3 is the advanced tier which includes an auto clock out system, advanced filtering, and bulk actions. The last tier is the expert tier which includes all benefits included in the previous 3 tiers as well as live GPS tracking, process automation and a personal profile for users to view and edit.

Features

- Real time chat functions
- Status updates
- Announcements
- Polls
- Digital suggestion box
- Onboarding training module with training courses
- Quizzes
- Employee monitoring tools
- Scheduling, attendance tracking, time sheet and clocking capabilities
- Dashboard

Features to be adopted

- Onboarding
- Status updates

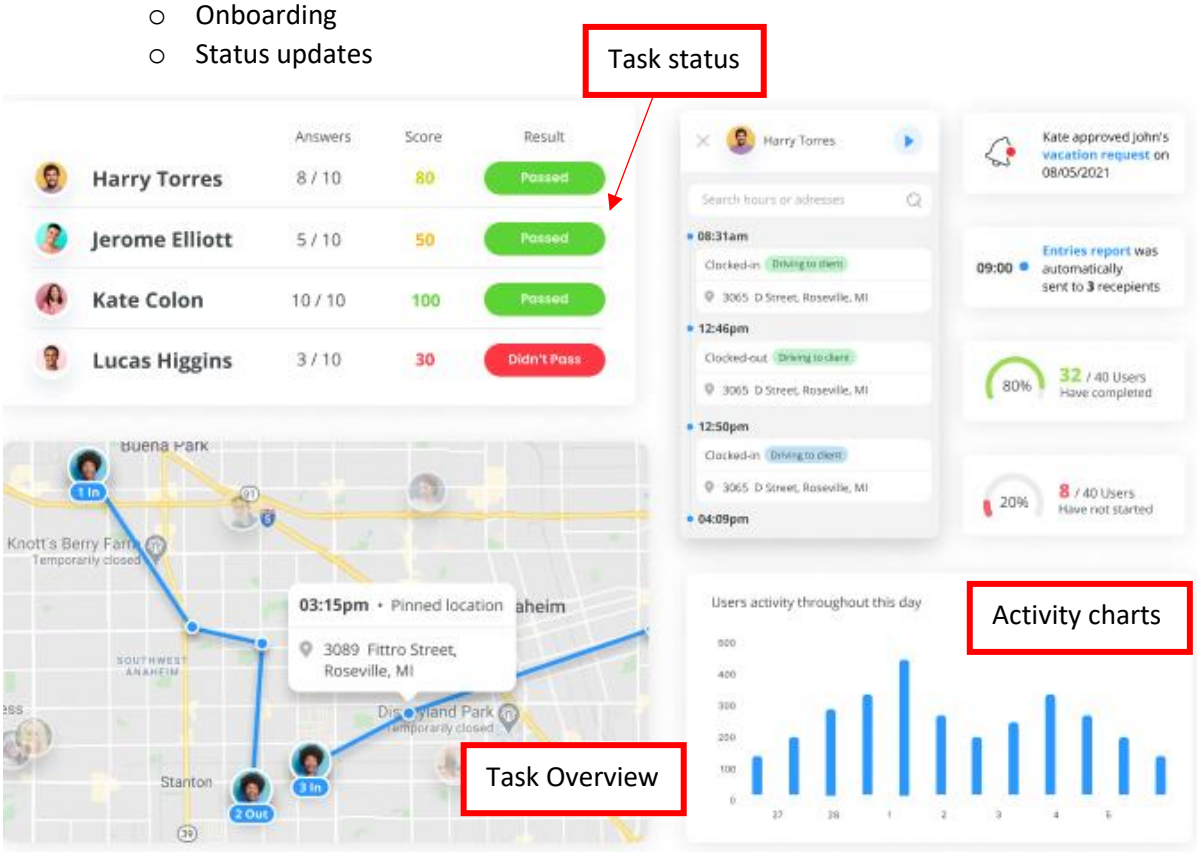

Figure 8 - Screenshot of Connecteam activity and status page

3.1.6 Process Street

Process street is a simple workflow management system that helps teams manage their recurring checklists and procedures. They provide a simple interface for creating structured documents, pages to capture and share knowledge as well as conditional logic to create dynamic workflows. Features it provides include group creation, an activity feed and progress tracking for multiple workflows. There are 3 tiers of pricing, the first of which is free and includes all core features, one workflow, unlimited pages and access to email and chat support. The second tier is the Pro tier for $30 a month and includes unlimited workflows, task permissions, dynamic due dates, and priority support. The final tier is the Enterprise tier with a custom price point which is to be negotiated through contacting the company. They provide a dedicated success manager, automations, unlimited integrations, API access and personalised team training.

Features

- Simple to create workflows and can assign to your team
- Drag and drop
- Conditional logic to create workflows
- Teamwork
- Forms
- Scheduling
- Create groups for employees
- Communicate between your team
- Assign tasks to individuals
- Control who can see what and edit

Features to be adopted

- Track progress of multiple workflows
- Activity feed

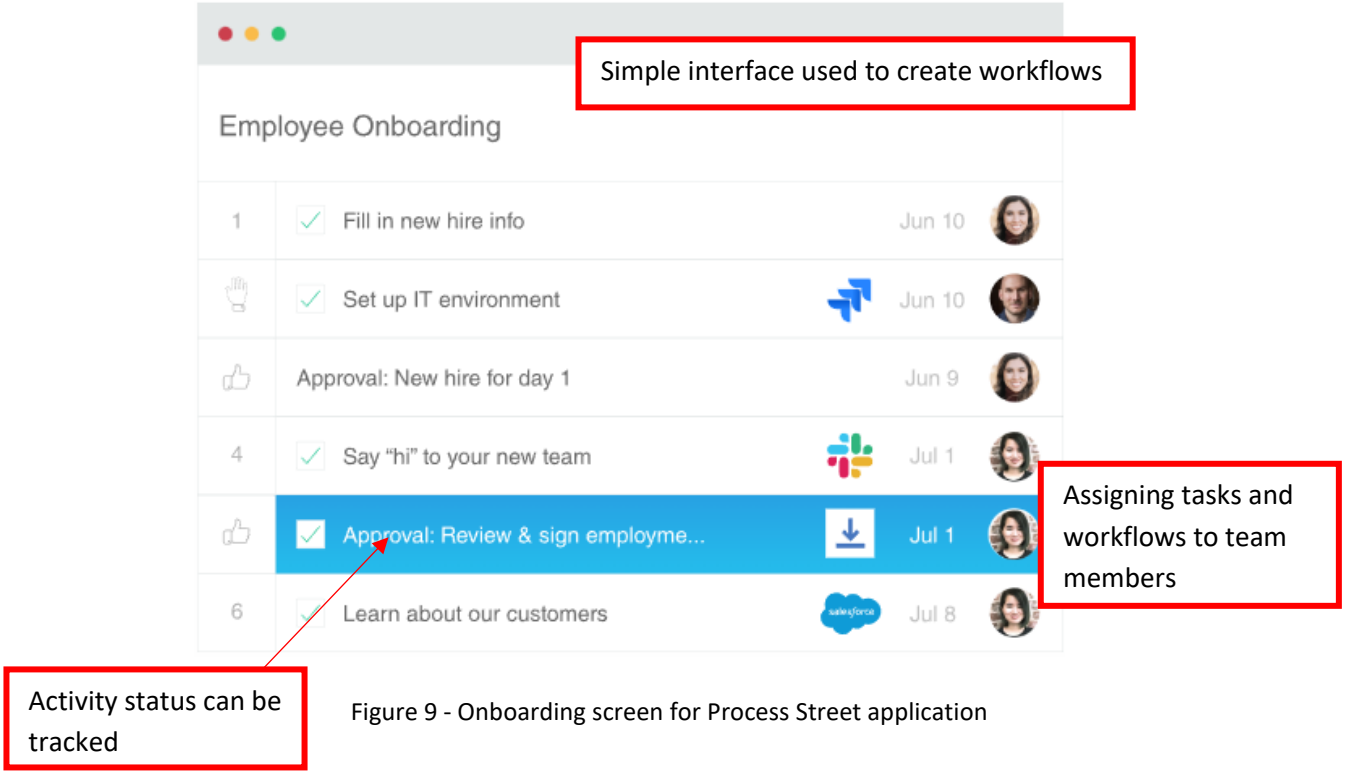

Figure 9 - Onboarding screen for Process Street application

3.1.7 Teamwork

Teamwork is a software management tool used to help manage teams, projects, clients, and freelancers using advanced features such as time tracking to resource allocation. It allows for easy task management by breaking them down into sub tasks and provides instant chat between team members. There are 4 tiers of pricing: A Free Forever tier, a Deliver tier, a Grow tier, and a Scale tier. The Free Forever tier is as mentioned free for up to 5 users and allows for basic project and task management, milestones, and messages. The Deliver tier is £10 monthly for a minimum of 3 users and includes 20 project templates, time tracking, invoicing, and an integrated team chat. The Grow tier costs £18 a month and includes everything mentioned previously as well as custom fields, workload resource management, resource scheduling and a time budget for projects. The final tier is the Scale tier and requires contacting the company for a price point. They include everything from the previous 3 tiers as well as a profitability report, unlimited financial budgets, an advanced resource scheduler and unlimited projects.

Features

- Track every detail from projects to tasks to subtasks
- Tasks can be assigned owners
- Milestones
- Due dates
- Priorities
- Attach files
- Instant chat, comments and @mentions
- Different styles of views between Kanban, lists, Gantt charts, and more
- Can track the capacity of team members to better suit the tasks involved
- Scheduling/calendar
- Birds eye view on the whole project and performance

Features to be adopted

- Priorities, milestones, and due dates
- Overview dashboard
- Projects and task tracking

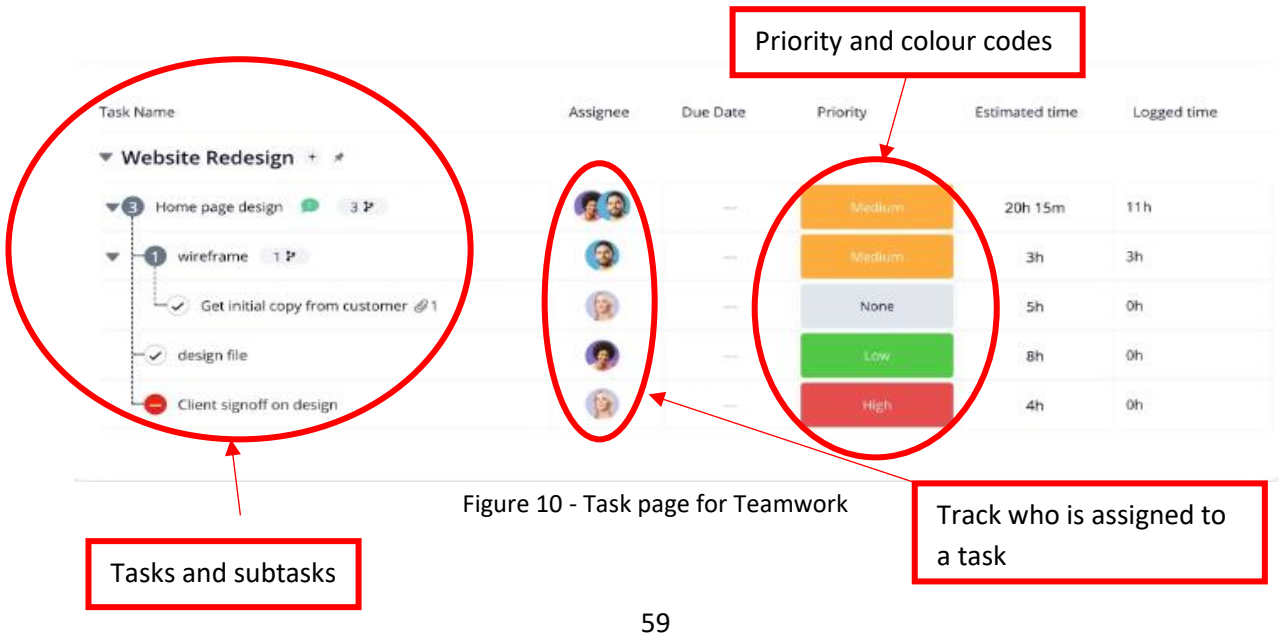

Figure 10 - Task page for Teamwork

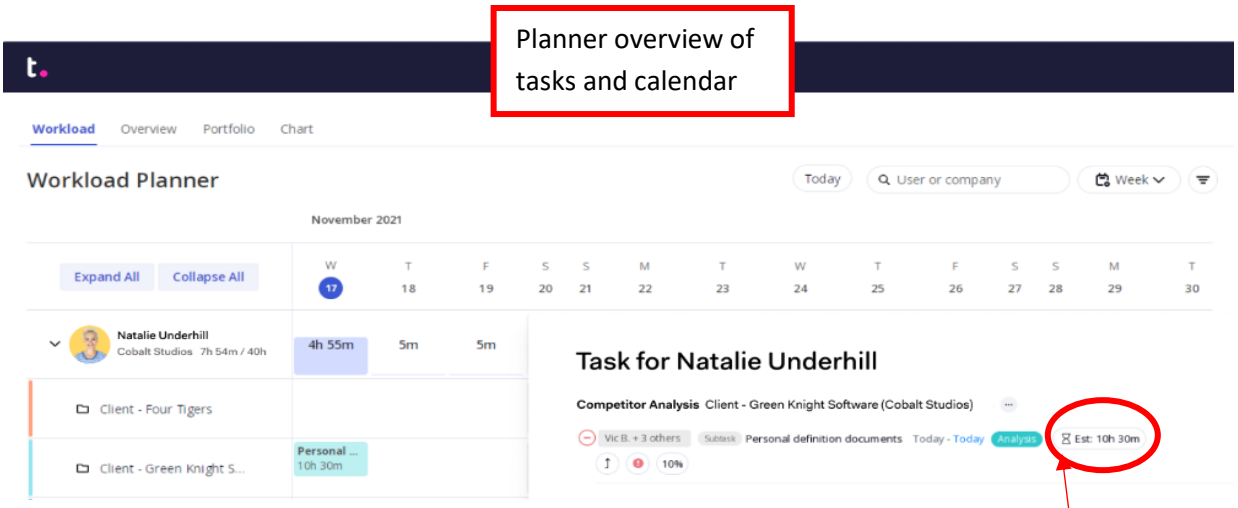

Figure 11 - Screenshot of Teamwork's planner

3.1.8 Evernote

Evernote is an online software application that helps towards task management, organisation, note taking and more. It allows for easy note taking, diverse note taking with images and files and provides quick access to any note you need. It also provides a hub page where you can access all of your notes and shortcuts. Evernote provides 4 tiers of pricing, the first being free and including the ability to clip web pages, attaching files, PDFs and images and a home dashboard. The second tier is called Personal and costs £5.99 a month with benefits such as unlimited devices to sync, 10GB monthly uploads, customisable home dashboard and task management. The Professional tier costs £7.49 a month and includes all of the aforementioned benefits as well as including access to all widgets for the home dashboard, creation, management, and assignment of tasks to others and integration with Microsoft teams, Slack, and other business applications.

Features

- Home screen with multiple widgets designed to display any and all content
- Task due dates
- Reminders
- Task flagging
- Assign tasks to team members
- Integration with google calendar
- Geographic search to find notes

Features to be adopted

- Flagging tasks for missing due dates
- Priority hierarchy
- Home screen dashboard

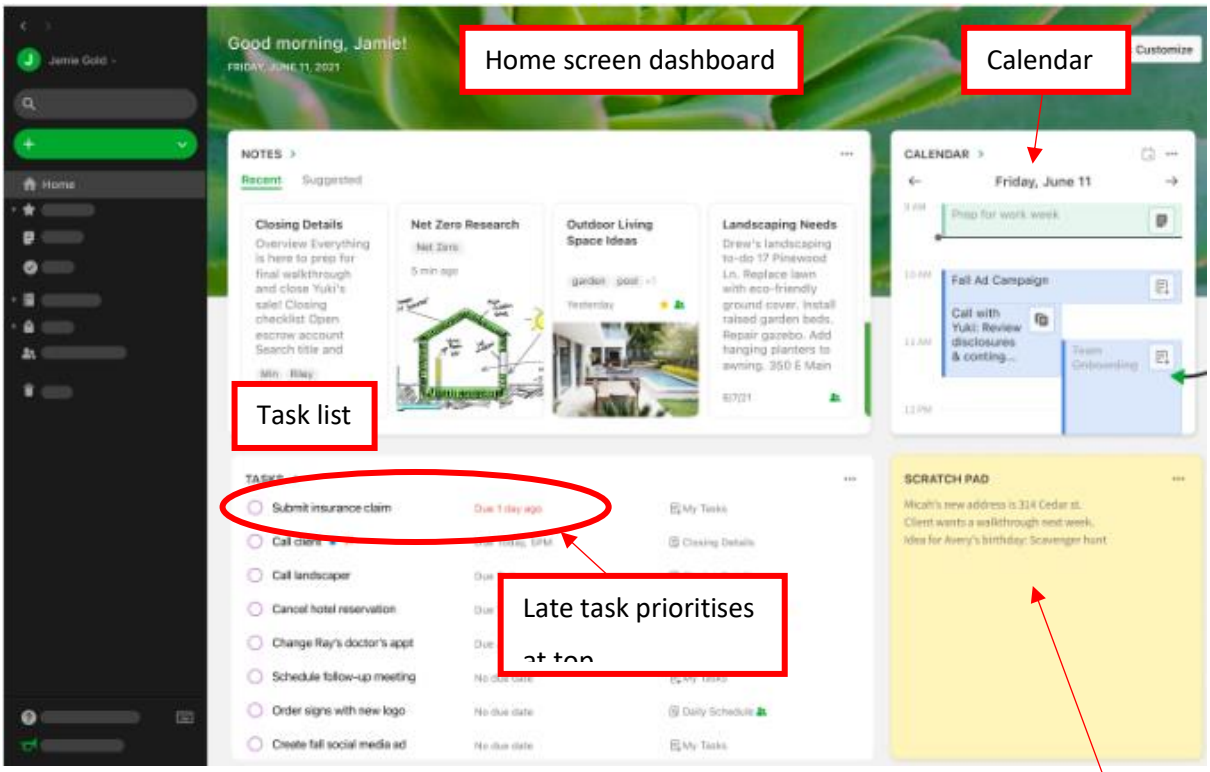

Figure 12 - Evernote's main overview page

3.2 Case Studies for Assignment Planners

In 3.1, studies around project management were the focal point and within this section, the research will be carried out for assignment planner applications.

3.2.1 My Study Life

My Study Life (MSL) is an organiser application that helps with scheduling, task management and reminders. MSL provides a customisable calendar, allows you to book term dates and holidays and can keep track of assignments that are due or overdue. MSL is free and is available for both iOS and Android.

Features

- Customisable calendar
- Specify the start and end dates for classes, terms, and holidays
- Track completion progress for tasks
- Dashboard with overview of assignments and due dates
- Customise types of tasks and assignments
- Reminders
- Stores data in the cloud

Features to be adopted

- Colour priority
- Due date reminder
- Calendar

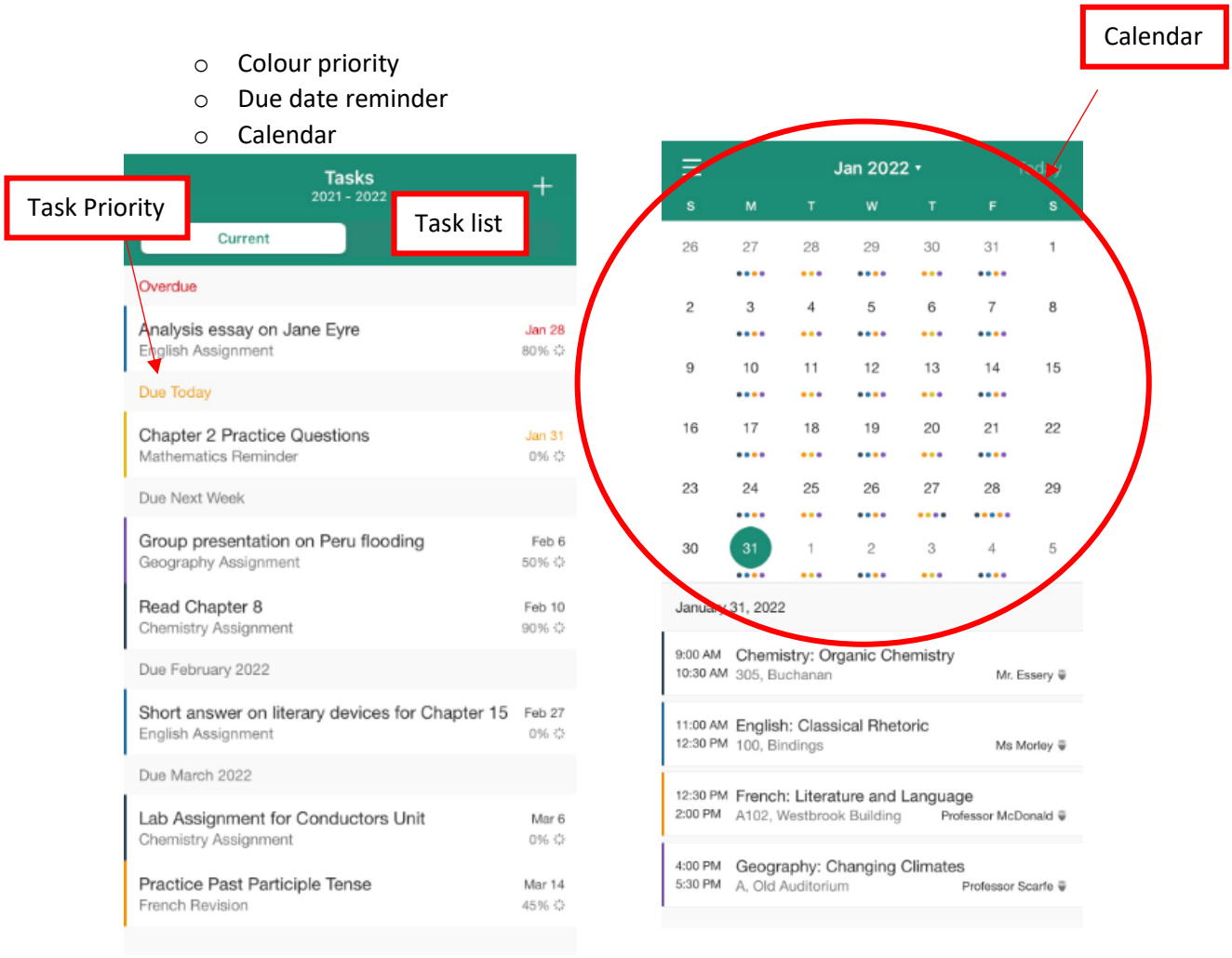

Figure 13 - Mobile overview for task list and calendar in My Study Life

3.2.2 Class Manager

Class manager is a software management tool that is focused around helping businesses take control of their teaching. It has a wide variety of fields from Dance and Gymnastics to Tennis and Martial Arts. It features class creation, schedule management and more. In terms of pricing, it offers one tier which is a standard tier of £25 a month and it includes free training, premium support and unlimited classes, customers, and staff. It also offers a 30-day free trial should they wish to try out the software before investing money.

Features

- Create classes and lesson plans
- Calendar and scheduling
- Text messaging and email, can track who clicks and opens them
- Daily backing up of data
- SSL encryption

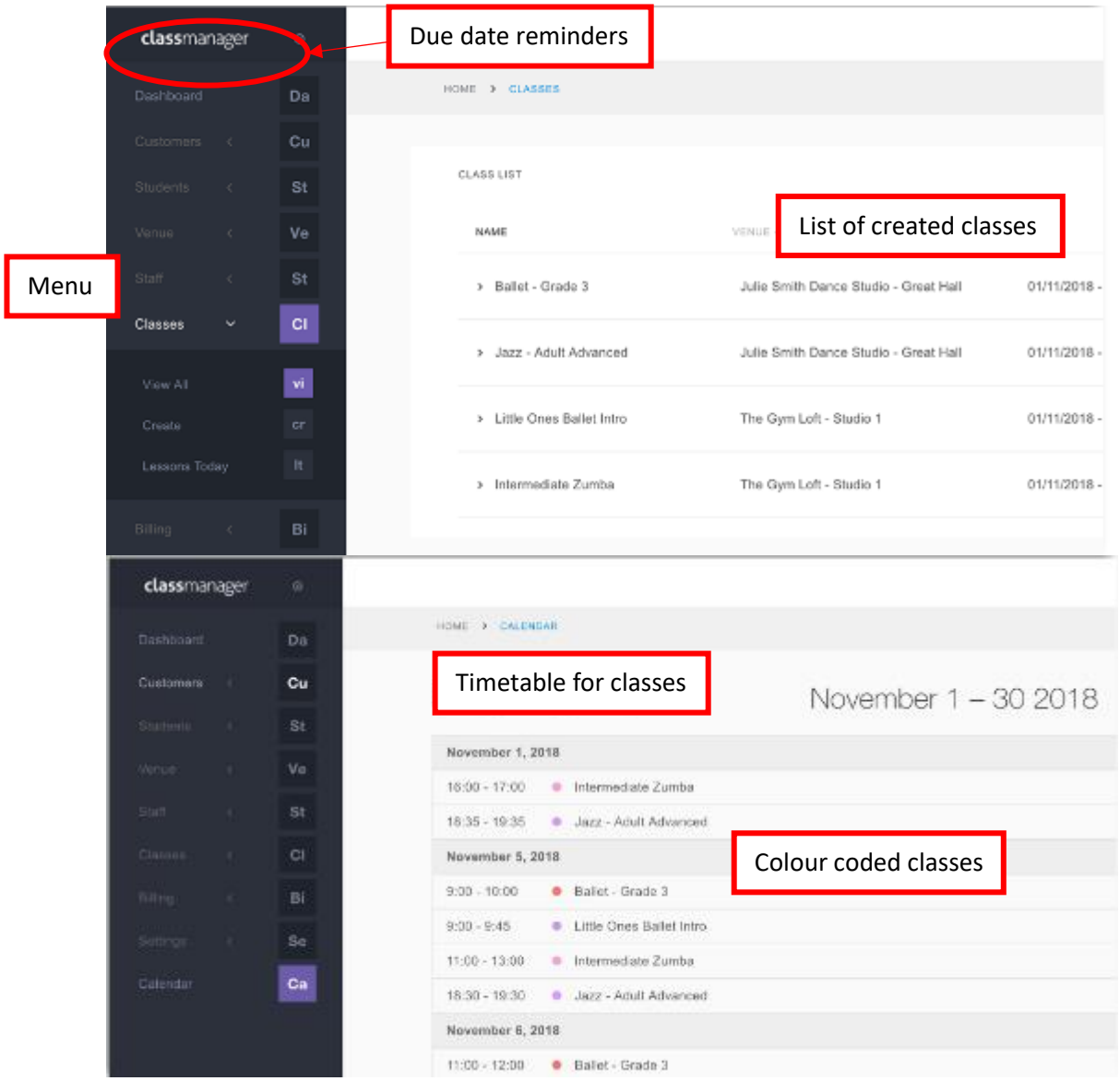

Figure 14 - Class manager's main scheduling page

3.2.3 myHomework Student Planner

A planner application designed to help students be more organised and manage their classes and assignments. myHomework is available for multiple platforms from desktop to mac to mobile to tablets. It features scheduling capabilities as well as tracking for assignments. It involves 2 price tiers, a free tier, and a premium tier for £4.99 a year. The free tier allows for tracking of assignments, projects, tests and more as well as classes and due date reminders. The premium tier includes all free features as well as no ads, enhanced app widgets and external calendar access.

Features

- Track assignments, projects, and tests
- Track classes
- Due date reminders

Features to be adopted

- Task list
- Task priorities
- Task reminders

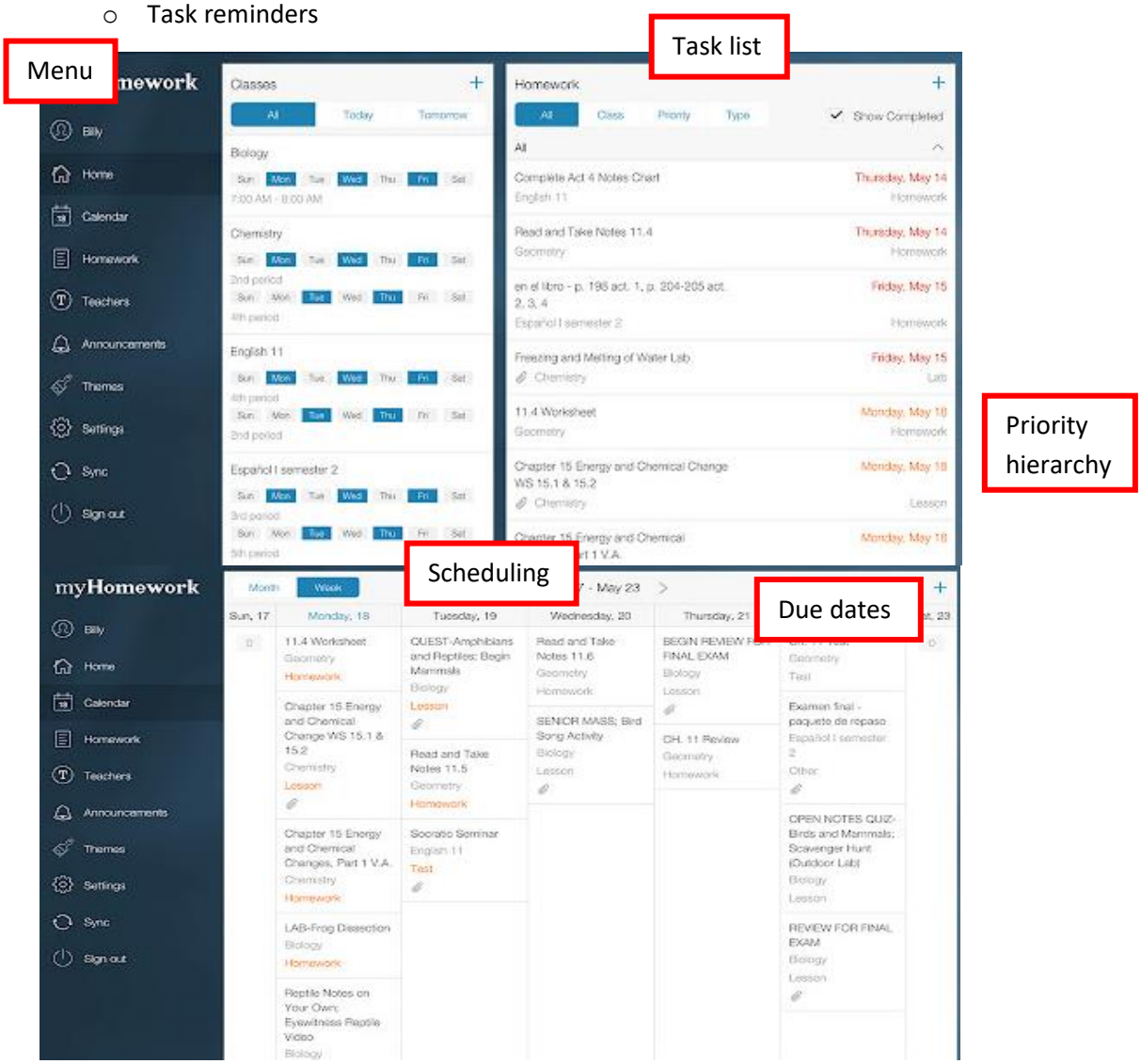

Figure 15 - Scheduling page for myHomework app

3.2.4 Class Timetable

Class timetable is a timetabling application that is centred around school, college, and university students to help with assignment tracking, class tracking and more. It is simple in that it only provides a handful of features such as a calendar, an organiser with reminders and notes, and a homework and assignment tracker. It is free to use and is available on both iOS and Android however there is a premium tier for $2 which is a onetime charge. It offers improved widgets, task reminders, calendar displays and ad free viewing.

Features

- Scheduling and calendar
- Track homework and assignments
- Notes
- Task reminders
- Categories
- Class reminders
- Notifications

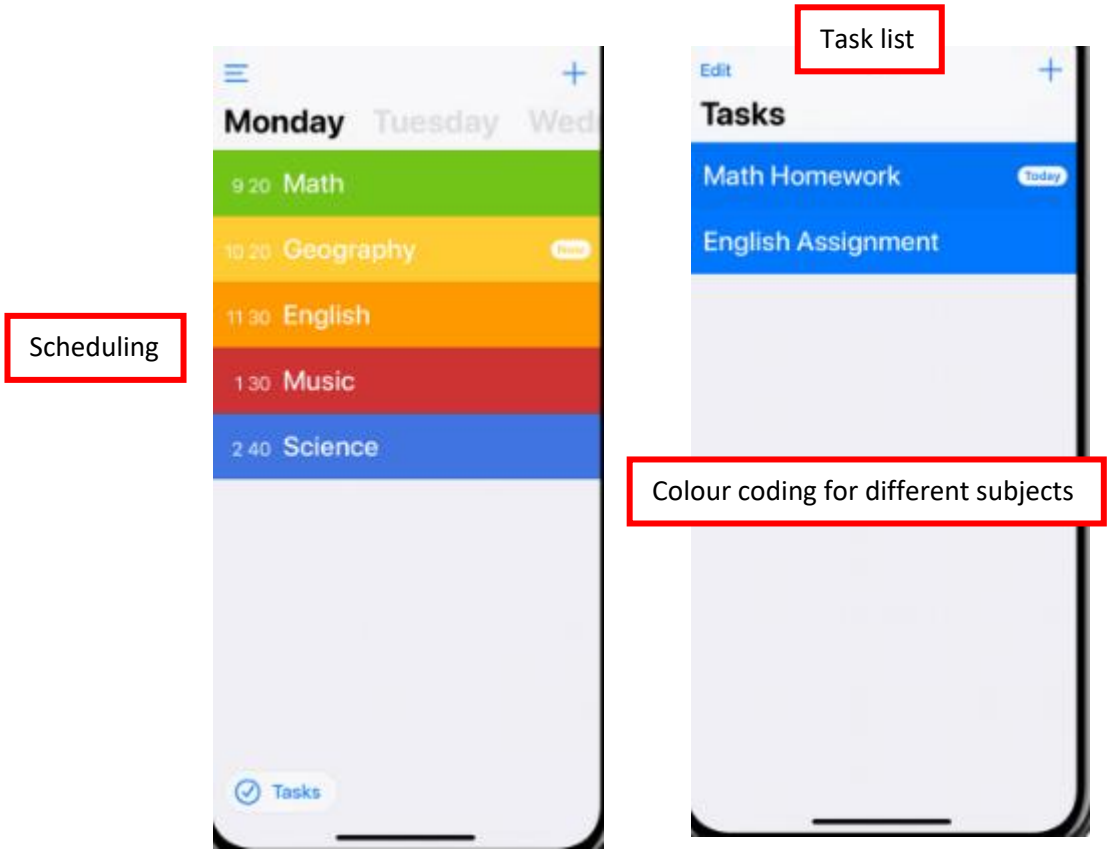

Figure 16 - Mobile screenshots for Class Timetable and task overview page

3.2.5 Any.Do

An award-winning organiser application for tasks, lists and assignments. It includes colour coding for priority setting, notes, and subtasks as well as due dates for ease-of-use tracking of progress. It is free and is available on a plethora of devices from android, iPhone, iPad, mac, desktop, smart watches and even on your google assistant. There is a premium tier that allows for customisable themes, WhatsApp reminders, colour tags and an unlimited daily planner. You can pay for 1 month, 6 months or 12 months for $5.99, $4.49, and $2.99 per month respectively.

Features

- Customise app icon badge and themes
- Task search bar
- Task organisation with colour tags
- Review list of completed tasks
- Calendar
- Available on wider variety of devices
- Reminders
- Daily planner

Features to be adopted

- Colour coded schedule
- Daily and weekly planner
- Tasks/lists
- Reminders

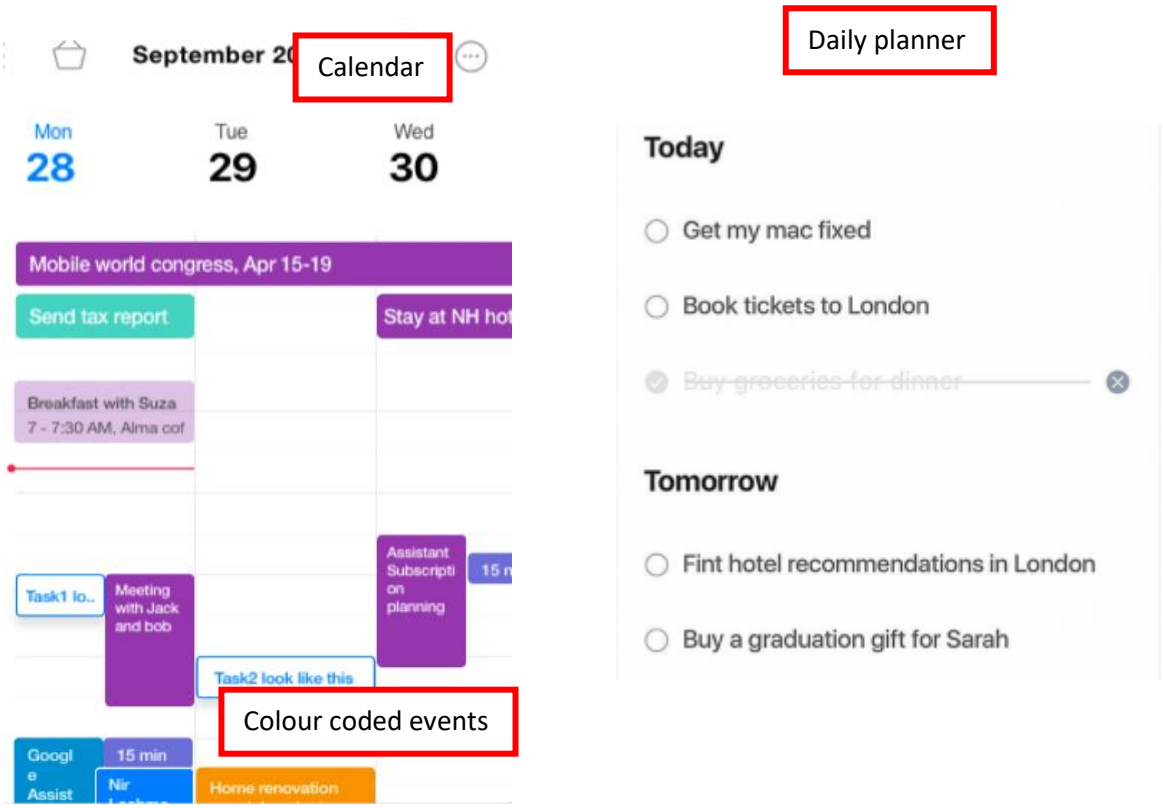

Figure 17 - Screenshot for Any.Do scheduling page

3.2.6 iStudiez Pro

iStudiez is a planner and management application used by students in school, college, and university. It allows for the scheduling of tasks and classes, and you can sync all your data across all devices you have it installed on. It can also be integrated within google calendar for a better visual representation and experience. It is free and available on iOS, Mac, Windows, and Android.

Features

- Overview of daily tasks and schedule on one screen
- Notifications
- Live tiles, showing information on live and/or current events
- View tasks and assignments
- Due dates and reminders
- Priority scale
- Planner to manage classes, courses, and terms
- Cloud sync
- Grade calculator
- Google calendar integration

Features to be adopted

- Calendar and scheduling
- Weekly planners
- Assignment list

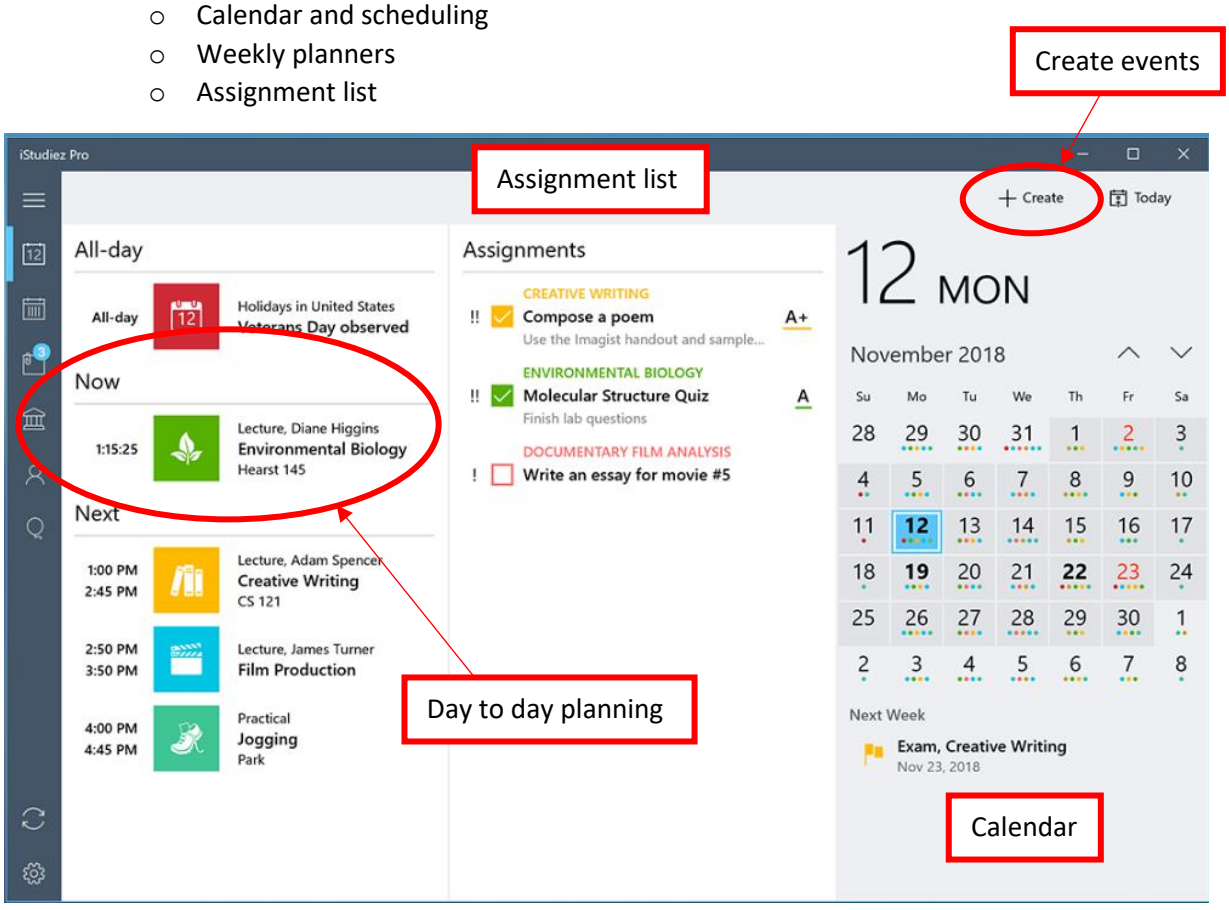

Figure 18 - Task overview and calendar page for iStudiez Pro

3.3 User Q&A

In section 3.1, different case studies have been researched and analysed for their strong and weak points; within this section, user needs are investigated, and a questionnaire is designed and given to users for feedback.

3.3.1 Design of the Questionnaire

To better understand the target audience, A questionnaire will be created for them to participate in and provide information about themselves as well as their experiences with assignments and late submissions. Through research on questionnaires, several online sources provide their insights on what makes a strong and effective questionnaire.

Bhandari explains 2 forms of questionnaires (Bhandari, 2022): self-administered and researcher administered. The former is more common as they are relatively easy to make and are cheap however the latter can lead to "deeper insights". Self-administered questionnaires can be completed either online or in person with paper and pen formats or by post, questions are the same for everyone to standardise the process (KE, et al., 2008). The pros for self-administered questionnaires are: Cheap to make, Easy to administer for small and large groups, People can attempt at their own pace, Anonymous and Suitable for sensitive topics. However, the cons: People with limited verbal and literacy skills will find it difficult to understand, People may not partake in the questionnaire and Volunteer bias.

Researcher administered questionnaires are 1 on 1 interviews that can take place online, in person or by phone. The pros are: Prevent volunteer bias, clarifies ambiguous questions and answers and Higher participation due to personal attention given to respondents. However, the cons: Time consuming and costly to carry out, Qualitative responses require more time to analyse, Experimenter bias and/or demand characteristics, Lack of anonymity can lead to social desirability bias.

Several practices that should be followed in order to create a balanced questionnaire such as using clear language, balanced framing, avoid leading questions and focusing on one item at a time. It is also important to keep in mind how you order your questions (Fife-Schaw, 1995) and how you can use logical flow from simple to complex questions or randomisation where questions are not laid out in an organised manner. Both have their pros and cons.

To construct an effective questionnaire requires "a list of mimeographed or printed questions that is completed by or for a respondent to give his opinion". Questionnaires are relatively inexpensive and can be used when resources are low, the only resource they will take is time. Questionnaires can also be corroborated with other sources of data when it comes to data collection. There are several stages that should be taken into consideration when forming a questionnaire from the initial considerations to the pilot test and revisions.

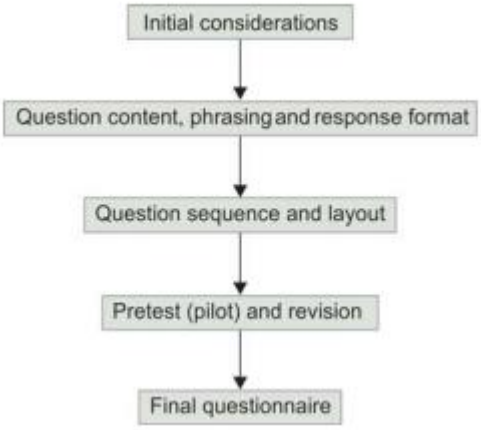

Figure 19 - Design process for a questionnaire

There are multiple types of questions that can invite a wide range of responses from respondents from open ended questions to matrix-oriented questions (Roopa & Rani, 2012). There are 4 types of questions that can be asked in a questionnaire:

1. Open-ended questions
2. Closed-ended questions
3. Matrix questions
4. Contingency questions

Open ended questions are long form and can allow people to give answers in their own words, lack of restrictions can mean that respondents provide a viewpoint that the researcher had not considered before (Siniscalco & Auriat, 2005). They do however require more from the respondent in terms of time and effort which may deter some from participating.

Closed-ended questions are short form questions with a limited set of responses that are designed to provoke simple and short answers from participants (Cornell, 2022). These question types are best used for qualitative datasets that require a quick analysis. Closed-ended questions also provide a large dataset very quickly due to the limited responses these question types have.

A matrix question is a popular type of closed-ended question that is shown in the form of multiple-choice questions laid out in a grid. These question types are simple to create by survey creators as well as simple to answer by participants (Cho). Due to the popularity of matrix questions, they are often overused by survey creators and questions with too many responses can encourage behaviour such as “straight-lining”.

Contingency questions also known as filtered questions are a question type that leads participants through the survey to depending on the answers they provide. These types of questions can take more time to create but often provide a higher quality dataset (12 Types of Survey Questions: Best Practices, Tips & Examples, 2021).

Due to the nature of this thesis, a questionnaire using a mixture of contingency, closed-ended and open-ended question types will be used. Contingency questions will help filter participants to a specific question and provide relevant data. Closed-ended questions will be useful for finding out information about the participant for e.g., their age, education type and their degree.

Open-ended questions will help provide more detailed data about participants and their experiences with motivation and assignments.

3.3.2 Questionnaire and Results

In the previous section, different ways and methods to create an effective questionnaire was investigated. In this section, the final questionnaire its results are laid out and discussed.

It is important to note that participants in this questionnaire has remained anonymous and their willingness to participate in the questionnaire was considered as them giving consent. The target age of participants for this questionnaire was 18-28, primarily targeting students who were on a college course or university degree.

The first 3 questions were closed-ended questions:

1. What is your age?
2. What type of education are you undergoing?
    a. College
    b. University
3. What degree/subject are you studying?

Question 2 provided the choice between college or university whereas questions 1 and 3 had allowed the participant to type in their answer.

Question 4 was a contingency question and was used to filter away participants that do not meet the criteria for the rest of the questionnaire. Question 5 was an open-ended question that allowed participants who fit the criteria to provide their reasoning for their answer in question 4.

4. How often do you submit assignments on time?
    a. Always
    b. Most often (more than 50% of assignments)
    c. Least often (Less than 50% of assignments)
    d. Never
5. If you chose always then you can ignore the rest of the questionnaire - Could you explain the reasons as to why you submitted them late? (Provide as much detail as you can)

Question 6 was a simple yes or no closed-ended question:

6. Do you start work on an assignment closer to its deadline date? (Within the last 2 weeks of the deadline date)
    a. Yes
    b. No

Question 7 featured a multiple-choice question with five options:

7. What factors would you say affect you starting an assignment?
    a. Submission Date
    b. Difficulty of assignment
    c. Procrastination
    d. All of the above

e. Other

Question 8 was answered by participants who had chosen the option “other” as their answer for the previous question.

8. If you chose Other, what are they?

The final 3 questions were open-ended and had asked the participant to provide their thoughts and opinions:

9. For the factor/factors you chose, can you explain why this is the case?
10. What would motivate you to start an assignment earlier?
11. If you were told of a mobile application that was designed to help motivate students to start and finish their assignments on time, what would be the key features that you would want added to this app? (List as many as you want)

After creating the questionnaire, it was sent out to 18 respondents who provided their own unique opinions and thoughts. The following results were recorded:

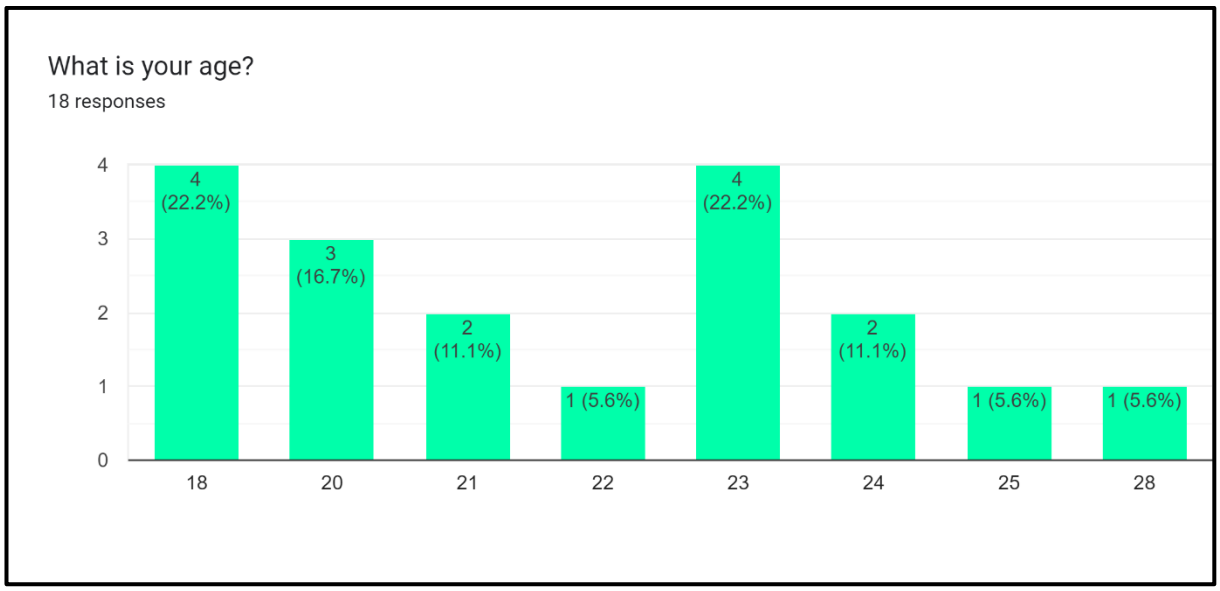

Figure 20 - Question 1 results in bar chart format

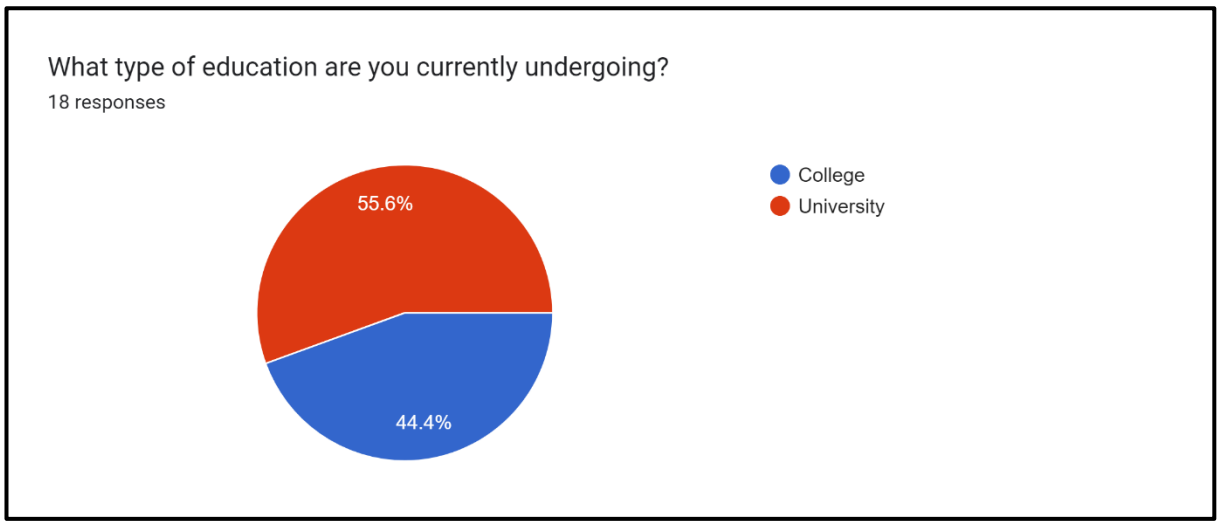

Figure 21 - Question 2 results in pie chart format

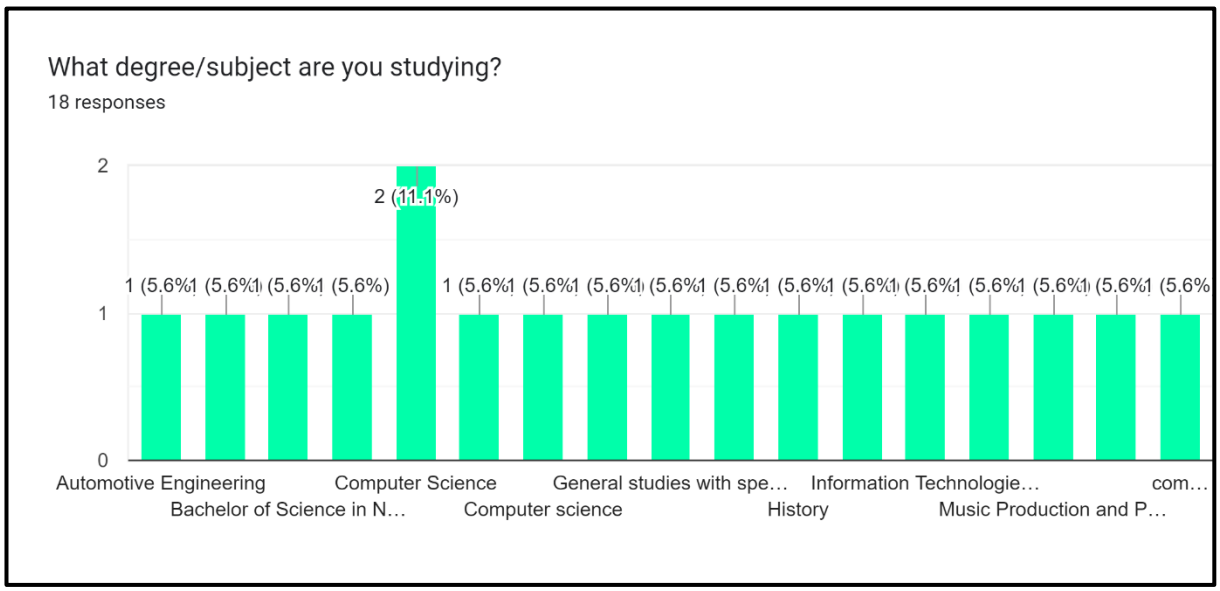

Figure 22 - Question 3 results in bar chart format

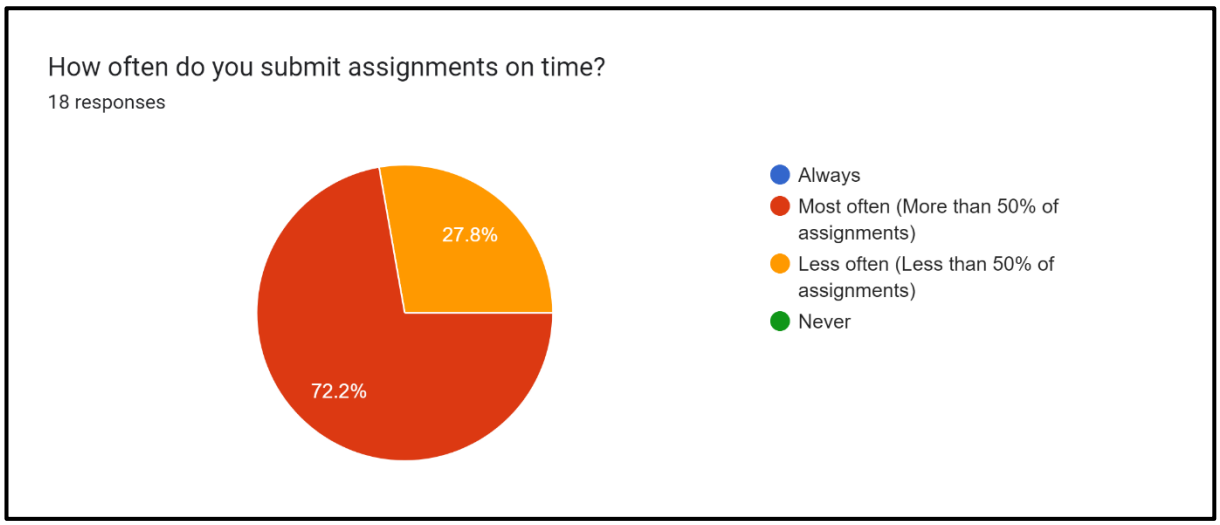

Figure 23 - Question 4 results in pie chart format

Question 5 results:

Participant 1: "I lacked motivation to start them in the first place. We all know, the sooner you can start it, the sooner you can finish it. I would always procrastinate doing anything apart from work because I always thought it would only take 20 odd minutes to do (which was never the case). If I did start it the day the assignments were given to me, I would start it off and then leave it till the last minute again. I think the rush of knowing you have to get it done for tomorrow or even the same day forced me to work faster. Although the results were never good in grading, I pushed out an assignment in 2 hours which I feel could have taken days. It would have been more thought out and have more content if I took days but if the 2 hour one is passable, why would I waste a lot of time doing it?"

Participant 2: "Laziness"

Participant 3: "For most of my assignments I submit on or before the deadline. There have been maybe two occasions where I requested an extension which was either due to personal reasons of long-term sickness or because I overestimated how long it would complete certain parts of assignment work. This set back had a knock-on effect of pushing work back which resulted in some assignments that I needed more time to complete because of how large they were".

Participant 4: "Because I have a tendency to start working when I'm under pressure to submit any type of work. Without that pressure I do not feel compelled enough to start work".

Participant 5: "bad work ethic"

Participant 6: "last minute work"

Participant 7: "Normally because I hadn't started the work until very close to the submission deadline and whatever I would've handed in wouldn't be worth it to avoid the late submission penalty. Then I can do some more work and submit and still end up with a better mark than if I had submitted on-time".

Participant 8: "I only submitted the one late so on the very end of most often. This one in particular I am not even sure I just thought I had submitted it but apparently didn't even try. Just slipped my mind and believed I had as I always did".

Participant 9: "My main reason(s) for submitting assignments late are for the most part a lack of motivation and interest for whatever the subject is, so chances are I will get started on them at some point however finishing them at all, let alone on time, is a struggle. Procrastinating any assignment to a degree where even if I were to get started, I would never have time to finish them on time".

Participant 10: "Sometimes it is due to poor time management, harder than expected task or external factors such as health issues".

Participant 11:

Participant 12: "Procrastination & Distraction"

Participant 13: "Forgot about assignment, began work too close to deadline"

Participant 14: "I suffer from a number of chronic medical conditions, for which I have some accommodations, that will occasionally 'flare' and make me unable to perform any work or attend class for approximately a week".

Participant 15: "I lost interest in education in high school. I rarely completed homework and pretty much got distracted from studying as soon as I sat down to do it. College was worse for me, with having more freedom and not legally obliged to attend, I struggled to get motivated to do my assignments".

Participant 16: "Usually due to work having very little time to complete everything on time, I do warn my teachers beforehand usually and give them the reason".

Participant 17: "I would either start on the assignment too late (usually the day before) or there was too much data I would need to collect to prepare it in time in a week".

Participant 18: "When I submitted an assignment late is generally because I started the assignment late so didn't give myself enough time to properly finish the assignment before the due date. Sometimes the instructions of an assignment are not written in a way the fully accommodates students who struggle with information processing speed, this can be applied in lectures as well. The information often comes in a big chunk rather than being broken down into more manageable sections or pieces which is something I found challenging. This contributed to difficulty in completing assignments on time as I struggled to understand what to do for the work".

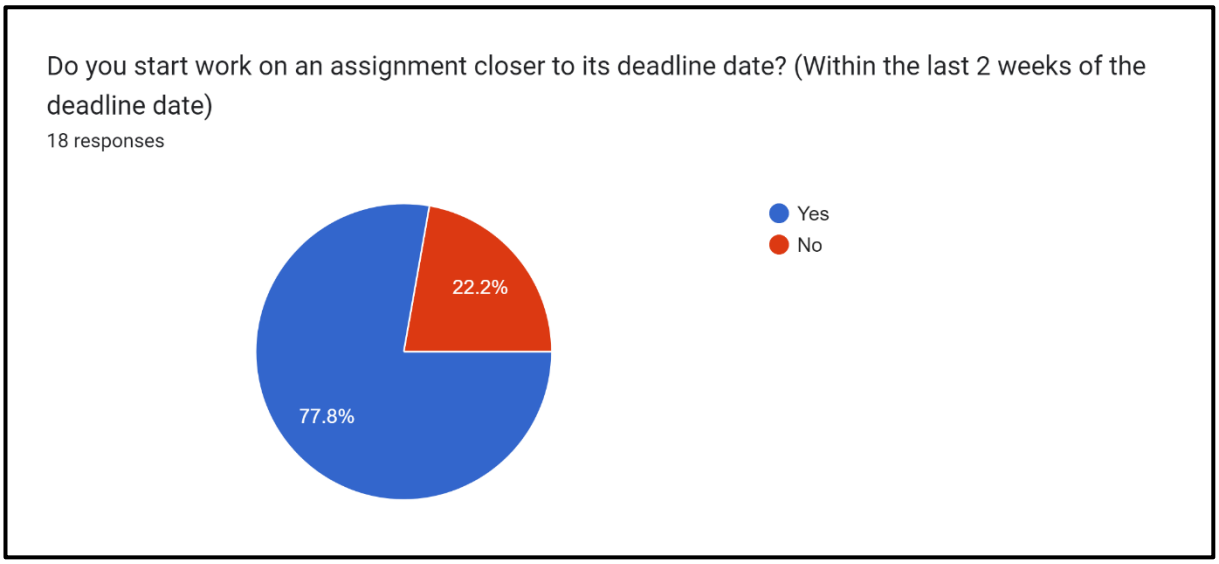

Figure 24 - Question 6 results in pie chart format

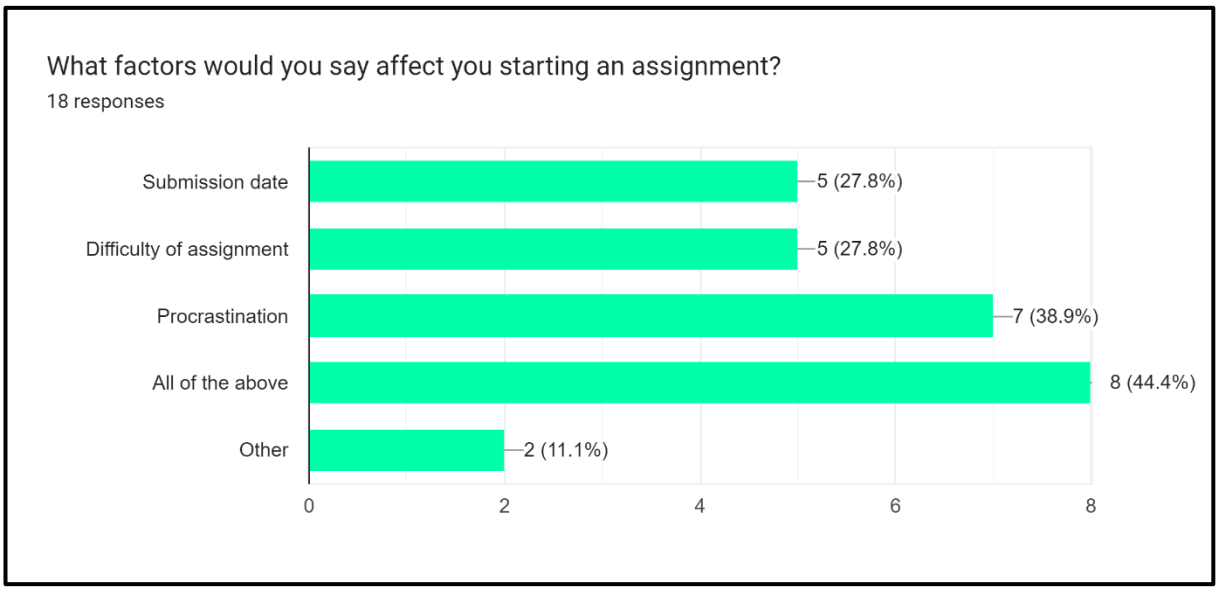

Figure 25 - Question 7 results in horizontal bar chart format

Question 8 results:

Participant 14: "Health issues, not understanding the assignment"

Participant 17: "Work/Study balance"

Question 9 results:

Participant 1: "I have ADHD. This causes me to procrastinate in anything I do. Even if it is something important such as education. With this I also found academic work a challenge, I didn't understand what I was doing unless information was spoon fed to me, rather than

telling me I need to find the information on my own. Also, if the submission date was a month away, I would use that time to do nothing, if the submission date was the next day that would force me to do it that evening".

Participant 2: "Had a lot of different assignments to do and I didn't know where to start so I would usually do them a day before submission date".

Participant 3: "Procrastination is a large part in taking longer than expected to complete assignments or parts of an assignment. I can become easily distracted or if the assignment doesn't catch my interest, I am slower to complete it. In regard to the submission date, I do set out a plan for when I will start and complete an assignment but the distant of the submission date does factor into how much little time I may spend on an assignment where others date priority".

Participant 4: "Submission dates as well as difficulty of assignment create pressure to try and start getting work done as soon as possible, procrastination comes in the form of wanting to seek out other hobbies and interests that create more engagement".

Participant 5: "no real interest in the assignment".

Participant 6: "Sometimes the subject isn't as fun, lack of motivation or busy schedule".

Participant 7: "If I don't feel like I immediately know how to finish the assignment then I don't want to start it because getting stuck on a problem is demotivating"

Participant 8: "I need some pressure to get me started and motivated to finish. I think naturally being good at the work means I can complete it within smaller timeframes, and it has been working every time I do it. Don't really have a reason not to given how successful it's been though I can see how if I get a huge issue I could run out of time".

Participant 9: "Submission date: If the due date is very soon chances are I will stress out about the assignment and will not find the "strength" to get started. If the due date is far from now, I will think "that is ages from now, I don't need to start yet." and as soon as the due date closes in the same thing happens as if the submission date was close.

Difficulty: I have a hard time understanding most subjects, or the way some tasks are formulated, so most assignments seem difficult to me, and I am prone to misunderstanding what they ask of me. This in turn makes me feel stupid and unmotivated to even start reading, or learning what it is it asks of me.

Procrastination: I will procrastinate anything until it is too late, my lack of general interest and motivation makes it extremely hard to start early with an assignment".

Participant 10: "Sometimes if there is a lengthy wait between start and finish, I will see this as time I can waste, other times the assignments just take more time than I thought, thus the difficulty. and I am lazy and will get distracted easy".

Participant 11: "If I found the subject to be difficult and the deadline wasn't very generous, I didn't always have motivation try to learn the new thing needed for the assignment because

there was no guarantee I'd have the time to learn it in time to finish the assignment. Hence feeling like I would have wasted time and got nothing to show for it".

Participant 12: "ADHD and bad decisions, get distracted easily, hard to focus, prioritise less important activities such as playing games instead of work"

Participant 13: "Generally I procrastinate difficult assignments as I am usually tired by the time, I have a free opportunity to complete them"

Participant 14: "Health issues can prevent me physically from starting and assignment. If I don't understand and assignment, I worry that beginning, it may lead to wasted effort if I don't get it right".

Participant 15: "I had no motivation at all to complete the assignments. I was always better working with things I could get my hands on and learn that way. If I could give an hour lecture on my assignment... easy. But make me sit down and write for hours, that is when I lose interest".

Participant 16: Refer to question 5 results

Participant 17: "First and foremost, assignments tend not to be interesting, and I would end up playing video games instead. There might be multiple difficult assignments from multiple subjects as well as there might be an influx of work that prevents doing the assignment in advance".

Participant 18: "Submission Date: If the submission date for an assignment is a fair way in the future (such as over 3 weeks) I do not feel any pressure to start the assignment as soon as it has been set as I feel as though there is a lot of time to get the work done.

Difficulty of Assignment: If an assignment is difficult, or I perceive it to be difficult then I am less likely to start the work as I know that that it will be a difficult and boring/not enjoyable experience to complete the assignment.

Procrastination: The procrastination come from the combination of the 2 factors that I have spoken about above. Along with the general feeling of not enjoying the degree I did as that decreased my motivation to do anything related to the degree".

Question 10 results:

Participant 1: "Rewards for early submissions/Time off from when you submitted the assignment to when the due date for the assignment is".

Participant 2: "having less of them"

Participant 3: "If the subject really interested me, I would start the research early or if I know I could complete the assignment at a quick pace to get it out of the way and clear up my schedule".

Participant 4: "Having earlier dates of submission, more check-ups with the person responsible for checking the work, more interesting/engaging assignments".

Participant 5: "a more personal assignment with more freedom and creativity"

Participant 6: "Weekly assignments that helps contribute to progression of assignment"

Participant 7: "Feeling confident that I know how to complete the assignment, and then being able to see that progress so I know that"

Participant 8: "Ability to get work checked fully before with a review to see how to improve. Hard to justify but I don't see any other reason to submitting early just means sat there waiting longer for a result (given you can definitely finish it on time)"

Participant 9: "I would need to somehow be interested and motivated for the subject of the assignment, if there is nothing about it that is interesting to me, chances are I will have no prior knowledge about it, and thus start stressing out about being conceived as "dumb.""

Participant 10: "if it was broken into smaller deadlines"

Participant 11: "Teach us the basics and give us sources for more complex stuff, so that we can start the assignment easy, hopefully get hooked, and then try to tackle the harder parts on our own".

Participant 12: "If I had goals set for the assignment, rather than "get it done", break it down into stages based on time to complete & difficulty. And there was an easy way to keep track of said goals".

Participant 13:

Participant 14: "Completing it in small segments".

Participant 15: "If it was in presentation form".

Participant 16: "More free time :)"

Participant 17: "Multiple deadlines"

Participant 18: "A shorter length of time to complete the assignment as I would feel pressure to get the work done. A more enjoyable and rewarding way of completing assignments, quite often I find the work tedious and boring which means I don't want to start the assignment. Better instructions for completing an assignment, the assignments that are set need to be more accommodating to students who struggle with some of the demands and speed of a university environment but who are intelligent enough to be. The information on an assignment should be broken down better into more manageable chunks for people who can get overwhelmed when information is clustered together and not separated out. If this were to happen it would make it easier for myself and other students who feel the same way to start the assignment therefore generating more motivation".

Question 11 results:

Participant 1: "Notifications reminders about time management. E.g., warning you about how much time there is left, Statistics on students who submit their work late vs students who

submit it on time or earlier, Countdown clock, Helpline numbers for stress, Mini games for when you do bits of your assignments to help keep motivated and keep your attention span high” [OBJ]

Participant 2: “Something to help with time management”

Participant 3: “Expected features would be to track the time left for an assignment from the current date until the deadline. Time tracked on each assignment to see how much work has been put into it. Perhaps suggestions of which assignment work should take priority where the person could break the assignment down into smaller tasks to help keep track of what has been done and what is left. If it is a group assignment, a way to share lists with other people within a group. Give reminders to students to take breaks after long period of working or focus them to work on something different to keep their mind fresh”.

Participant 4: “A schedule feature with reminders”

Participant 5: “Rewards”

Participant 6: “Ability to help breaking down of a task/project, not having aggressive notifications, allowing for flexibility if schedule changes e.g., having buffer/extra time for a task to take this into account”

Participant 7: “Ability to break a task (like an assignment) up into many smaller, easier to quickly tackle tasks (based on different criteria e.g., word count or no. of hours it should take to complete)

Ability to work backwards from the deadline and create a schedule from those tasks

In-built timer that lets you know how much longer you have for the task you're working on

Progress bar for assignments? Maybe with predicted finish time based on data input from time spent working on the assignment. (e.g., app tells me on Monday evening I need to write 200 words to be on track to finish assignment by next Friday. I write 400 words and now it tells me I’m on track to finish next Tuesday. woo!)”

Participant 8: “Time required vs time left so:

- Ability to enter how many hours a day/week spent working on a specific assignment

- Add how many hours you think it will take (with a buffer for issues) and when the deadline is

- This would then work out how many working hours you have before the deadline and if you have enough hours booked. This would let you see if you need to spend more time in it / when is the absolute latest you need to start to not go over your planned daily/weekly working hours

Planned working hours for assignment:

- so can set work on this assignment for x hours at this time

- would then receive notifications/alerts reminding you to do so

- potential calendar integration so can properly plan”

Participant 9: “What would help me specifically the most is if there was some sort of reward system where you somehow prove to the app that you have started and it gives you whatever this reward would be, and the sooner you start the better the reward is”.

Participant 10: “Reminders and rewards”

Participant 11: “Easy to put reminders with easy and quick way to add info; select reminder date, select reminder repeat dates, select reminder time during the day, reminder subject, extra info added by the user, button to add completion percentage (+5, +10, +25, all done!) to the notification and the motivation reminder to denote if you have done progress on that particular assignment.

Additional notifications of encouragement (that can be turned off)”.

Participant 12: “Have a page where goals can be set, and marked complete, also have a page where you can put different assignments and have a way to prioritise them, using factors such as when they're due, time it would complete (longest --> shortest, based on size) and difficulty”.

Participant 13: “A way to enter in and track assignments due dates. Function to allow user to enter their schedule and free time Calendar to plan out which assignments will be worked on when Alarms to remind students to take breaks”

Participant 14: “In theory. I would love to be able to tell the app the assignment and have it break it down into smaller segments. It would then remind me, or give me a timer, to complete these smaller parts until the assignment is complete”.

Participant 15: “If you could set reminders on the app, that mark certain stages in which you should be in your assignment. This would create mini goals for you to work towards without it making it seem like one huge task.

Have it as a social platform, where people on the same course can interact etc. You could then create a forum where your peers can give advice or share information.

Could you potentially have a reward system where you earn points towards affiliated brands. Once an assignment is complete, you can scan it, submit it and if you have hit your targets throughout, you earn the points. Very difficult to implement, however”.

Participant 16: “Notification system, preferably one I don't have to fill myself that would send me information about my current deadlines, because I don't usually have time/motivation to do that myself”.

Participant 17: “Rewards for video games (premium currency or a lot of useful materials), bonus points for the subject whose assignment this is, free coffee tickets for a local café”

Participant 18: "1) A full list of assignments that are due for the course, listed in chronological order of when they are due, making it easier to understand what work needs to be done when.

2) Notification reminders that give prompts about when assignments are due.

3) Have a page where the number of assignments that need to be done and how much time approximately, they will each need to be worked on to be completed fully.

4) Calendar showing when assignments are due".

3.3.3 List of Requirements

In the previous section, the final questionnaire was showcased and discussed, the flow as well as the results from participants taking part in the questionnaire was analysed. In this section, the feedback garnered from participants on specific questions will be curated into a list of requirements that will then be put forward towards a final list of requirements for the prototype design.

The last 2 questions of the questionnaire were open-ended questions that asked the participants to provide their own thoughts and opinions on what would motivate them to start an assignment earlier as well as features they would want to see in a mobile app that is design to motivate students. The feedback included:

1. Rewards
2. Weekly assignments for progression
3. Goals to achieve
4. Sort assignments in order of time to achieve and difficulty
5. Notifications
6. Time management
7. Assignment timer
8. Scheduling
9. Progress bar for assignments
10. Reminders
11. Social system

3.4 User Journeys

In the previous section, the researcher designed a questionnaire to understand the needs of the user as well as their thoughts and opinions on motivation, assignments, and late submissions. In the following section, user journeys are discussed and used to create new narratives to visualize the target audience using the prototype.

3.4.1 User Journey Theory

"Data often fails to communicate the frustrations and experiences of customers. A story can do that, and one of the best storytelling tools in business is the customer journey map" (Boag, n.d.).

As technology evolves, new items such as smartphones have given users immediate access to new brands and have allowed connections to grow between the 2 parties. The interaction between users and the products they use can be further described in more detail through the use of User journey maps. The definition of a journey map can be defined as “a visualization of the process that a person goes through in order to accomplish a goal.” (Gibbons, Journey Mapping 101, 2018). Journey mapping is a UX mapping method that requires compiling user actions throughout a linear timeline, fleshing out the user’s thoughts and emotions in order to create a narrative. This narrative is then condensed and smoothed out to create a visualisation. User journey maps are used to study user experiences when interacting with a product over a period of time and during that time, any problems the user discovers will reveal areas for improvement. They are also helpful as they enable brands to learn more about their target audience and creating maps will also create effective mechanisms for displaying information in a memorable and concise way. A well-designed user experience map can not only increase customer satisfaction but will also create better business outcomes (Maechler, Neher, & Park, 2016). The concept of user journey maps has been implemented by many organizations, investing into a good quality customer experience (Pointillist, 2021).

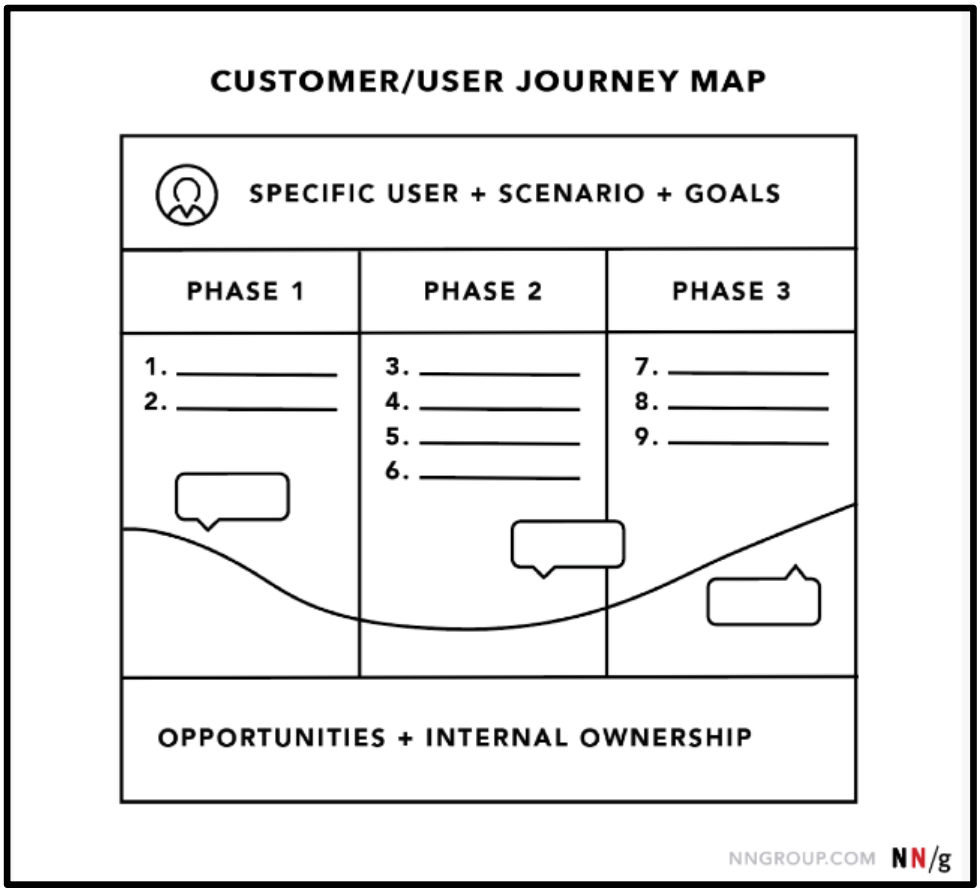

Figure 26 - Template for User Journey Map and Actors, Scenarios and Outcomes

Figure 26 previews a template for a User/Customer journey map. User journey maps can come in different shapes and sizes however all of them will include 5 common elements:

1) Actor
2) Scenario + Expectations
3) Journey Phases

4) Actions, Mindsets, and Emotions
5) Opportunities

The actor is a persona/user who will experience the journey, the journey map will specifically focus on the user from their point of view (Harley, 2015). An example for an actor would be a student. Scenarios + expectations address the situation that the actor is going through and the goals that they are trying to achieve (Gibbons, UX Mapping Methods Compared: A Cheat Sheet, 2017). These scenarios can be real or anticipated, an example of a scenario would be trying to switch a phone plan and the expectations would include friendly tech support from different phone providers and compare/contrasting phone providers (Kaplan, User Journeys vs. User Flows, 2023). Journey phases consist of different high-level stages that provide organised information from the journey map such as actions, thoughts, and emotions. An example of this would be stages for buying a Bluetooth speaker such as discover, try, buy, use, and seek support. The next stage includes behaviours, thoughts, and feelings that the actor will feel throughout their journey (Kaplan, When and How to Create Customer Journey Maps, 2016). The behaviours are called Actions and are carried out by the user, the thoughts the user has at different stages of the journey are referred to as a Mindset and feelings felt by the user during the Ups and Downs of the journey are Emotions. The last stage is called Opportunities, and this stage reveals insights that have been gained from the journey map, insights will often include user experiences that can be optimised and improved upon. Different insights can include what needs to be done with the knowledge gained from the journey map? Who owns the changes? Where are the biggest opportunities? How are we going to measure the improvements we implement? (Joyce A. , 2021).

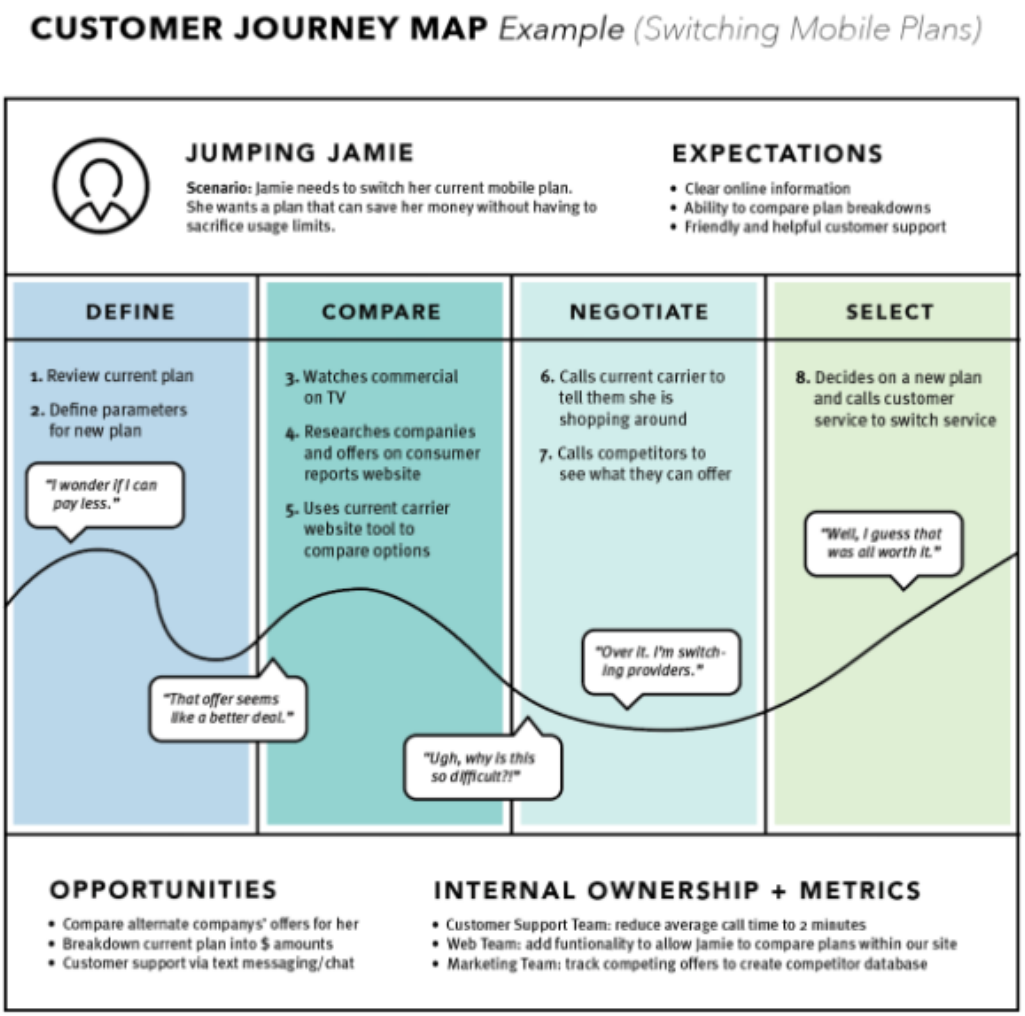

Figure 27 - Example of a user journey map

Figure 27 provides a user journey map displaying the scenario and expectations at the top, opportunities and insights discovered at the bottom and the user experience and journey in the middle. In this scenario, the user is looking to switch their current phone plan. The plan they would be looking to have would save them money without sacrificing their usage limits. Their expectations going forward would be to research and find clear online information on different phone providers, being able to compare and contrast different phone providers and talk to friendly and helpful customer support. They journey itself shows off different thoughts the user is thinking in their experience as well as the different stages the user is taking to find a new phone plan. The line is also showing off their emotional state, as the line goes up, the more positive the thought and as the line goes down the thoughts become more negative. At the bottom, it states the insights that have been learned and improved upon such as reducing the average call time to 2 minutes for the customer support team and adding functionality for the user to compare phone plans on phone provider websites.

3.4.2 Journey One: Jonny Zhang

Previously the theory behind user journey maps and what each phase and section of the user journey map represents was discussed. The following example showcases a user journey map that represents a student who is a part of the target audience for this project.

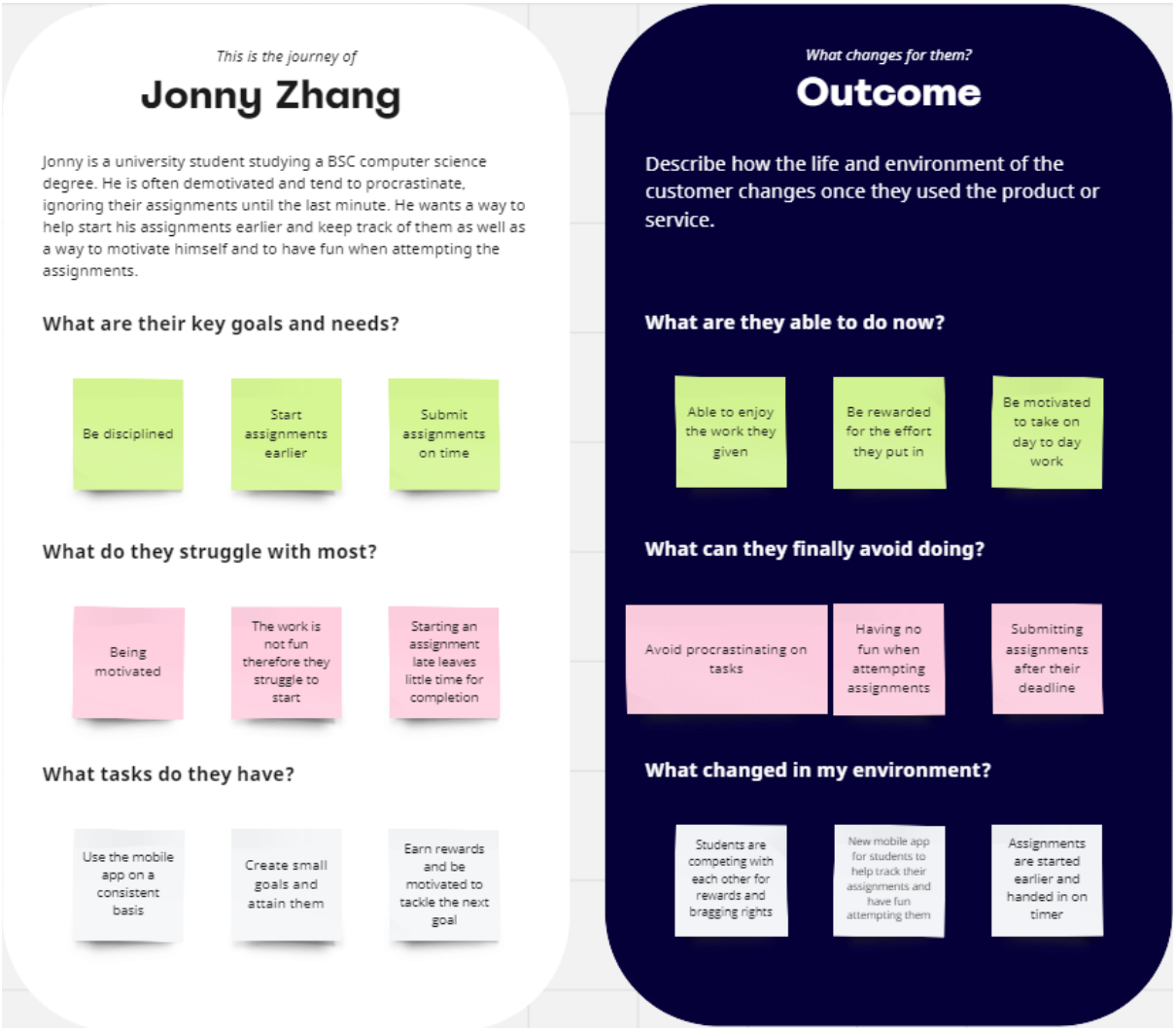

Figure 28 - User journey map aimed towards target user group

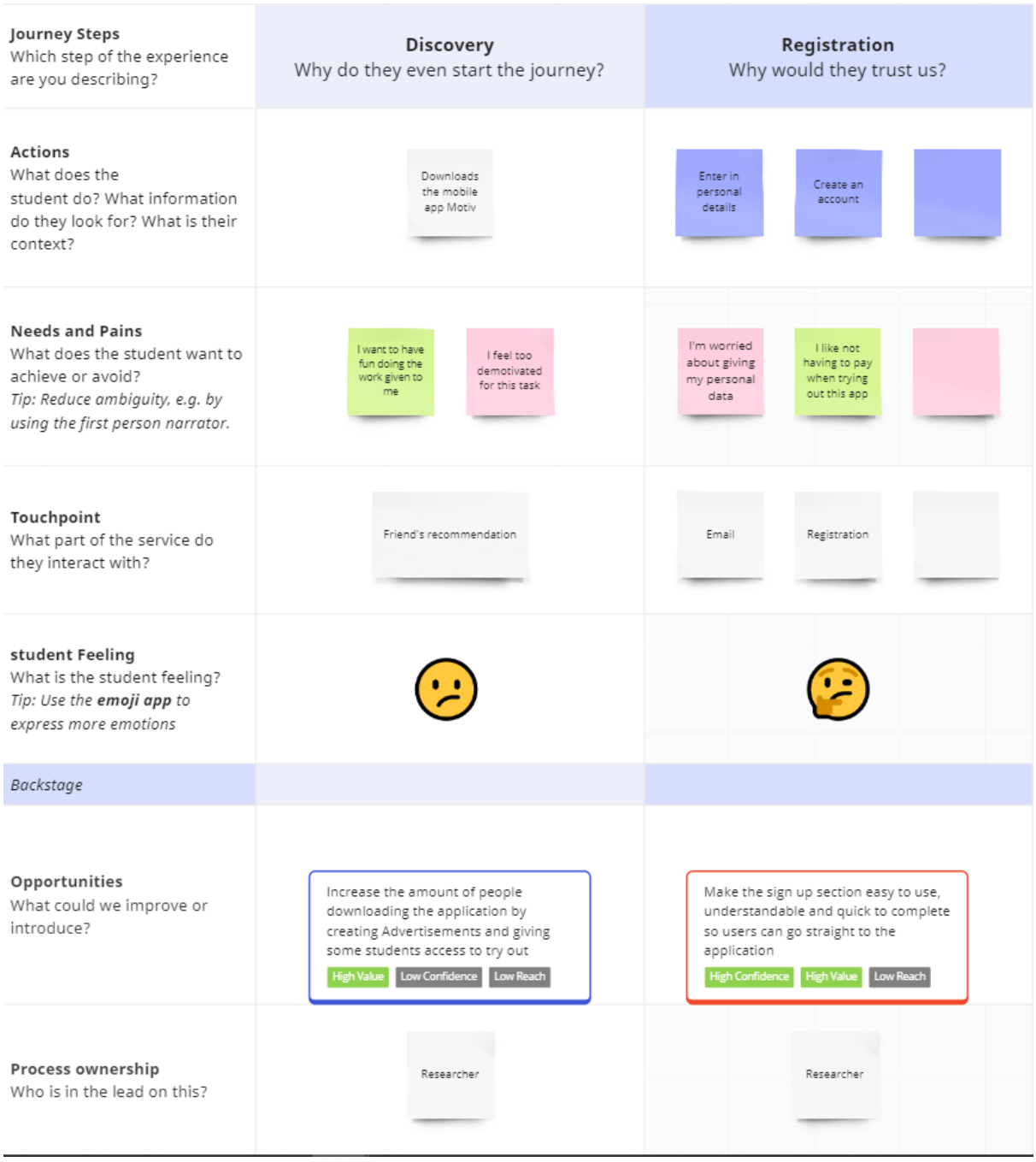

Figure 29 - Part 1 of the user journey map showcasing the first 2 phases and their opportunities

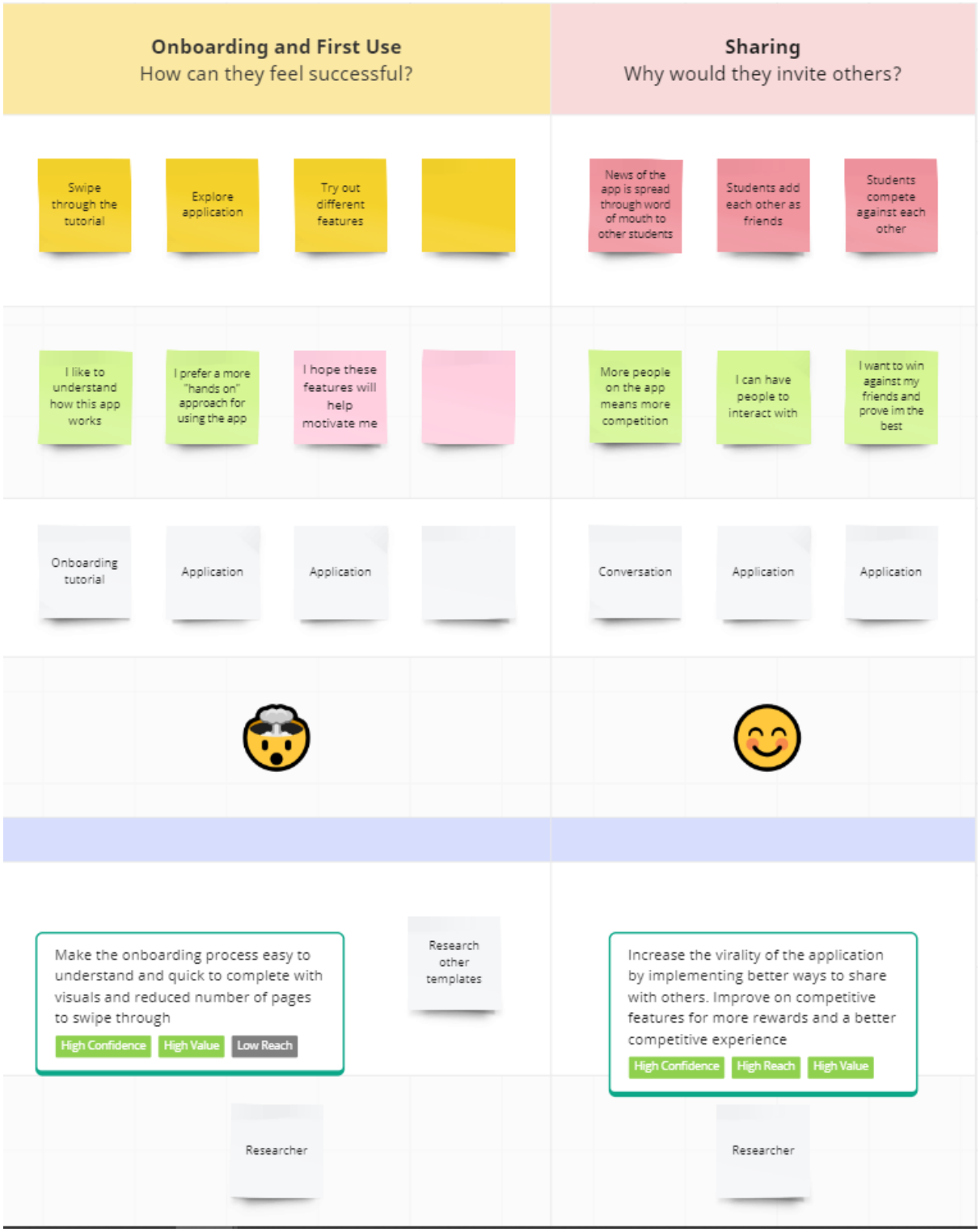

Figure 30 - Part 2 of the user journey map showing the last 2 phases and their opportunities

3.5 List of Requirements

In the previous section, current and existing mobile applications that helped students with their assignments were investigated. strong and weak points for every application were and analysed, many features and qualities that made each solution unique were learned. The features that will be adopted into the design process include:

1. Calendars and Scheduling
2. A main overview pages
3. Checklists
4. Task timer
5. Task management
6. Progress Tracking
7. Onboarding
8. Notifications
9. Priority Tracking
10. Due date reminders
11. Late Flagging for assignments

Summary

This chapter presents research into additional factors that help towards the design process, mainly user needs and current case studies. Users of the prototype provided their thoughts on what they believed to be the most important for an application that motivates students and feedback given will be used in the design process. Case studies were also researched to provide a list of features that are common in most of them as well as unique features that set them apart. All knowledge gained in this chapter will be pushed towards the design process.

Chapter 4 – Design

In the previous chapter, the targeted user group for this application was researched as well as the current mobile applications in the market. Within this chapter, a final list of requirements is curated and used to design a prototype using the list to guide the design process.

In the literature review, the researcher carried out an extensive assessment of motivation, gamification and case studies that relate to the theme of the thesis. Research into motivation has shown many useful and important pieces of information that can help aid the researcher into designing a robust prototype, information such as intrinsic and extrinsic motivation and introducing difficult challenges to people with rewards to justify tackling those challenges. Students that are more intrinsically motivated are focussed more on their individual performance on assignments and challenges than the rewards that come with them, for them the task itself and overcoming the challenges that come with it is more rewarding than the reward. Extrinsic motivation can provide short term motivation for people however being over reliant on rewards can end up causing the opposite effect in the long term. While intrinsic motivation can help with overcoming difficulty in challenges, often times when a challenge or task is deemed too difficult or impossible to do people will dismiss the challenge no matter how rewarding it is.

Gamification is the concept of integrating video game elements into a non-video game setting, the premise for this is to help motivate people into undertaking tasks that are deemed demotivating to do or considered dull. Features that have seen use in a real-world application and shown to be effective at motivating people will be adopted by the researcher to use during the design process, these features include a points system, badges, and leaderboards. The social interactions between students have also been investigated and it was found that students on a day to day are always competitive with each other especially within their own peer groups, and this is a motivational factor that drives people to become better so that they can compete with one another. Another feature that has been found to promote motivation is progression, as mentioned before people who are intrinsically motivated are motivated by the journey they undertake so for progression, seeing the progress they have made from nothing to something can be very motivating especially when they are closer to the goal they want to achieve, this effect is known as the goal-gradient effect. Milestones are a form of progression that people can achieve at the end of a progression cycle, these are normally in the form of a reward, and they can provide people with motivation for a long period of time. Milestones are often repetitive and as people progress over time, the milestones become bigger with better scaling rewards.

Existing case studies had been assessed to help provide the researcher with an understanding of current solutions and the features that they include to help people with managing their assignments, a wide range of case studies were reviewed however they mostly fit into 2 categories: Team project applications and Assignment planners. Team project applications included features such as a main overview page that provided all the details a person needed on one screen, task management, time management, an onboarding process to welcome new users and help them get comfortable with the application as well as priority tracking to help visualise which assignments needed the most attention. Assignment planners often included a task timer, notifications to remind students of important information, calendars and scheduling

features for better organisation, due date reminders and late flagging for assignments past their due date.

4.1 Final List of Requirements

In the literature reviews for motivation and gamification as well as the user research that has been carried out, many ideas and features have been learned proven useful and effective. Listed below are the aforementioned ideas and features:

1. Extrinsic Incentives
2. Performance over Results
3. Increase fun in tasks
4. Task Mastery
5. Positive feedback
6. Exercises broken down into smaller chunks
7. Task checklist
8. Instant feedback
9. Social Interactions
10. Time management
11. Progress tracking
12. Task difficulty
13. Rewards
14. Competition
15. Missions/Challenges
16. Milestones
17. Give multiple tries to complete tasks
18. Profiles
19. Progression
20. Calendars
21. Scheduling
22. Main overview page
23. Task timer
24. Task management
25. Onboarding
26. Notifications
27. Priority tracking
28. Due date reminders
29. Late flagging for assignments

4.2 Design Overview

Previously a list was curated discussing different ideas and features from previous chapters and will be implemented into the prototype. Next an overview of the prototype and its nodes are discussed in detail. Due to technical limitations and time restraints, the features mentioned in

section 5.7 will not be implemented into the prototype but instead these features will be considered as future work that can be worked on at a later date.

Shown below is the main prototype which consists of a loading screen that will be the main starting point for the user when they load the application for the first time. This screen will then lead the user into the onboarding process and from there they will learn what the prototype has to offer and experience the different nodes. The main 5 nodes that make up the prototype are:

1. The Onboarding Process
2. The Main Menu
3. The Settings Menu
4. Achievements
5. Assignment Management

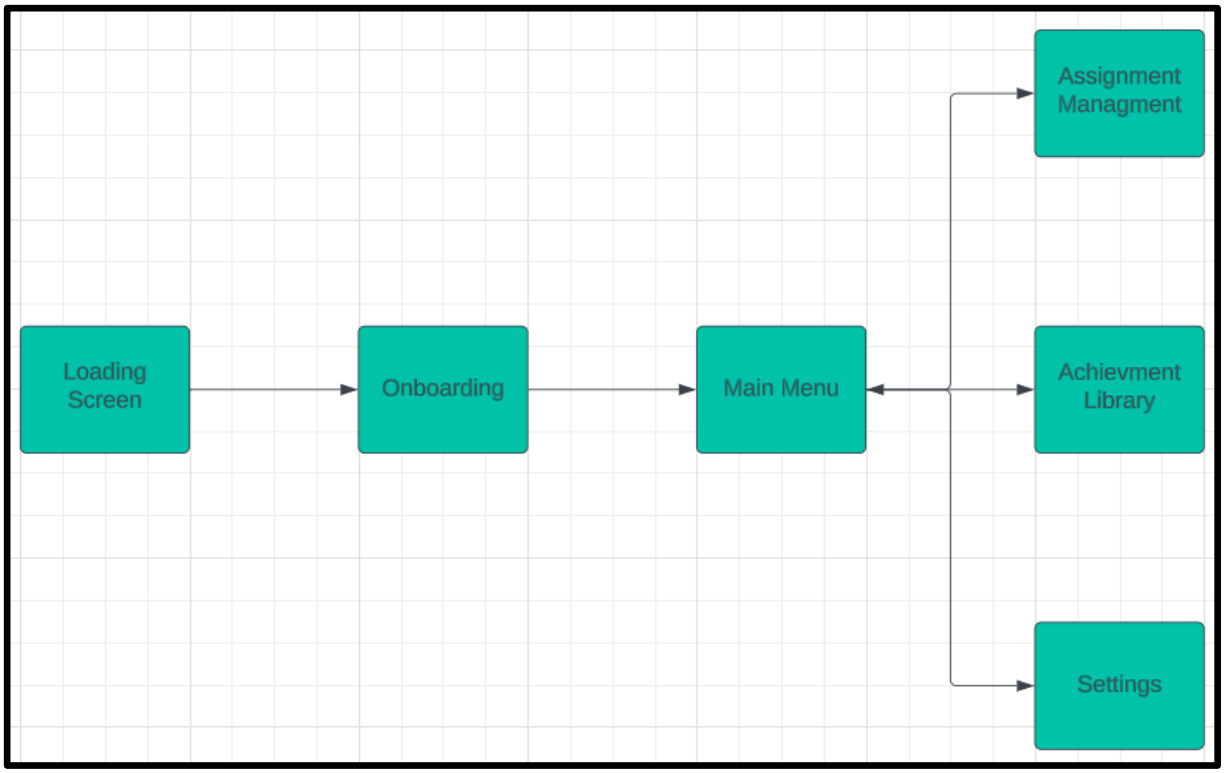

Figure 31 - Basic Wireframe for Motiv Prototype outlining the main nodes and relationships between them

4.3 Onboarding

In the previous section, an overview of the design is provided and examined. Within this section, the theory behind onboarding, the design principles used and the design optimisation for onboarding is deliberated.

4.3.1 Onboarding Theory

Onboarding is the “process of helping new users learn and understand your product or service with the hopes of turning them into long-term customers and advocates” (Appcues, n.d.). By the end of the onboarding journey, the user should be equipped with the knowledge on how to use the app as well as understand how to meet their goals successfully. It’s important to note that onboarding is not the same as a product tour however product tours can be included in the overall onboarding experience. It’s shown by the product led growth flywheel that good user onboarding can take new users or “evaluators” and turn them into champions which in turn will bring more evaluators to try out the app. There are 3 types of onboarding processes: progressive onboarding, function-oriented onboarding, and benefit-oriented onboarding (Cibin, 2022; Chiappetto, 2020). Progressive onboarding focusses on displaying information onscreen while giving the user the freedom to navigate through the app. It can also be seen as a step-by-step process directing the user to take action. Function-oriented onboarding is focussed on educating users about the functionality of the app and explaining to users how they can make use of the functionality. Benefit-oriented onboarding helps communicate the benefits of using the app and showcasing the value the product can add to the user’s life. It can also sometimes provide a quick overview with little detail on the app’s functionality.

4.3.2 Onboarding Principles

The type of process that will be followed is a progressive type of onboarding however it will be simplified by not taking the user through the app but instead once the user has finished the onboarding process they will be taken straight to sign up. When designing the onboarding process, specific design principles and guidelines will be adhered to. The principles described are all centred around the user and their journey, understanding, and satisfying their needs and aspirations (CARLÈN, 2017). One principle is helping out the user’s autonomy, helping them to get started by themselves. Another principle is that onboarding is a continuous process, having a mentality of believing that every day is the first day a user is using an app and to question whether the decisions being made are helping the user (Oliveira, 2019). Showing the user that their needs have been prioritised and satisfying their needs will remind them of the factors that made them download the app in the first place. A brief guidance that is not overly informative is provided, making tutorials that simplifies information while still keeping the users engaged. The principle to help to inspire goals being set, taking advantage of a common trait that is shared among people, that is to “work on fulfilling a commitment when motivated” (Kaminska, 2023). While users are inspired to set goals, users should also want to improve their performance. Effective onboarding will make users feel like they can improve their life and skills. The last principle is to encourage users to return after their first time of using the app, getting them engaged and excited every time they use the app (Petersen, Thomsen, Mirza-Babaei, & Drachen, 2017). Guidelines that apply to my design process include simplicity, using simple language and methods to explain how the product works. The fewer the steps to convey information the less effort and skill is needed from the user for e.g., 5 steps instead of 10 (Strahm et al, 2018). Another guideline is show not tell, instead of explaining features to the users, a demonstration or graphic to show users how the features work. Rewarding users for the progress they make during the onboarding will make them feel recognised for their efforts and can encourage them to come back (Eriksson & Parflo, 2019). Congratulatory messaging and innovative rewards will be used. The last guideline is giving the user less time for learning and more time for productivity,

helping them perceive the value of the product and understand it is right for them (Kurzweg, 2022).

4.3.3 Onboarding Design

In the design, simplicity allows for clear and concise communication. To convey the information about the app, a slideshow flow design makes use of infographics to show the user what the key features of the app are (Joyce A. , 2020). The graphics themselves are simple illustrations that show to the user what it represents for e.g., the trophy graphic represents reward. The information is split into 5 slides which is long enough to help the user understand the key features they need to be aware of but not too long that it will retain the user's attention span. The 5 dots underneath will represent the onboarding journey and the dot will glow to represent where they are in the journey. Colours can signal action, influence moods and different physiological actions, choosing the right colour can affect how a user interacts with the app (Cherry, Color Psychology: Does it affect how you feel?, 2022). The colour green is chosen due to its calming and tranquil nature due to its link with nature (Cherry, What does the color green mean?, 2022). It also represents growth which links with the theme of the app. Some users don't wish to expend effort towards reading onboarding text even if its minimal (Oliveira, 2019), so users are given the choice to skip the onboarding process and move straight to the sign-up process.

Figure 32 - Welcome screen for Onboarding process

Figure 32 showcases the onboarding process welcome screen and in this design, you will see that different shades of the green colour palette have been used to create a calm, welcoming

and positive environment. The text accompanying the book image displays “Welcome to Motiv”, Motiv being the name of the application.

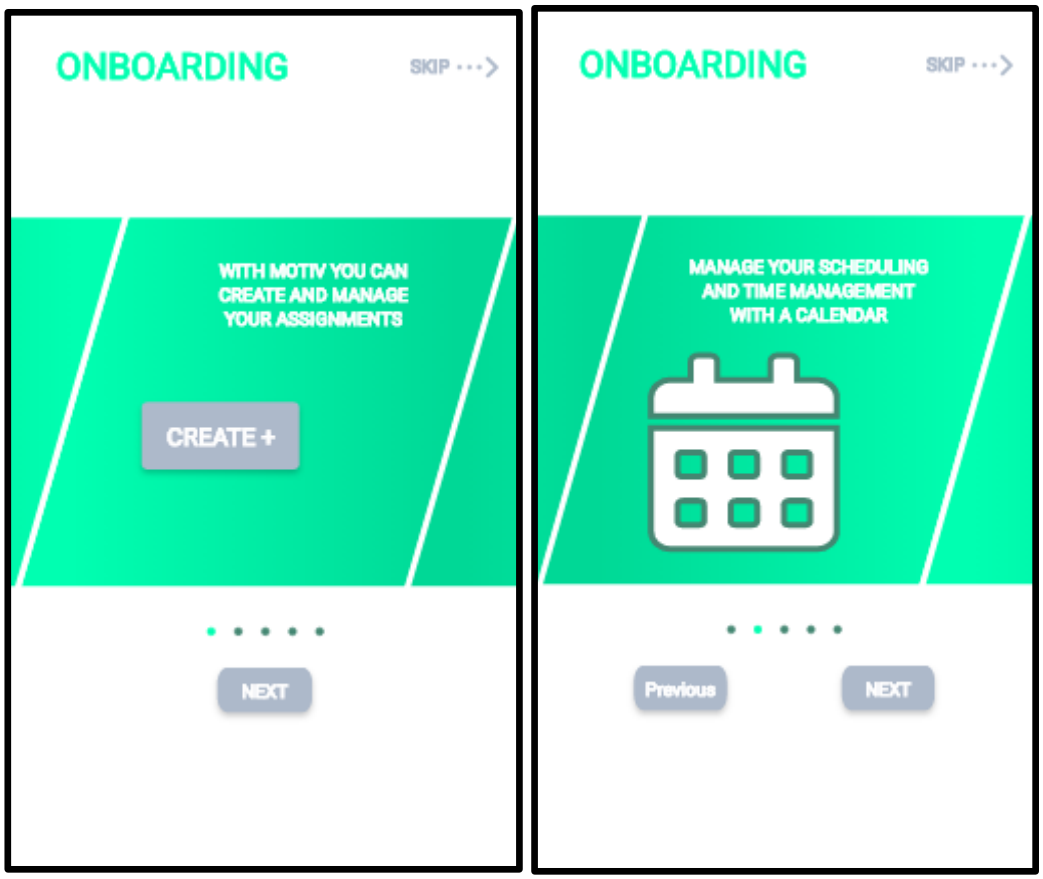

Figure 33 - The first and second page for the Onboarding process

Figure 33 includes screenshots of the onboarding process displayed in a slideshow format and the calming green colour palette has been carried over. The first screenshot includes the first slide with information on creating and managing assignments. Below the slides are 5 dots to represent the number of total slides and a button titled “next” to navigate the Onboarding. At the top right of the screen is a Skip button to allow the user to Skip past the Tutorial and get straight into the application. Screenshot 2 reveals more information on time management and scheduling with a calendar, it includes a button labelled “previous” to allow users to navigate to the previous slide.

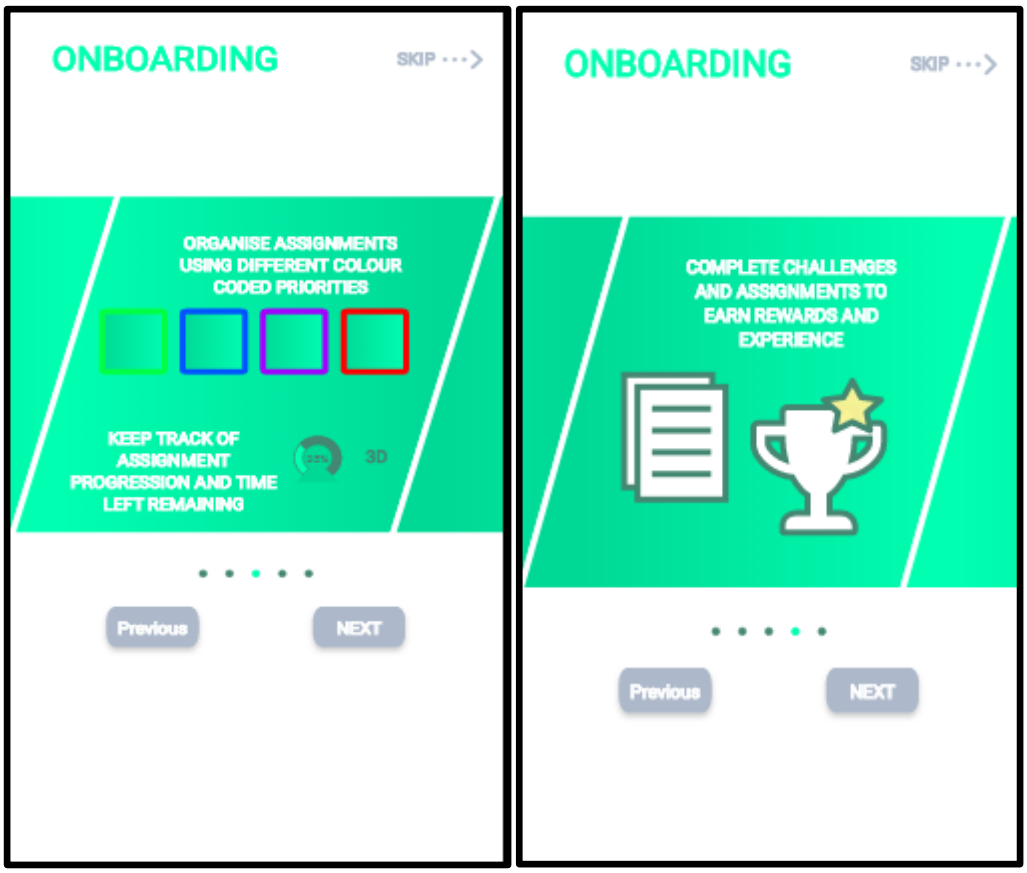

Figure 34 - Third and Fourth page for Onboarding process

Figure 34 provides more screenshots for the Onboarding process with information on colour coded priorities, visual progression reminders, timers as well as rewards for completed assignments and challenges.

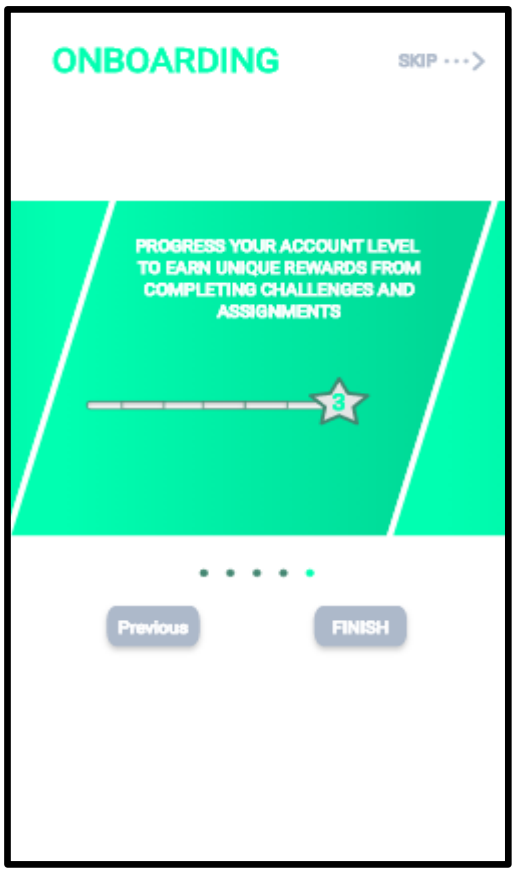

Figure 35 - Fifth page for Onboarding process

Figure 35 showcases the final screenshot of the Onboarding process, with information on account progression and unique rewards. There is a graphic to provide a visual description on the information provided with the accompanying text “Level Up” to show the progression.

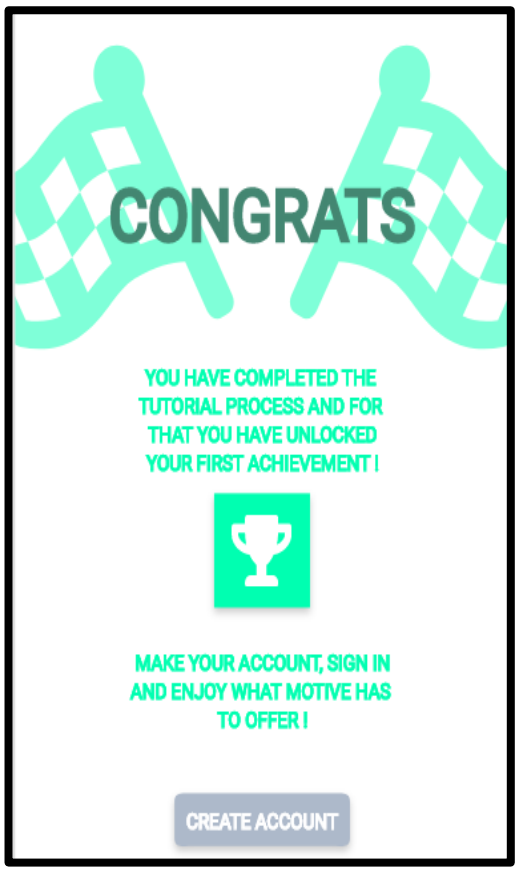

Figure 36 - Ending screen for Onboarding process

Figure 36 involves the congratulatory screen for users that have completed the Onboarding process accompanied with information explaining what the user has been rewarded with as well as a “Congrats” text to make the user feel content with what they have achieved. Users are shown the achievement they have unlocked and under the paragraph of information is a button labelled “create account” that will lead users to a different section where they can create their own account.

Figure 37 - A button for users to skip to the Onboarding process (Zoomed in)

Figure 37 is a zoomed in image of the skip button that will be used by the user to skip past the Onboarding process and go straight to the application.

The aim behind my onboarding experience is to help users understand the key features in the app and help them to understand how they can successfully achieve their goals. The app at its core is to help motivate people to complete their work so users that share the same problems will come to understand the unique features that can help motivate them such as challenges and rewards. Other features such as the calendar and priority system are not necessarily features that will help directly with motivation but instead provides a toolset for the users to make use of when they are motivated to tackle the assignments and challenges.

4.4 Main Menu

In 5.3, the process of Onboarding and the principles behind designing a good Onboarding tutorial are examined. Here the purpose of the Main menu screen as well as its design decisions are consulted in detail.

The Main menu screen is a central hub that provides users access to all features that are available within the prototype. These features can be accessed via buttons and each button is designed to represent the feature that they connect to. The design of the main menu screen aims to keep a simple and clean look with minimal elements on screen to prevent the user from being overwhelmed with information. Elements at the top of the screen consists of two buttons that are represented by a symbol relating to the node that the buttons provide access to, a Gear icon for the accessibility menu and a Question mark icon for the Onboarding process. The top left houses a progression bar to give a visual representation of how far the user has reached their next level. The name of the prototype is centred in the middle and below it is two labelled buttons that transition to their respective page when clicked.

Figure 38 - Button elements at the top of the screen (Zoomed in)

Figure 38 displays a screenshot that shows UI elements at the top of the screen, the elements include a wrench icon that is used to represent the accessibility menu, a question mark button that will navigate the user to the onboarding process and a progression bar to show the user their progress in completing challenges and assignments.

Figure 39 - Main menu background image (Zoomed in)

Figure 39 consists of a background image that includes a stack of books with a mortarboard on top, the nature of the application is tied to education and the imagery of books, and the mortarboard is often related to academia and education.

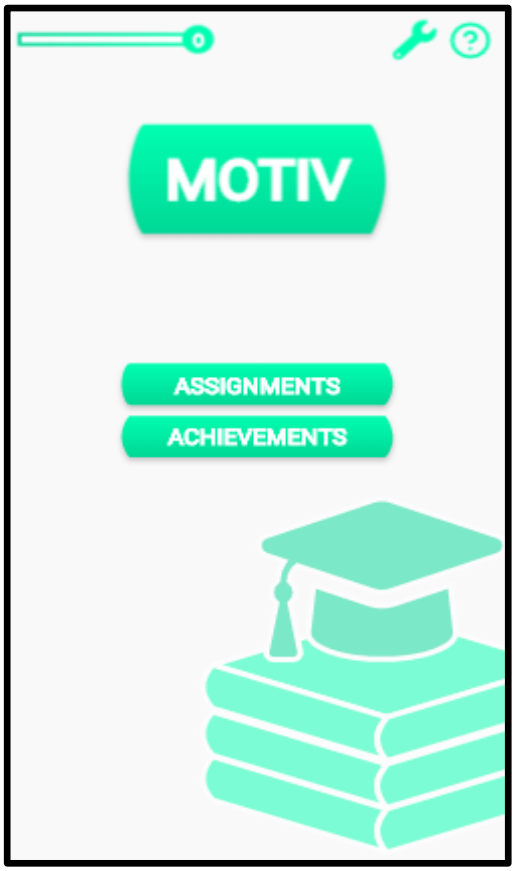

Figure 40 - Screenshot of the Main menu screen

Figure 40 provides an overall screen view of the Main menu page that includes multiple elements such as a title box labelled “motiv” explaining the name of the application, UI elements at the top of the screen, buttons in the middle of the screen to navigate to different parts of the application and a background image.

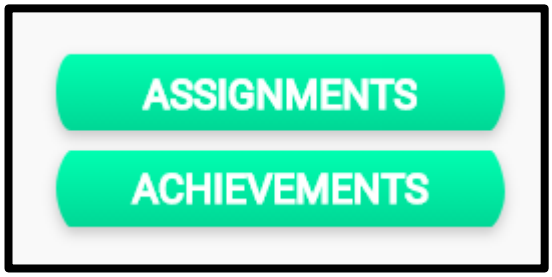

Figure 41 - Buttons for Assignments and Achievements nodes (Zoomed in)

Figure 41 comprises of two buttons that navigate to different areas of the prototype application, the first button labelled “assignments” which leads to the assignment management section and the second button labelled “Achievements” which navigates to a library that holds all achievements that are unlocked by the user.

4.5 Assignment Management

In the previous section, the purpose and design decisions behind the Main menu screen is discussed. In this section, how assignments are created and managed are explained.

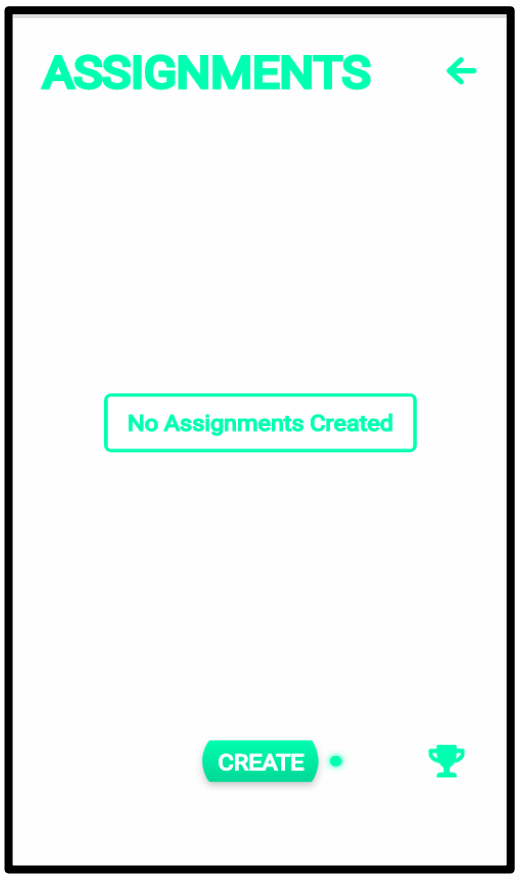

Figure 42 - Assignment management screen

Figure 42 provides an overview of the assignment management screen accompanied with the text “Assignments” titled at the top of the screen to display what section of the application the user is navigating. An Arrow is shown at the top right of the screen to allow users to navigate back to the main menu. In the middle of the screen is a box coupled with the text “No assignments created” to convey to the user that the management page is empty with no assignments, other UI elements include a button labelled “create” to help the user create assignments, a trophy icon that will provide an overlay displaying the challenges as well as a hotspot to provide to the user information on what specific elements functions.

Figure 43 - Assignment Create Button (Zoomed in)

Figure 43 is a zoomed in image of the “Create” Button element accompanied by a hotspot UI element

Figure 44 - Hotspot expansion for Create button (Zoomed in)

Figure 44 showcases an expanded view of the UI hotspot element located next to the “Create” button element. Within the expanded view is the accompanying text “Create an assignment here!” alerting the user that the button will allow the user to create their assignments.

Figure 45 - Challenges button (Zoomed in)

Figure 45 consists of a zoomed in image of the challenges button which is made up of 4 horizontal bars to represent the shape of the challenges.

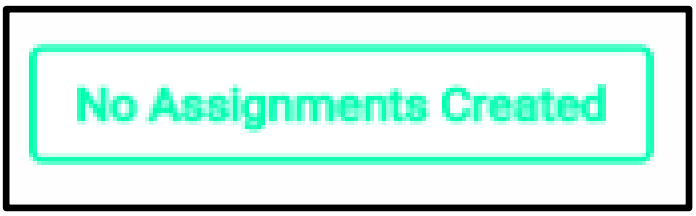

Figure 46 - Assignment Management background icon (Zoomed in)

Figure 46 shows off a zoomed in image of the background icon in the assignment management page, the icon is translucent to make the image less bright and easier to view for users. The icon represents an assignment consisting of 2 pages, one laid behind the other with different shades of green.

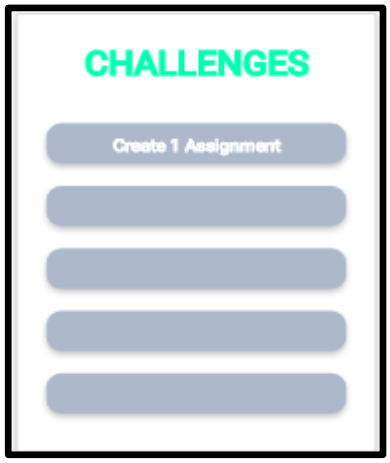

Figure 47 - Challenges overlay

Figure 47 is an overlay that displays onscreen various challenges that are designed as part of a progression feature for users to complete and earn rewards. Different challenges have differing difficulties and the harder the challenge is to complete, the better rewards the user earns. The colour grey was chosen to represent an incomplete challenge and when the user has completed a challenge, it will change colours to the bright green colour palette.

The main purpose for this prototype is helping students with managing and completing their assignments and submitting them before a deadline. To help students with this issue, a management page has been designed where assignments are created, listed and information on the assignment will be displayed to convey to the user which assignments are more important than others. The page carries on the idea of simplicity and doesn't strain the user with too much visual information so there are minimal amount visual elements on the screen. The assignment management page includes a green bar at the top of the screen that houses a title explaining what screen they are on as well as an arrow button that allows the user to navigate back to the main menu screen. There is a simplified background image that conveys to the user what page they have navigated to centre in the middle and to not overpower the user's eyes, the opacity of the image has been reduced to 20% so the users can still see the image, but the brightness of the image is easy to look at. A gamification feature that has been researched and implemented are difficult challenges for the user to attempt and they can view these achievements via an Icon in the bottom right corner of the page. Clicking the icon will provide an overlay housing all challenges that they can achieve and there will be visual representations showing which challenges have been completed and which are still being attempted. A create button exists at the bottom of the page for users to create their assignments, this button will pull up an overlay where users can go through a process to create their assignments. The design of the create button follows the same shape as the title and buttons for the Main menu page. Next to the create button lies a small interactable hotspot that users can click to expand for more information, hotspots are used as a way to convey information to a user on how a specific element works. These hotspots will be placed in areas of the prototype that the user will be navigating to the most.

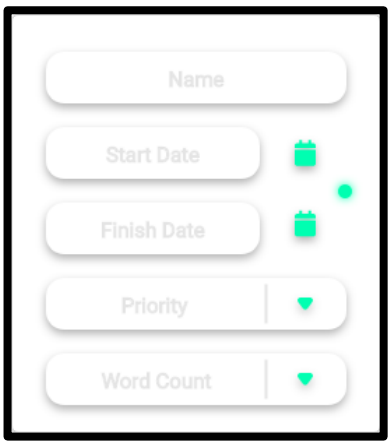

Figure 48 - Assignment Creation overlay

Figure 48 is creation overlay that shows up onscreen after the user has interacted with the “create” button element. It has a simple design for the user to input the necessary information to create an assignment such as the Name, start and end dates as well as priority levels and word counts. Accompanying the start and end date fields are calendar icons for the user to interact with as well as another hotspot UI element. The priority and Wordcount fields feature a dropdown menu that will reveal options to the user. The interactable elements in the overlay are coloured green so it is easier for the user to see and interact with.

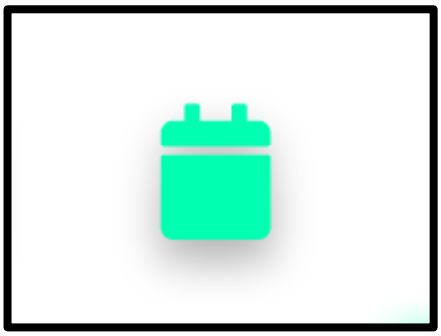

Figure 49 - Calendar icon (Zoomed in)

Figure 49 is a zoomed in image of the calendar icon on the creation overlay, the icon has a shadow underneath to make it stand out for the user to see.

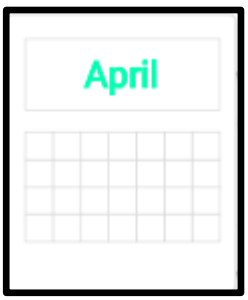

Figure 50 - Calendar icon (Zoomed in)

Figure 50 showcases a simple calendar design that is revealed onscreen when the user clicks on the calendar icon in the creation overlay, each date on the calendar can be clicked on and set as a start and end date. Accompanied at the top of the calendar is text displaying the Month.

Figure 51 - Priority dropdown menu

Figure 51 reveals a dropdown menu for priority levels that can be set for assignments, different priorities represent how important a task is and the less time an assignment has until its end date the more urgent the priority.

When the user clicks the create button, an overlay will show up where users can enter details of their assignment such as the assignment name and their due dates. To set up due dates, users can access a calendar via an Icon and clicking on the first date will be set up as the start date, the second date chosen will be set as the ending date. Users can also set up priority levels to show which assignments are more important to complete than others, if an assignment is created without setting a priority level, then by default the priority level will be set to Low. A dropdown menu can be accessed via an arrow and will reveal 4 priority levels: Low, Medium, High, and Important.

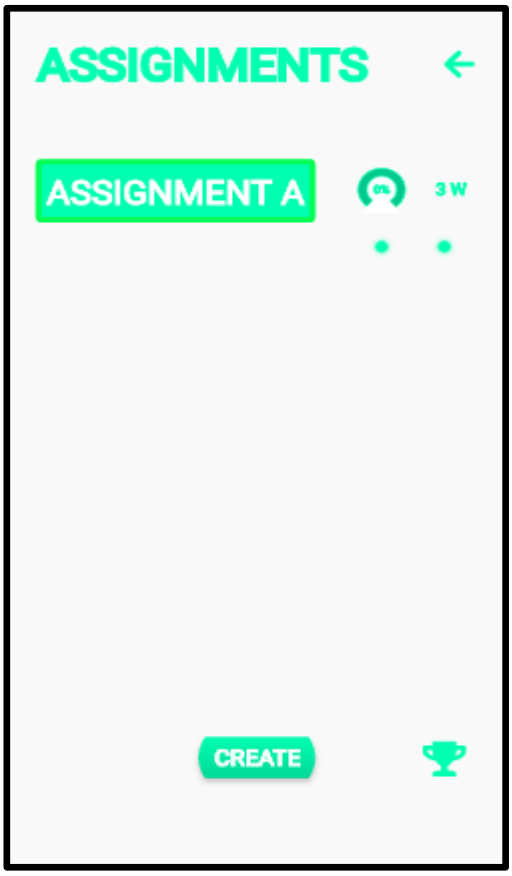

Figure 52 - Assignment management page with assignment created

Figure 52 provides a screenshot of the assignment management page when an assignment is created and active, the assignment is represented as a box accompanied by the text “Assignment A” and the colour of the assignment border represents the priority level of the assignment. Adjacent to the assignment are UI elements such as the progression bar with a percentage counter in the middle as well as a timer next to it to remind the user of how long the assignment has left. Underneath the timer and progress bar is a hotspot element for the user to interact with and learn more information.

Figure 53 - Assignment Progress and Timer (Zoomed in)

Figure 53 provides a zoomed in screenshot of the assignment progress bar and date timer, the progress bar uses 2 shades of green to show off when the bar fills and how much progress has been made. Inside the bar will be a percentage to visually show to the user how much progress they have made when attempting assignments. Adjacent is a date timer that will inform the user of how long the assignment has until the end date has been reached, the timer will be counted down from weeks to days.

4.6 Achievements

Achievements are trophies that are earned through the completion of specific challenges and objectives. They are a gamification feature that have been introduced as incentives to keep users interacting with the prototype long term. The library that houses all achievements can be accessed from the Main menu via a labelled button. The achievement library features three horizontal rows with seven achievements in each row, each row can be scrolled to reveal more achievements. Achievements have two states: Locked and Unlocked, Locked achievements are shown by a grey square and a light grey Lock icon whereas Unlocked achievements have a bright green colour with a trophy icon. Users can view their unlocked achievements but clicking on them and expanding them, this reveals more information about the achievement. The achievement library has a green bar at the top housing the title of the screen as well as an arrow that will take the user back to the main menu. In the background of the library screen is an image of a trophy with a crown inside, this gives the user a visual aid so they know what screen they are on should the title of the screen not be in a legible state. To notify users on when they earn their achievements, they are shown a pop-up box notification that will appear at the top of their screen (see Figure 40 below), when the user clicks the box, they are taken straight to the achievement library so they can view what they have earned.

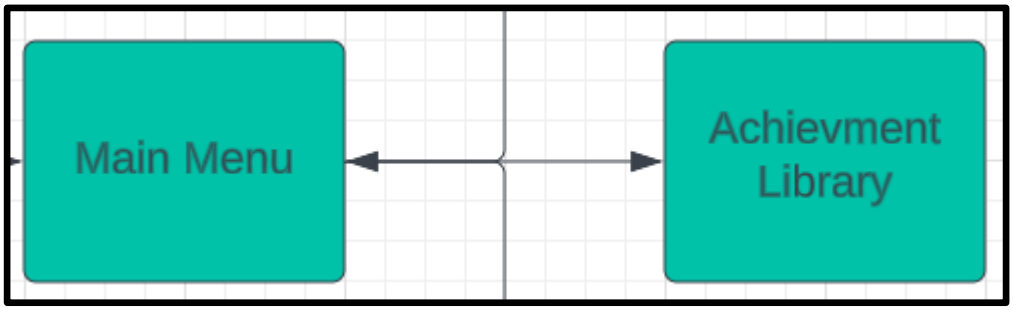

Figure 54 - Wireframe for Achievements menu

Figure 54 features a simple wireframe displaying the relationship between the Main menu node and the Achievement library node.

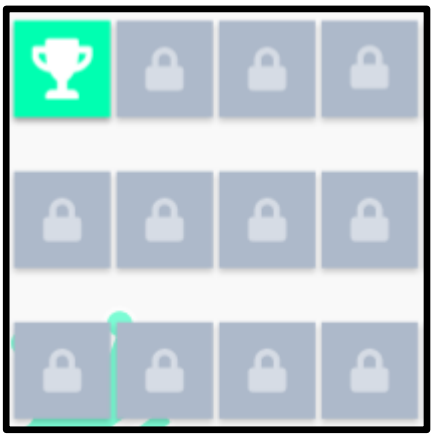

Figure 55 - Achievement Library

Figure 55 shows the Achievement library that consists of 3 horizontal scrollable rows, each box represents an achievement that can be earned through completing a specific task. The colour of the achievement is determined by the state, grey coloured boxes with a lock icon refers to a locked achievement. Green boxes with a trophy icon represent an unlocked achievement.

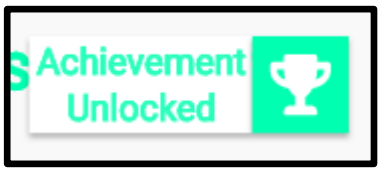

Figure 56 - Achievement notification

Figure 56 shows off a notification that the user will receive when they have completed an action or task and earned an achievement. The notification consists of a rectangular box accompanied by the text “Achievement unlocked” and a green box with a white trophy icon centred inside.

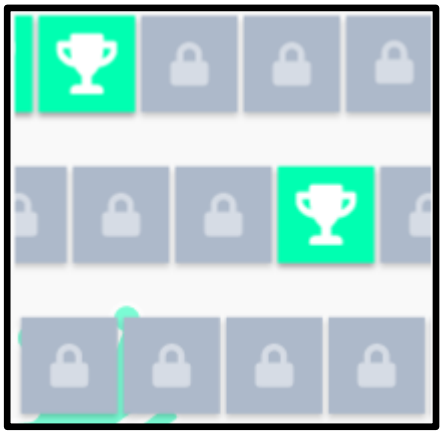

Figure 57 - Horizontal scroll of Library

Figure 57 displays the scroll feature of the achievement library; users can drag the rows across to reveal more achievements that can be earned.

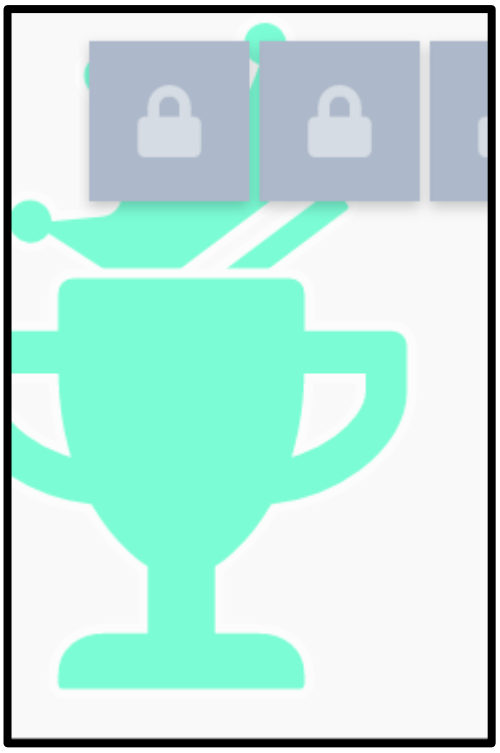

Figure 58 - Trophy background for Achievement library (Zoomed in)

Figure 58 shows off the background image for the achievement library, this consists of a trophy with a crown nested inside. The green used to colour the background image is slightly dialled down in brightness to make it easy on the eyes for the user to see. The image is positioned in the bottom left of the screen with a some of the trophy handle offscreen.

4.7 Accessibility

In the previous section, the achievement library as well as the achievements earned was outlined in detail. In this section, accessibility options for users are discussed.

Accessibility is defined as "the concept of whether a product or service can be used by everyone—however they encounter it". it concerns itself with being able to provide the same experience to all users with or without a disability (accessed by https://www.interaction-design.org/literature/topics/accessibility). According to a report in 2011 by the World Health Organisation, 15% of the earth's population would struggle with accessibility should designers overlook an important factor of design. Different disabilities can be categorised in 2 groups: Physical and Technical. The different types of physical disabilities include (Ivey, 2022):

- Visual (colour blindness)
- Motor (wheelchair users)
- Auditory (Hearing issues)
- Seizures (Photosensitive epilepsy)
- Learning/Cognitive (Dyslexia)

Technical disabilities to watch out for include:

- Technical literacy (how well users can understand technical jargon)
- User devices (are user devices compatible with websites and apps)
- Locations (can users access your websites and apps from their location)

Due to the nature of the prototype however, the disability issues that the prototype will aim to cover in the accessibility menu will be visual and auditory impairments. Standards and guidelines were created by the world wide web consortium to help with accessibility in design. These guidelines were broken down into 4 principles (Kramer, 2018) each with their own success rating. They are rated from A, AA and AAA with A being the minimum requirement and AAA being the gold standard for accessible design.

1. Perceivable (Can content be consumed in different ways on my website/app)
2. Operable (can the website/app function without causing any confusion)
3. Understandable (can users navigate the user interface and understand how the website/app functions)
4. Robust (can the website/app be used by different apps)

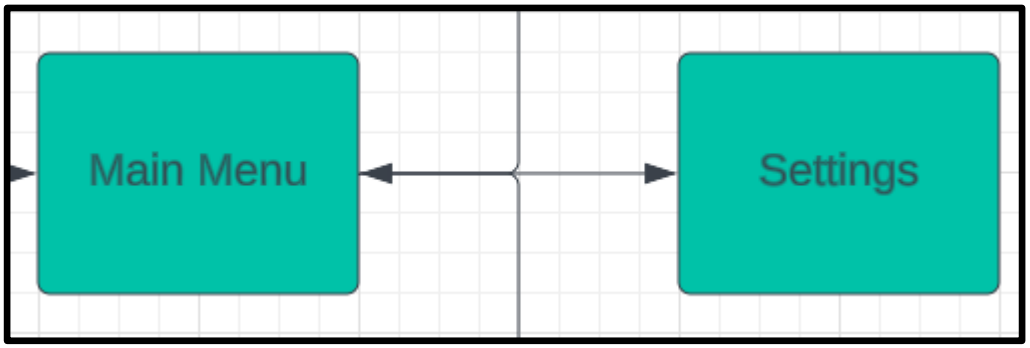

Figure 59 - Wireframe for Accessibility menu

Figure 59 shows off a wireframe displaying the relationship between the main menu node and the accessibility menu node.

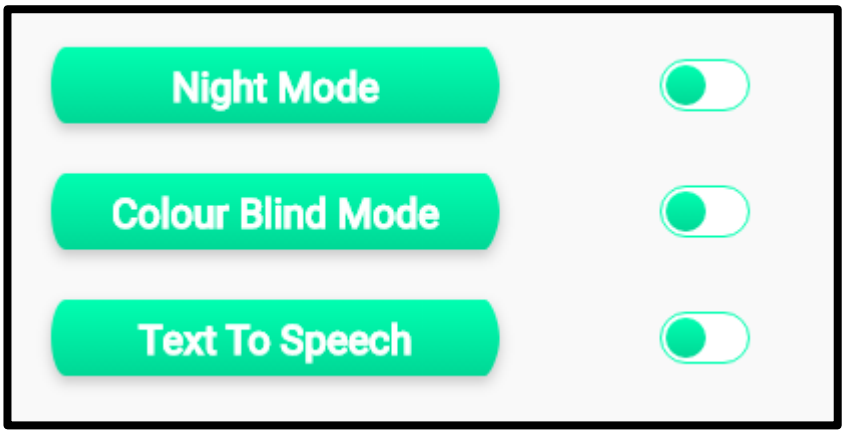

Figure 60 - Accessibility Options (Zoomed in)

Figure 60 is a screenshot of the accessibility settings that can be interacted with and changed by the user, settings include a Night mode feature, Colour blind mode feature and a Text to speech feature. As mentioned earlier in the design process, these accessibility features are cosmetic only and will not make any changes when toggled on in the prototype. The features are housed in a rounded box with a shadow underneath to make it stand out to the user.

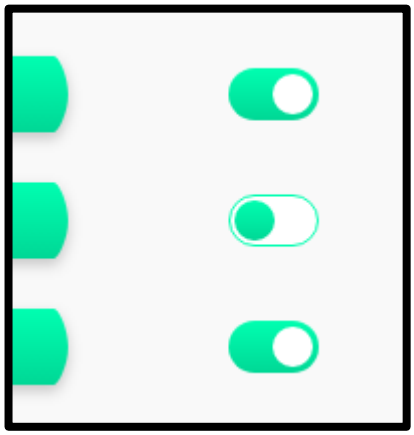

Figure 61 - Accessibility Sliders (Zoomed in)

Figure 61 provides a zoomed in image of the toggle switches used to turn on and off the accessibility features. The toggle switches have two states with different colours to provide the user with a visual representation, bright green with a white circle represents the on state and white with a green circle will represent the off state.

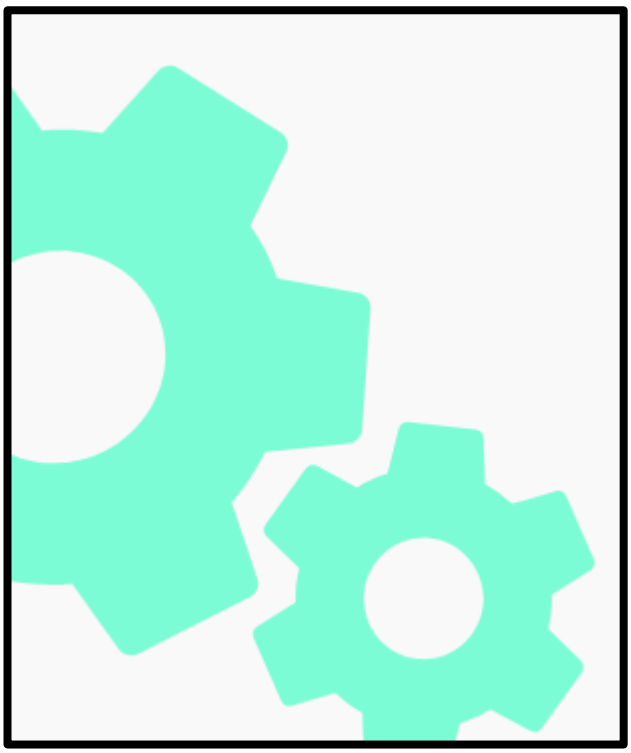

Figure 62 - Gear background for Accessibility menu (Zoomed in)

Figure 62 showcases the background image for the accessibility menu page, consisting of 2 gear icons nested side by side. It follows the same colour palette as other background images to make it easier for the user to see.

The disabilities that this prototype will aim to help users with will be auditory and visual impairments. To help with visual impairments, users will have access to a colour blind feature that will change the colours of the app to a colour that they are able to see as well as a night mode for other users that have a hard time looking at bright colours or want to be able to use the app in a darker room without the screen emitting a bright light. The background image for menu will reflect the nature of the screen the user is currently navigating so if they can't read the title, they can infer from the gear image that they are in the accessibility menu. For auditory impairments, users have a text to speech option that will translate text in the app and be read out to them via an AI voice for e.g., when navigating the main menu, should they click on a button, the speaker will say where they have navigated to such as Achievements or Onboarding. Each accessibility option is controlled by a slider and when clicked the slider will change state to show the user that the option is active. The accessibility menu can be navigated to from the Main menu via a Gear icon in the top right corner.

Summary

This chapter highlights the overall design process of the prototype application starting from the list of requirements to the end product. In the previous chapters, design features and mechanics were researched to curate a list of requirements that would guide the design process. The prototype was split into several sections from onboarding to the core experience to bonus features with each section explaining its reasoning for the choices made.

Chapter 5- Prototype Evaluation

Chapter 4 detailed the design process that the researcher undertook to design and create the prototype application, starting from a list of requirements to an end product. In this chapter, the prototype application is put through a series of black box and white box tests.

5.1 Functionality Testing

The first series of iterative tests carried out by the researcher will be aimed at testing the prototype's functionality, performance, and overall robustness. Users will be able to use the prototype to test whether certain features are working as intended as well as provide feedback on aesthetics and overall feel of the prototype.

5.1.1 Prototype Test 1

In this section, details about the first prototype test that occurred using the think aloud method are discussed, the methods used are discussed in depth and the reasons why; The results and feedback from the test as well as the changes made to the prototype are shown.

Aim

The aim for this test was to understand the players thought process when interacting with the app prototype and receive feedback about the prototype's functionality and usability. The prototype is then iterated on using feedback from the test and made ready for the next prototype test.

Background

The test was carried out at 11 am and consisted of 2 UK based individuals both of which were the developer and co-developer of the prototype. The tester undergoing the prototype test is the co-developer of the prototype and is aged 66 which is older than that of the targeted age group and he is a teacher at the university of Hull as opposed to a student which is the intended audience for the app therefore he may not understand some terminology that would be understood by someone younger or a student. The developer noted down feedback using notepad and recorded the test with Microsoft Teams. Both developers were online in a Microsoft teams video call with the tester using Adobe Xd to test out the prototype application. Adobe XD is a software tool used to create prototypes that can be tested and used as a real product. This platform makes use of multiple features such as components and states, 3D transforms and sharable libraries. This particular software was used because it is available on both Windows PC and Mac as well as it being easy to use. It includes a share feature which allows other people to view prototypes, test them and leave feedback (Rae, 2020). As the co-developer was navigating through the prototype, he would voice out his thought process and talk about everything he sees from images and text to features and buttons. Every thought that is seen as feedback will be noted down by the developer. The test itself however was not carried out as well as it should have been as there were questions asked which led to a "to and fro" dialogue and became more supervised.

Methods

The method used to carry out this test was called the think aloud method where the tester would speak out their thoughts as they are using the app. The thoughts would then be written down and recorded as feedback. Nielson (Nielson, 2012) mentions many benefits that come with using this method specifically which include:

- Being cheap: minimal equipment is required for testing, all that is required is a notepad to write down notes as the tester talks.
- Robustness: if tests are not run exactly the way the user wants them to, results can still yield reasonably well
- Flexibility: this method can be used through the product lifestyle from early stages to a fully developed application and still provide quality results. Projects that are often iterated on benefit the most from this method type.
- Convinces Minds: when developers hear first-hand from their users about their product, they are more likely to open up and pay more attention to usability and Quality of Life.
- Easy to learn: the method itself is simple to learn and even more so to apply in practice.

A review by Nisbett and Wilson (Nisbett & Wilson, 1977) into the think aloud method led them to believe that "people often provide inaccurate reports about their cognitions". When individuals have to report about their thoughts but are unable to do so they will often think up implicit theories about their thoughts in order to provide the report. They reviewed a piece of research (Maier, 1931) that demonstrated the problem discussed and it was concluded that "individuals have specific limits on access to the thoughts meditating their decision and actions".

Results/Discussion

The journey the tester undertook when interacting with the prototype was recorded using Microsoft teams and feedback that the tester provided was written down. The following feedback was recorded:

1. Non specialist in UI/UX would be confused around the word onboarding
2. Confusion around the loading screen, clarification is needed
3. A route back to the tutorial in the case players decide to skip
4. Language can be reworded to sound crispier
5. More clarity in images
6. The term "Account level" is not clear
7. Clarity on what rewards the player have earned, change wording when describing them and add visual representation
8. Messy UI for assignments page
9. "Turn off tips" graphic should be only seen once and be clearer
10. Calendar should be clearer
11. Hotspots should be changed to make better sense
12. Achievement notification should be translucent
13. Too many circles around
14. Make assignment page more intelligent, recognise when an assignment as been created to change create button to create more
15. Flesh out placeholders

Conclusion

To conclude, the test was useful in receiving feedback for the prototype however there are variables to take into account such as the tester being a co-developer for the app as well as not being within the targeted age group and audience so the data may not be as reliable. The prototype should be iterated on with the feedback provided and more tests should be carried out with testers that are within the targeted age group and audience to compare and contrast the datasets.

Changes made:

Figure 63 - The label Onboarding has been changed to Tutorial for a better understanding

Figure 64 - Loading screen now has the word “loading” for clarification as well as a simple animation to showcase it

Figure 65 - A simple button to provide players a route back to the tutorial

Figure 66 - Better wording to portray features

Figure 67 - Reworked UI elements to provide a better understanding

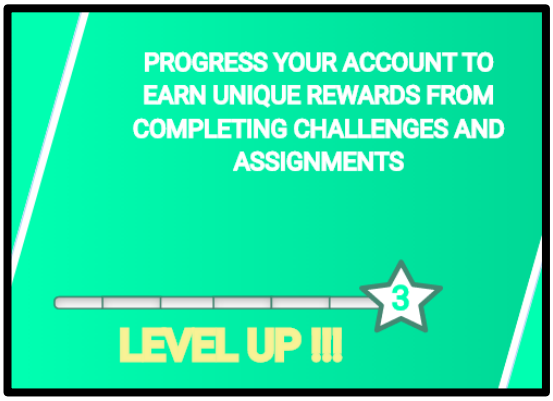

Figure 68 - Account level is reworded to account progression; level up text is added to image for clarity

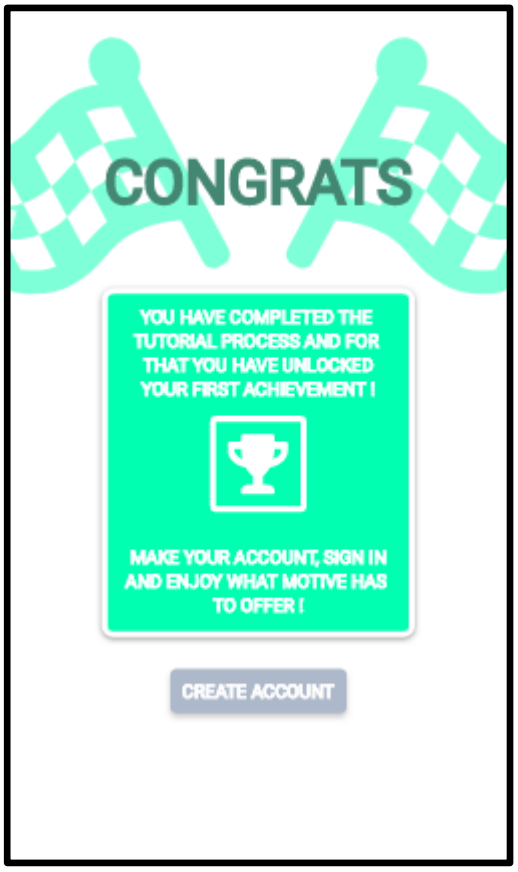

Figure 69 - Reward for completion is given a visual representation and clarified more

Figure 70 - Reduced size of some elements to create space

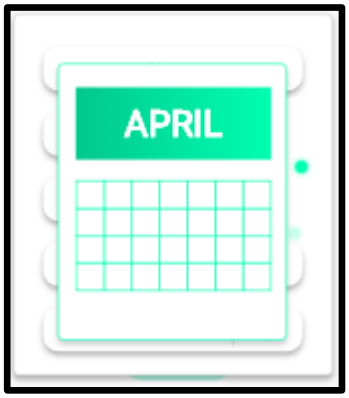

Figure 71 - Calendar visuals have been updated to better clarify to the user they are viewing a calendar

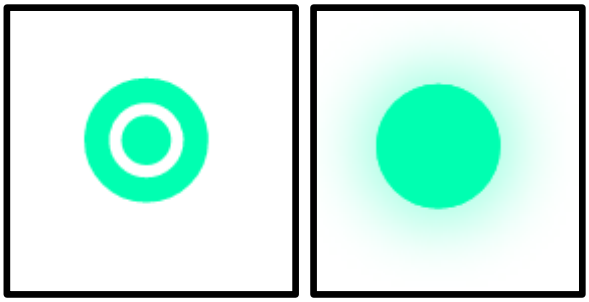

Figure 72 - Hotspot design showing off the default state and the hover state

Figure 73 - Achievement notification opacity has been reduced to 85% to allow title to show in the background

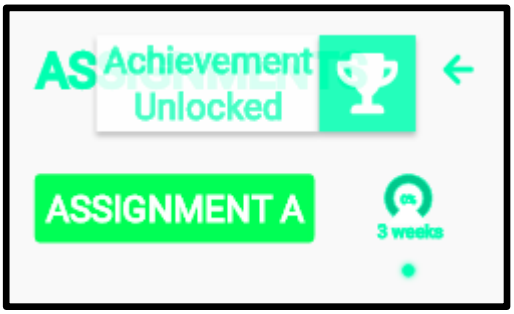

Figure 74 - Some hotspot elements have been removed to de-clutter the screen; Assignment colour has changed from border only to whole box to better represent priority.

Figure 75 - When an assignment has been created, the create button has been changed to create more to show off some intelligence

Figure 76 - Placeholders have been fleshed out

5.1.2 Prototype Test 2

In this section, the first iteration of changes is taken from the first prototype test. The test was recorded separately by the tester without the developer being present. Results were then recorded, and changes were made for the next test.

Aims

The aim for this test was to iterate on the prototype using the feedback given from the previous test and using a different tester to navigate the new iteration and provide more feedback for the next up and coming test.

Background

This second test was undertaken at 5:45pm by an UK based individual who is part of the target audience for this app. He is 24 years of age currently undergoing a computer science for games development degree so he will have a good understanding of terminology used in mobile apps compared to the previous tester. Some changes were made to the testing format to see if the quality of feedback differs, the tester recorded them using the prototype without the developer's presence. This was done to allow the tester to voice out their opinions without having to be influenced by the developer. The tester was given a link to access the prototype on

Adobe Xd (Rae, 2020) using its share function and the video was recorded using OBS (OBS, 2012). The video was sent to the developer who then watched through the video to record and note down feedback. Overall, the test was carried out better than the previous, however there can be changes made to improve such as asking the tester to talk more about what they see and not rushing through the prototype.

Methods

This test follows the same methodology of the previous test with the think aloud method and the tester has recorded his thought process as he navigated the prototype. This test however was not done with the developer present but rather recorded separately and sent to the developer for them to watch and note down feedback. This change was made to remove any bias or influence towards the tester's thought process and to prevent the supervision that occurred in the previous test.

Results

The following points were considered feedback to add and change about the prototype:

1. Change challenge icon to prevent confusion
2. Change 3W to 3 weeks
3. add more to assignments and allow editing
4. expand achievement icons for extra information

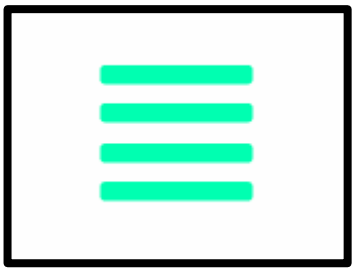

Figure 77 - Trophy icon changed to 4 lines representing the challenge icons (Zoomed in)

Figure 78 - 3W has been changed to 3 weeks to avoid confusion (Zoomed in)

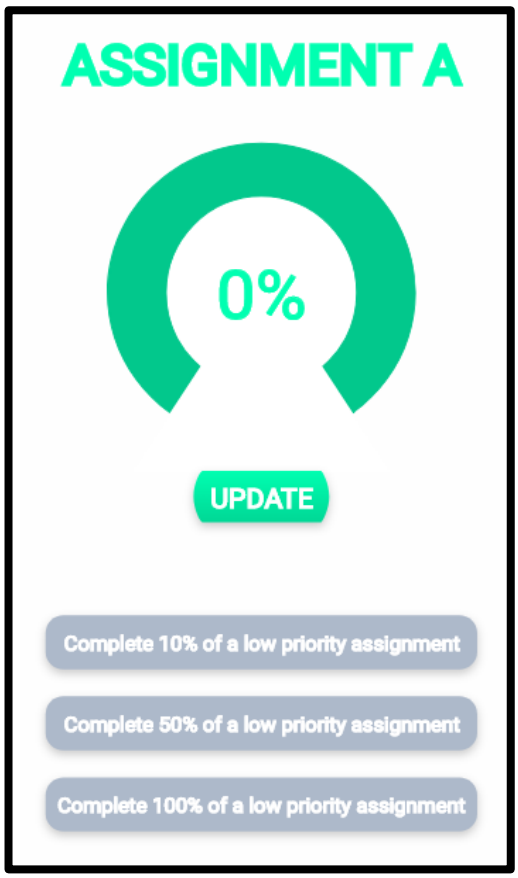

Figure 79 - Assignments can be expanded to show more information

Figure 79 is a screenshot of an expanded view of an assignment when clicked on in the assignment management page. When the assignment is clicked on, the assignment title will expand and move to the top. The progress bar also expands in size and is centred in the middle and underneath is a button element labelled “Update” which will allow the user to update the word counter and progression bar. At the bottom of the screen are challenges unique to the assignment created.

Figure 80 - Achievements expand to reveal information about the achievement

Figure 80 provides an expanded view of an achievement when interacted with by the user in the achievement library. The trophy icon and green box enlarges and a white box also enlarging in size accompanied by the achievement text.

5.1.3 Prototype Test 3

This section carries on from the previous with the changes that have been made with the last test have now been implemented and tested. The feedback given is discussed and changes made using that feedback is shown.

Aim

The aim for this test is to gather feedback on the improved features from the previous test as well as gather data from a different perspective on the prototype, its features, and the UI elements.

Background

The third test was carried out by another individual based out of the UK at the time of 11.01am. he is 23 years old and is studying English language for his bachelor's degree. His understanding for computers and technical terminology is very high so he will be able to navigate and understand the basics of using a mobile application. Quality of feedback from the previous test has increased due to the changes made to the testing format so the new test format will be used going forward. OBS was the software of choice for this individual to record his test video file which was then sent to the developer through Discord and analysed. Feedback was noted down and the changes made are shown below.

Methods

Test 3 will resume using the same methodology as the previous 2 tests.

Results

Shown below is feedback gathered from the test video:

1) Empty white space in the tutorial boards
2) Green border is difficult to see against green background
3) Level number and exclamation mark is hard to read
4) Shades of green in assignments page can be toned down
5) Change the look of priority from borders to the assignment block itself
6) Put the assignment progress and timer on top of each other instead of side by side for easier transition into expanded page
7) Add timer to expanded details page
8) Green on white makes readability difficult for users

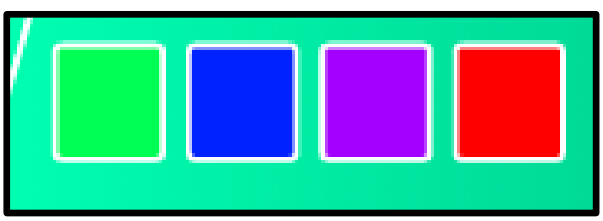

Figure 81 - Assignment border colours have changed to blocks with a white border, so it does not blend in with the background (Zoomed in)

Figure 82 - Exclamation marks have extra space in between for more clarity (Zoomed in)

Figure 83 - Reduced size of background element, and shades of green toned down

Figure 84 - Assignment priority border replaced with full block colour, Assignment progress and timer elements placed on top of each other (Zoomed in)

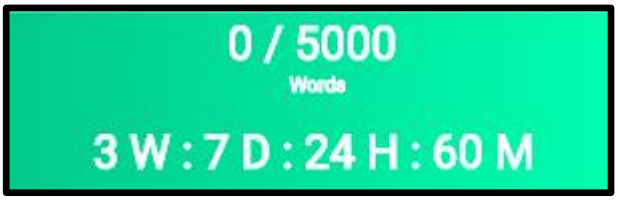

Figure 85 - Expanded assignment timer and wordcount (Zoomed in)

Figure 85 showcases an assignment submission timer that has been and expanded to reveal more detailed information and a word counter. The timer changes from displaying the time left in weeks to weeks, days, hours, and minutes. The colours have changed so they it is easier to read.

5.1.4 Prototype Test 4

This section follows on from the previous prototype test and the results taken will be tested, changed, and discussed within this section.

Aim

The aim for this test is to take the new iteration of the prototype from the previous test and gather feedback from the user to provide any new opinions on features, UI elements and the layout.

Background

The third test was carried out by another individual based out of the UK at the time of 3:25 pm. She is 20 years old and is studying Music Production and Performance Level 3 for her bachelor's degree. Her understanding for computers and technical terminology is average so she will be able to navigate and understand the basics of using a mobile application. Microsoft teams was the software of choice for this individual to record her test video file which was then sent to the developer through Outlook Email. The video file was downloaded and analysed. Feedback was noted down and the changes made are shown below.

Methods

Test 4 will resume using the same methodology as previous tests.

Results

Feedback gathered from the test is shown below:

1) Assignment missions take up too much space

Figure 86 - Assignment missions expanded (Zoomed in)

Figure 86 reveals assignment missions that have been reduced in size to save space on screen, the colour grey is used along with having a dark filter and the lock icon is used to show that the missions have been locked that are linked to the assignment created. Next to the challenges is the button element used to expand the challenge view, the icon changes from a plus when not

expanded to a minus when fully expanded. The colour green is used to show the user that the button elements can be interacted with.

5.2 User surveys

Previously in 6.1, a discussion involving black box testing was carried out by the researcher, within 6.2 surveys were provided to garner feedback and their thoughts on specific gamification features.

Due to limitations and time restraints, the researcher is unable to create a final prototype application to test the hypothesis for this project, therefore, to test the hypothesis of this project, users will be provided a survey by the researcher asking them questions on specific gamification features and if these features were to be applied in the real world, how would it affect them and their motivation.

5.2.1 Designing the Survey

Designing this survey will follow the same principles of questionnaire design as stated and discussed and in chapter 4.1.1. The nature of this survey will be to garner feedback and opinions over specific gamification features and their motivation so open-ended questions will be best suited for this.

The gamification features that will be the sole focus for this survey will be:

- Achievements
- Challenges
- Milestones
- Personal Progression
- Rewards

The questions to ask will open ended questions that will allow for long form answers that provide depth in people's opinions and feedback:

Figure 87 - Assignment Progress Bar with a percentage value in the middle to inform the user of the precise point they have achieved, Wordcount below the bar to provide the user another metric for progression.

1. Assignments have a visual progression system for students to keep track of their progress, this is implemented in a prototype application for real world use.
    a. Does being able to see your progress visually motivate you to want to start an assignment early? YES/NO

b. Please explain your reasons for why a visual progression system would/would not help motivate you to start an assignment early. (Provide as much information as you can)

Figure 88 - Horizontal and scrollable row for achievements, unlocked achievement shown by trophy icon and green background, locked achievements indicated by grey background and lock icon.

2. Achievements are an extrinsic reward system that can be earned when completing specific actions e.g., complete 1 assignment.
    a. Do extrinsic incentives give you a reason to want to complete an assignment on time? YES/NO
    b. Can you share your opinions on why an extrinsic/Incentive based reward system would/would not help motivate you to complete an assignment on time. (Provide as much information as you can)

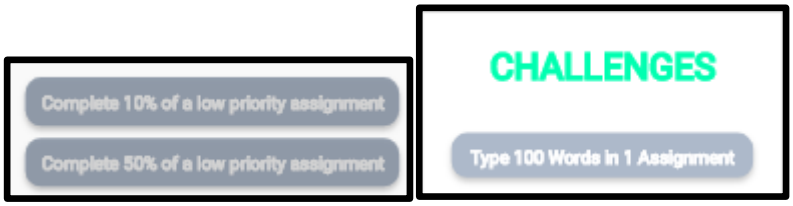

Figure 89 - Challenges and Assignment missions shown to be incomplete by grey coloured background and dark translucent shadow.

3. Missions and challenges of various difficulty are a feature that students can try to complete in order to earn rewards.
    a. Does facing difficult challenges/missions motivate you to want to attempt and complete challenges/missions and earn the rewards they give? YES/NO
    b. Please explain why experiencing challenges/missions of varying difficulty to complete would/would not help motivate you to attempt to complete them. (Provide as much information as you can)

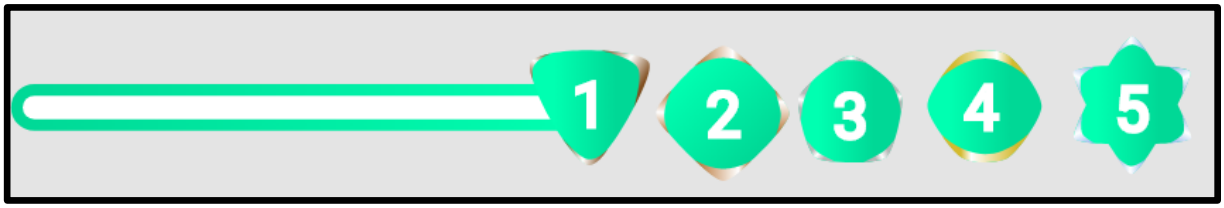

Figure 90 - Milestone rewards for every progression level attained by the user, border colour changes as they increase in level from copper one to platinum five.

4. Milestones are a system designed to provide a long-term goal for students to work towards and provides rewards as they complete their milestones, such rewards include different borders for every progression level they complete.
    a. Does the addition of these long-term goals provide motivation for you to want to use the application in the long run? YES/NO
    b. Please provide your opinions as to why a milestone system would/would not motivate you to use the application for a long period of time. (Please provide as much detail as possible)

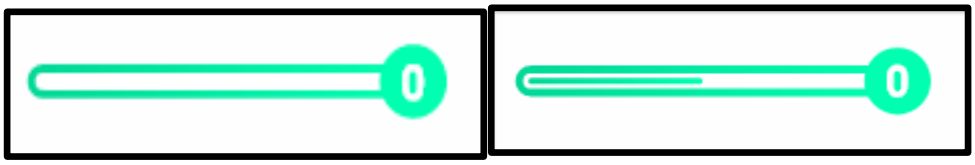

Figure 91 - Personal progression bar for user to earn rewards as they attain each level, right screen shot showcases progress earned when completing an action such as an assignment, challenge, or mission.

5. A progression system in the form of a levelling bar is a gamification system that has been implemented into the prototype to give students a sense of progression when using the application such as completing assignments, challenges and earning rewards.
    a. Does this Progression system, influenced from similar systems found in video games, incentivize, and motivate you as a student to want to work on assignments and undertake challenges? YES/NO
    b. Please explain why a progression system would/would not provide an added benefit to motivation in working on assignments and attempting challenges. (Please provide as much information as possible).

5.2.2 Surveying Users and Results

Previously the design of the survey was researched and discussed, in the next section the design will be put forward towards users and the results are shown.

Question 1a Results:

Participant 1: Yes

Participant 2: Yes

Participant 3: Yes

Participant 4: Yes

Participant 5: Yes

Participant 6: No

Participant 7: Yes

Participant 8: No

Participant 9: No

Participant 10: Yes

Participant 11: No

Participant 12: Yes

Participant 13: Yes

Participant 14: Yes

Participant 15: Yes

Participant 16: No

Participant 17: Yes

Participant 18: Yes

Question 1b Results:

Participant 1: "When I can visually see my progress, it motivates me to work just a little bit more every time, without it and not seeing a goal in site it doesn't give me a reason to work more because I can't see when the end is near".

Participant 2: "It is nice to see a visual representation of your progress".

Participant 3: "It helps me understand how far I am through the assignment, otherwise I just procrastinate, thinking it may be a small assignment. but then I'll have to stay up later to get it done as I would have left it until the last moment to do it."

Participant 4: "It would help motivate me to start earlier because I will be able to see progress which appeals to the instant gratification side of my brain",

Participant 5: "The visual allows for me to see the end goal and my progress towards it. This is a much more rewarding way to show progression. Having the end goal visually in front of me while working would help me keep track of targets".

Participant 6: "It would work: Because the assignments can be better planned out as it can be broken down into smaller pieces which lets me focus more on the little details and not just of the overall assignment. It would also reassure that I don't feel overwhelmed with too many assignments if it can be planned out early.

It might also not work because having another thing to keep track of might put me off from filling in the information.

Participant 7: "It keeps me motivated because everything I'm able to track and see how the actions I take are progressing the task. It makes the assignment feel more manageable because I can set milestone goals to ensure I will finish on time. I'm less likely to procrastinate because now I can break the task down into smaller parts, and this way I can avoid last-minute rushes to start the assignment."

Participant 8: "It would not, this is because I know I need to do the same amount of work regardless of when I start it. So, seeing the progress bar being empty means nothing to me I am aware it is just because I haven't started. On the other hand, if I have started, I will be aware of how close I am regardless of a bar or not as I tend to focus on things like word count if that is the measurement".

Participant 9: "Being able to see my progress is more encouraging once some progress has already been made. Until I have made progress on something, progression info is irrelevant to me."

Participant 10: "A progressive system would motivate me because it's very reminiscent of games with completion counters e.g., 100% area discovered, which I enjoy completing."

Participant 11: "It would terrify me seeing how much I still haven't done, which in return might make me to not want to start even."

Participant 12: "Having a visual representation of my progression would force me to be more motivated but also may induce anxiety"

Participant 13: "Well it depends on the assignment given, because sometime different assignments can be easier for some people than others. As for starting the assignment early I don't think it would matter because if you want to do it than you will otherwise, I don't think that the system will help you if you don't feel like doing it."

Participant 14: "It can motivate users to complete tasks a chunk at a time and keep organised."

Participant 15: "Growing up as someone who played video games, a visual representation always meant that I was accomplishing something. Bright green and high percentages were highly valued to me."

Participant 16: "The feature of having a visual progress bar for the work done towards an assignment is definitely a good way to keep track of progress, but it of itself does not provide any motivational value in my opinion. It would be the same as seeing the number of words on a report, which is more a requirement towards actually completing the assignment rather than any sort of incentive for completing said assignment".

Participant 17: "Seeing progress would allow me to better manage workflow - it would work as an acknowledgement for inputted time and effort. On the other hand, seeing an empty progress bar would evoke a feeling of anxiety that "nothing is done" and, in another way, cause me to start working on an assignment early".

Participant 18: "A visual progression system does provide added motivation because it allows me to see exactly how much I have done of an assignment and how much I have left. This

visual reminder would help to keep me on track and the idea of wanting to complete the bar would be a good source of motivation”.

Question 2a Results:

Participant 1: No

Participant 2: Yes

Participant 3: Yes

Participant 4: No

Participant 5: Yes

Participant 6: No

Participant 7: Yes

Participant 8: No

Participant 9: Yes

Participant 10: No

Participant 11: Yes

Participant 12: No

Participant 13: No

Participant 14: Yes

Participant 15: Yes

Participant 16: Yes

Participant 17: Yes

Participant 18: No

Question 2b Results:

Participant 1: “it doesn't help me personally when the achievements don't give you anything, just visual cues so I wouldn't care about them”.

Participant 2: “Same reasoning as the previous example”.

Participant 3: “It would set the goals for me, so I don't see it as one large assignment and delay it.”

Participant 4: "As fun as they would be and I'm sure they would improve me productivity I am motivated to complete assignments as I want to achieve"

Participant 5: "Incentives are always helpful in motivating me. Having reward system would once again ensure I reach all the targets for the current assignment as I could visually see all my targets. Also breaking a single assignment into several mini steps/goal would encourage me to work periodically instead of working in one sitting".

Participant 6: "It would not motivate me because for the moment the rewards are really simple and don't really have much meaning for me. Real life rewards would be more motivational and could even bring a competition between other students."

Participant 7: "An incentive-based reward system gives an instant reward for completing tasks on time, which satisfying. Setting clear goals/targets also helps break the overall assignment up into smaller chunks which makes the assignment more manageable. I'd be more focused and invested in the work - and I also have more of a sense of accountability."

Participant 8: "I don't have an issue with submitting on time and to me it is a pointless metric. assuming it isn't anything physical. I am going to submit regardless so having the things means nothing".

Participant 9: "This one is a bit of a situational for me. I feel like it would become more of an incentive the more of them I have - maybe there's a set amount for my course, and I have 80% already, I'm going to feel more inclined to getting all of them than when I'm at the beginning of the course and I don't have any."

Participant 10: "Achievements wouldn't motivate me because I'm more for the overall completion of a goal and possibly beyond that."

Participant 11: "Achievements would give an easy progress goal, a stepping point. I personally like completing achievements because it makes me see a proof that I managed to do something, even if it was just a small thing worth getting a small award for."

Participant 12: "In my mind I know they these rewards do not amount to anything so it may drive me to a certain point until I'm bored of it"

Participant 13: "Well in terms of achievements you get them regardless of whether this system is in place or not because at the end of the day you have to complete the assignment if you want it or not otherwise you will fail whatever subject you are currently working on".

Participant 14: "Satisfaction of completing tasks one by one can help motivate people to continue momentum."

Participant 15: "Very similar to my explanation on a visual progression system. Since my childhood was full of a video game centred focus, Achievements felt good to get."

Participant 16: "It depends on the implementation of the reward system. If said reward system is merely flair awarded within the application I don't believe that to offer any motivational value, however if it were to provide me with more tangible rewards (e.g. extend

the deadline of another assignment, get a boost to your total grade, etc.) that would definitely make me more motivated to finish the assignment on time".

Participant 17: "In cases where the subject is complex, an achievement system that would reward, for example, additional marks towards the final exam has encouraged me to complete assignments on time as it alleviates the preparation for the said exam. I have actually automatically passed exams in similar scenarios. The reason why this motivates me to complete assignments on time is because the incentive is worth my time and effort and will benefit me in the long run".

Participant 18: "Rewards like this would become more of an end of assignment motivation task however because of how I struggle with assignments they would not work as well as a form of motivation when compared to a visual progression system or challenges which help give real time updates on progress through a task. These real time rewards would personally provide greater motivation when compared to the extrinsic reward system".

Question 3a Results:

Participant 1: No

Participant 2: Yes

Participant 3: Yes

Participant 4: Yes

Participant 5: Yes

Participant 6: No

Participant 7: No

Participant 8: No

Participant 9: Yes

Participant 10: No

Participant 11: Yes

Participant 12: Yes

Participant 13: No

Participant 14: Yes

Participant 15: Yes

Participant 16: No

Participant 17: No

Participant 18: Yes

Question 3b Results:

Participant 1: "Same as the answer above, it's not like a badge where other people can view how you have done and see your achievements. this doesn't personally benefit me; in fact, it seems like it's giving more work while doing work which I would avoid".

Participant 2: "This depends on the person but personally I enjoy challenging tasks".

Participant 3: "The more challenges / missions there are makes it easier for me to get through the assignment as it makes goals during the project more attainable / achievable."

Participant 4: "It motivates me to push myself, try new things or shorten the time frame for me to complete something, which all together will improve my ability and therefore benefit me"

Participant 5: "This would motivate me to work harder per session spent on assignments, this is crucial to ensure goals are met in the time frame they should be. Rewards would once again be a great motivator for me".

Participant 6: "The moment as it is now it wouldn't motivate me unless the rewards are better or if the challenges stack to give better rewards."

Participant 7: "I think meeting a difficult mission/challenge could lead to frustration and demotivate me if I cannot complete it. I also think this could prompt me to just complete challenges for the sake of earning rewards, and not necessarily completing them in a way that is useful for the assignments. It seems like it would be hard to have the challenges link meaningfully to the learning material and that could make it take away from the learning objectives of the assignment. The challenges might not necessarily always link to more marks in the assignment I think, which makes them feel a bit less useful."

Participant 8: "Very similar to the previous (achievements) They are kind of a pointless metric, and I don't feel I would get satisfaction from completing them. It is kind of just oh I did that... okay. I don't get the gratification from systems like this, similar to gaming unless I am 100% interested, I won't be interested in small things like challenges if it offers no actual benefit".

Participant 9: "It's very easy for me to get addicted to incremental challenge & reward loops. This is more specific to me as an individual though, I don't know how it would have affected for more people."

Participant 10: "Challenges and missions don't motivate me because I would rather focus completing an assignment without pressure of other aspects".

Participant 11: "Depending on the reward and the difficulty of the challenge, yes. If the reward is uninteresting or the mission too difficult it might have less positive effect. If everyone has the same challenges and there's no way to finish certain challenges in my homework then that would feel bad, it will mean others could get more challenges completed just by their school and that's not fair!".

Participant 12: "If I am enjoying the challenges and there is a good variety then this would motivate me as I would need to concentrate more and will not lose interest as easily"

Participant 13: "Personally I don't think that challenges would help, I even think that they would actually distract you a bit form the actual assignment"

Participant 14: "People who get easily distracted can easily do a bunch of tasks a day without getting distracted during one long task."

Participant 15: "Challenge should propel anyone forward, regardless of what they are doing. I think that if you are not aiming to be the best version of yourself, then you will not progress anywhere in life."

Participant 16: "Challenges as defined within this context seem to expect you to set some sort of milestones within a single assignment, which similarly to the first point in the survey would merely be a way to track progress, I don't believe it to offer much in motivational value. If an assignment has some sort of requirements, it does not matter what "challenges" are set to you if they're merely a subset of what's required of you to do for the assignment regardless".

Participant 17: "The reason why challenges would not motivate me to complete them, but I would complete them, is because their very existence makes them mandatory - there is no reason not to do them. Secondly, I believe that these challenges may be additional tasks (for example, solve equation) that the entire class could do together and get the challenge rewards, negating the whole point of the system".

Participant 18: "Completing achievements would act like ticking off tasks on a list, so similar to the visual progression bar, it would act as a visual reminder of how much has been done and how much I have left to go. Then increasing the number of challenges completed would become a good source of motivation".

Question 4a Results:

Participant 1: Yes

Participant 2: No

Participant 3: Yes

Participant 4: Yes

Participant 5: Yes

Participant 6: Yes

Participant 7: Yes

Participant 8: No

Participant 9: Yes

Participant 10: Yes

Participant 11: Yes

Participant 12: No

Participant 13: Yes

Participant 14: Yes

Participant 15: Yes

Participant 16: No

Participant 17: Yes

Participant 18: Yes

Question 4b Results:

Participant 1: "If others can see your badges as well as it would motivate me as I would want to be the best, better than anyone else and this visually shows it so I would work faster and harder to have it displayed before anyone else".

Participant 2: "I think milestones are a bit too abstract and don't really portray progress very well, as each of them usually tend to weight differently".

Participant 3: "Smaller / more frequent milestones help me keep track of my progress through the assignment and easier to get each goal completed."

Participant 4: "Customization is a large thing that attracts people to stay around in an application, this would appeal to that side of me and make me feel more invested in using the application"

Participant 5: "A milestone system would sway me away from leaving assignments to the last minute, which is a bad habit I have. This would help create a schedule styled working experience which would help me stay on track for assignments".

Participant 6: "Yes it would motivate me because the higher the level the better the reward."

Participant 7: "Milestones as a long-term goal seems useful as it would give a sense of direction over an extended period. That would mean that the motivation could last for a long time. I think the reward of a border for example gives a good immediately noticeable reward for my efforts and that would happen frequently over and over. I think unlike the challenges it also allows me to work at my own pace while still receiving positive feedback, which will prevent burnout in the long term."

Participant 8: "It is artificial and literally means nothing except maybe bragging rights but that isn't really for me and could cause negative interactions between individuals (assuming multiple using it) Falls under the same thing as the challenges and achievements".

Participant 9: "I think regardless of what it is you are trying to accomplish, setting milestones is the absolute best way of managing your focus. If you have a task that seems too big just cut it up, and work on the first milestone without even thinking of the next - this has helped me both academically and professionally."

Participant 10: "Milestone system would motivate me because it's in the field of the progressive systems and seeing the next milestone ahead of me would push me to do more in one day/week."

Participant 11: "I'm personally mostly indifferent about this, it wouldn't affect me negatively, maybe positively. It could be a potential enticement for long term, but only if it feels good. Prestige systems rarely don't make me feel much difference unless there's a clear competitive case to it."

Participant 12: "Not really because it can seem daunting to see milestones when starting off and may actually put me off"

Participant 13: "If we are talking short term no but over a longer period of time, I guess would make more sense because you can grind towards goals and maybe even see some benefits in your workflow".

Participant 14: "Helps people plan step by step guides to completing tasks."

Participant 15: "Milestones seem very similar to my reasoning for achievements"

Participant 16: "This essentially ties in with my input on the 2nd question in the survey, it only provides motivational value if there are tangible rewards presented".

Participant 17: "Long-term goals with milestones would help me work on my thesis, as the system would perfectly fit in with the way a master's thesis would need to be spread over the course of the studies. For smaller scale coursework, I believe milestones may not work as well because there will be less time and assignments and the goals would be very few for 6 months".

Participant 18: "Milestones and the progression through them would motivate me a lot because they are continually increasing and seeing a bar moving towards a new milestone would be a good source of motivation. Seeing constant progress is good".

Question 5a Results:

Participant 1: Yes

Participant 2: Yes

Participant 3: Yes

Participant 4: Yes

Participant 5: Yes

Participant 6: Yes

Participant 7: Yes

Participant 8: No

Participant 9: Yes

Participant 10: Yes

Participant 11: Yes

Participant 12: Yes

Participant 13: Yes

Participant 14: No

Participant 15: No

Participant 16: No

Participant 17: No

Participant 18: Yes

Question 5b Results:

Participant 1: "As long as you know what the max level is you can achieve it would help, like the previous system where there is a goal in site, it's an incentive to keep working".

Participant 2: "Mostly same reasoning as 1. and 2".

Participant 3: "Just like in video games, a bar system helps to visualise how far through the project I am, so I know if I need to work harder / quicker or if I can take more breaks and relax / chill more."

Participant 4: "This system would help me keep track on time, help me reach a good work life balance and finish projects on time as I would be able to tell how much I have left to do"

Participant 5: "Once again having a visual aid such as this to show progression would be much more rewarding to see how far I have progressed towards my end goal. to see the gain in progress after each individual session would be very motivating".

Participant 6: "Yes that would help because it shows my overall progress of the assignments which could motivate me to ensure that its always high."

Participant 7: "I think this does a lot of the same good things as the milestone system. It would help me engage more as I can see a visual representation of my progress. As I "level-up" I feel motivated to continue working to get to the next level. It gives a clear goal that I can track as I work."

Participant 8: "It doesn't really motivate me to continue/start my work I would just use it to keep track. I don't think I find the artificial motivation useful for work I know I have to do. Having it from a form of entertainment, games for example, it is a choice to take part and complete/do things. So, when something is visually shown/earned/etc. it is satisfying/rewarding as I am choosing to do it. When it comes to doing work, I kind of have to do it regardless so if anything, it is off putting like false encouragement. I have to do it anyway so the rewards/achievements/progress means nothing in the end, I will get there".

Participant 9: "This is another one that I think would be situational. If there was an instance where there was an expectation of a certain level of progression, and I was below that mark, this would be discouraging for me personally. Equally if I was above that mark, I'd want to maintain my rate of progression."

Participant 10: "This would motivate me because just like a video game I want to be as high a level as I can to gloat to my friends. A system like this I would uncap the level because it would motivate me to see how high I can get that level, or even creating a nice even number which is something people take enjoyment in".

Participant 11: "As a gamer I do enjoy seeing xp bars and level numbers go up, harder challenges/things that give more xp could be a motivator for me."

Participant 12: "I like video games so a system like this would motivate me to work harder but if the actual assignment is not interesting this wouldn't last"

Participant 13: "The progression system would show you where exactly you are currently with your assignment so it would give you the option to plan out your work and get some free time between the actual work."

Participant 14: "Sometimes level bars like this are too vague to keep track of how things are going."

Participant 15: "As someone who has current educational resources tied to a bar like this, it usually discourages me when it is at a low percent if I have a large amount of work to accomplish."

Participant 16: "Same as the 1st point in the survey, hardly motivational due to it being more of a means to track progress rather than actually provide motivation".

Participant 17: "In my opinion, unless this progression system rewards you in some meaningful way upon levelling up, it would not motivate me to complete assignments, challenges as a level number on its' own does not really provide value. If anything, having a high level may attract people that will pester you to copy your homework".

Participant 18: "This would provide good motivation because the progression is constant and every time an assignment or challenge is complete the movement of the progression bar would be good motivation to keep working on assignments/challenges".

Summary

This chapter takes the final prototype application designed in chapter 5 and is put through many functional checks to test the usability and functionality of the application. Ensuring that buttons work as intended and navigation is simple and user-friendly. User surveys were given out for people to provide their thoughts and opinions on specific gamification features that have been implemented in the prototype.

Chapter 6 – Results

In the previous chapter, the prototype application underwent rigorous testing to improve on its functionality using participants from the Questionnaire in chapter 4. Participants were also given a survey to provide feedback on specific gamification features that were to be used in a real-world application. Chapter 6 takes the results gathered from survey created in section 6.2 and provides an in-depth analysis and discussion of those results.

6.1 Findings and Analysis

Within this section, the survey findings in 5.2 are analysed and discussed; Participants were questioned about the use of specific gamification features and how it will affect their motivation to tackle an assignment. The survey was sent out to 18 people, each of whom are students that attend either a university or college and undergoing a degree. The age range for the participants are between the ages of 18-25. Results show that the majority of participants agreed that each gamification feature would help motivate them to start their assignments earlier and complete them on time. While that was the general consensus, there is a sizable number of participants that did not agree on the idea that gamification features would help motivate them to start and complete their assignments on time.

6.1.1 Question 1 Analysis

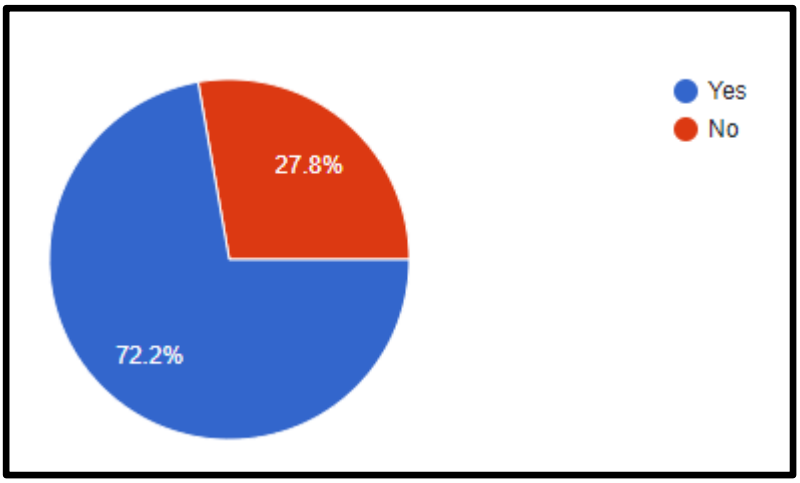

Figure 92 - Statistical Pie chart showing results of Yes/No for Question 1a

Question 1 was based around a visual progression feature that showed users how far they have progressed in their assignments. Participants were asked if the feature in question would motivate them to start and complete their assignments on time. Figure 72 shows the statistical split of “Yes” and “No” answers with 13 participants saying “Yes” to 5 participants saying “No”. The majority of participants who chose the option Yes say that being able to see the progress they have made helps motivate them to want to keep going. Others believe that the visual progress bar gives them the motivation to want to complete the bar and have it displayed 100% complete. Other reasons include having an end goal to strive for, making assignments easier to manage and being able to break down tasks into smaller chunks. Participants who chose the option “No” believe that seeing the progress they have or have not made can cause some

anxiety and prevent them from wanting to tackle their assignments, others have expressed that seeing the progress bar does not make any difference to their motivation for starting and completing assignments nor does it change the workload so having a visual representation means nothing. Another opinion stated that until they have the motivation to start making progress on assignments, the bar itself does not motivate them.

6.1.2 Question 2 Analysis

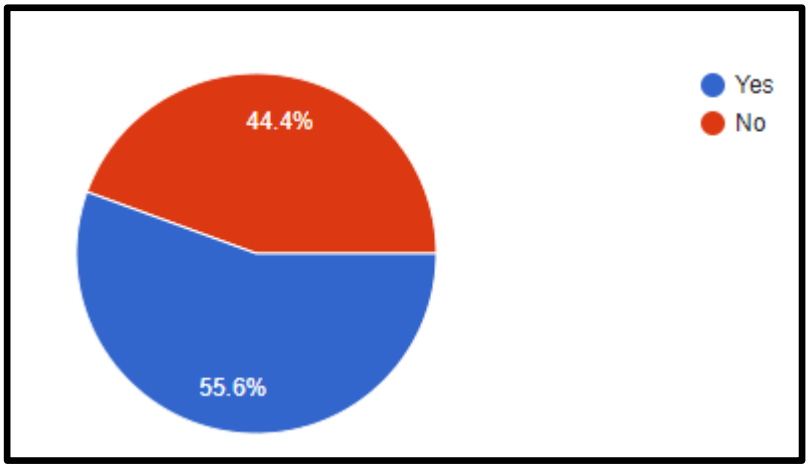

Figure 93 - Statistical Pie chart showing results of Yes/No for Question 2a

Question 2 focuses on the extrinsic reward system and asks participants on their opinions on this system and if it incentivises them to complete their assignments on time. Figure 73 shows a pie chart statistic displaying the ratio split of Yes and No answers. 10 participants chose the option “Yes” while 8 participants chose the option “No”. The main consensus that participants have said about the extrinsic reward system say that they would be motivated due to the satisfaction that they gain when completing tasks and assignments and earning those rewards. Being rewarded allows people to manage their assignments easier and they would be motivated to breakdown difficult tasks into smaller and easier chunks. Other opinions say that as they are earning more achievements, they become more motivated and have a drive to earn and achieve more. The opinions of the other 8 participants who chose “No” can be outlined by 2 major points: Early motivation and tangible value. Participants believe that achievements have no real value outside of their looks and use as a collectible so for them, achievements do not provide any additional motivational benefits or any motivational benefits. They also believe that early on in their assignments when they have made little to no progress or have earned nothing, their motivation to want to earn or achieve anything is low.

6.1.3 Question 3 Analysis

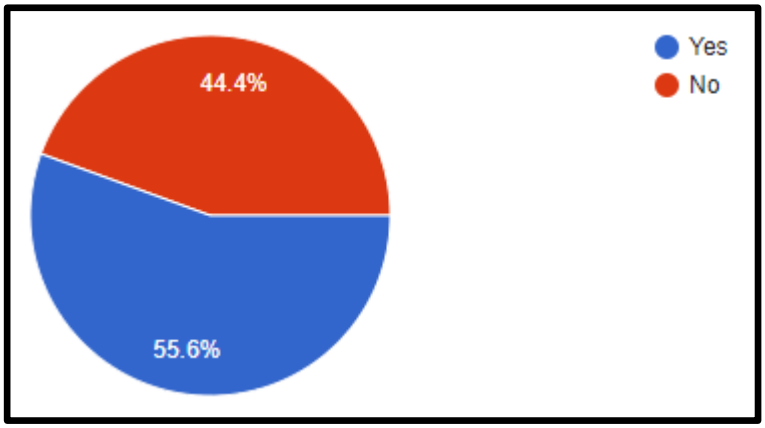

Figure 94 - Statistical Pie chart showing results of Yes/No for Question 3a

Question 3 talks about the concept of facing difficulty when tackling challenges and missions, participants are questioned on their motivation when facing difficult challenges and missions. Figure 74 showcases the results of participants choosing between the options “Yes” and “No” on if their motivation increases or dwindles when facing difficulty in challenges and missions. The results were a similar split to the previous question with 10 participants choosing “Yes” and 8 participants choosing “No”. Those who chose “Yes” believed their motivation would increase when facing difficulty in challenges and missions due to 2 reasons: The first reason being that people are motivated by difficulty and they like to push themselves outside of their comfort zone to try and attain the rewards that come with those harder challenges. The second reason is that with challenges, people can treat them as small goals that they can easily achieve and with every goal achieved, it motivates them to take that one step further and earn and attain more. The opinions of the participants who chose No mostly believed in a similar consensus to the previous question in that challenges and missions provide an empty benefit and there is no real tangible meaning with them, if they were to complete them then it simply adds more to the workload as opposed to providing them with motivation. Some feel that facing difficulty would in fact cause frustration especially if the difficulty is too high to the point where it is impossible to be attained. Others also believe that challenges and missions could end up being a distraction and cause the user to face their attention away from the assignment instead.

6.1.4 Question 4 Analysis

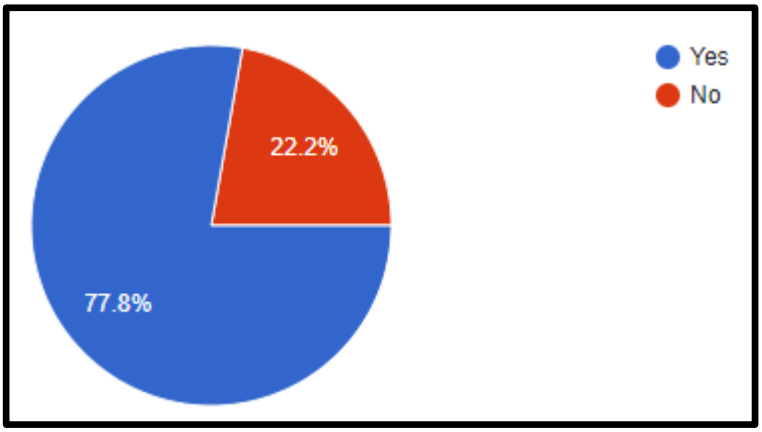

Figure 95 - Statistical Pie chart showing results of Yes/No for Question 4a

Question 4 is tailored around Milestones and users long term motivation and commitment. Figure 75 provides a statistical overview of participants deciding whether or not the use of a milestone system can provide long term motivation towards using the prototype application and tackling assignments. The ratio split between participants is larger than that of the last 2 questions with a ratio of 14:4, 14 participants chose “Yes” and 4 chose “No”. The general opinions of the participants who chose Yes all believed that the milestone system allows them to have small goals that can be attainable and achievable. This means that they can maintain their motivation over a long period of time, and it allows them to be more organised and prepared when having goals that are split into smaller chunks. The milestone system also leads to instant gratification and rewards when attaining those goals so users can be satisfied with what they have achieved. Other opinions that have been provided include healthy competition that can be promoted between multiple users that wish to show off the badges they earned when progressing through the milestones as well as those badges being visually appeasing on their screen. For participants who chose “No”, their main point of contention was tied to the fact that the milestone system has no tangible value attached to it and it is simply just an infinite loop with no real benefit therefore the progression earned is meaningless. Also, for some participants, seeing the milestones that they can achieve and how long it will take to earn them can be daunting and they could be anxious to try it.

6.1.5 Question 5 Analysis

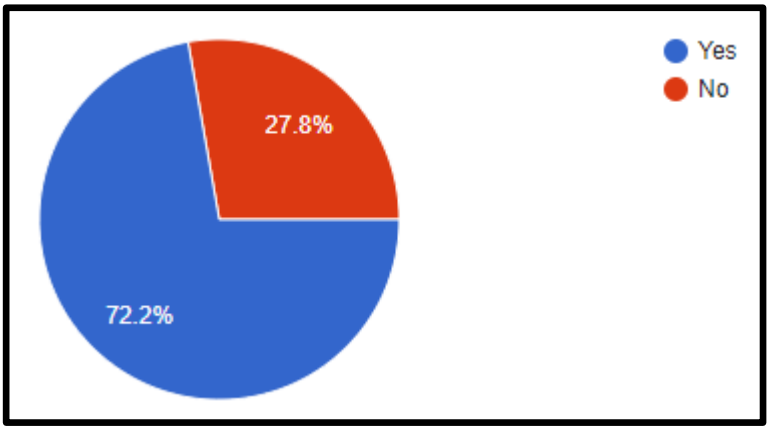

Figure 96 - Statistical Pie chart showing results of Yes/No for Question 5a

Question 5 is centred around personal progression tied to the completion of assignments and challenges. Participants were given the choice to decide whether or not this gamification feature would provide any additional motivation when attempting assignments and challenges and figure 76 shows the results with a slight smaller split than question 4 with 13 participants choosing Yes and 5 choosing no. The majority of the participants who chose "Yes" to enjoy having a progression system and having a visual indicator of the progress they have made gives them motivation to want to reach their end goals. Other opinions provided by participants include being more organised after seeing the progress they have made and have to make to the end goal; this gives users motivation for the long term. The main reasons for concern for those who chose "No" is that the visual progression and progression itself has no meaning, and for those that can see how little progress they make and how far they are from the end goal, it can discourage them to try. For others it can provide a distraction from the work at hand and depending on the assignments, if they are not interesting then the visual progression would provide no motivation for the user.

Summary

Overall, the findings show that the majority consensus of students' opinions on gamification and its effect on motivation is that they agree that it can be used to help motivate them to start their assignments earlier to complete them on time. Features that provide a sense of progression and milestones had a larger majority of students believing that they will be more motivated to handle assignments whereas other features such as extrinsic rewards and challenges and missions had more of a split between student opinions. The main point of contention for students tackling challenges was the rewards you earn after completing them, the rewards themselves require some tangibility and value in order for it to be worth the time and effort expended for e.g. rewards having a real world effect on your life as a student such as extending assignment deadlines, adding more points towards your grade, and earning vouchers that could be used at stores on university campus such as free food and more. The data gathered from this survey was from a small sample size of 18 students so for future reference, a larger sample size would be needed to gather more data and gain a better understanding of the use of gamification in a mobile application.

Chapter 7 – Discussion

In chapter 6, an analysis and discussion were carried out on the results for the user surveys in 5.2. In this chapter, the limitations the researcher faced in this project, contributions and future work for the project is discussed as well as reviewing and concluding the overall thesis.

7.1 Project Limitations

In this section, the limitations, and restraints that the researcher has experienced is discussed in detail.

The main restraints the researcher has experienced are mainly due to the researcher having a limited understanding of Adobe Xd, the software used to create the prototype application. Because of this, more time was assigned to learning how to use the software than to create the prototype itself. This has led to time restraints which prevented the researcher from being able to design the final prototype and features have been cut from the development plan due to their priority. Without a final prototype, the researcher was unable to test fully if the gamification features that have been implemented can induce motivation within students. The product created during the design process is considered a prototype therefore guidelines on creating buttons and other UI elements have not been followed.

7.2 Project Contributions

Despite the time restraints and limitations encountered, this project offers a theoretical and practical contribution to the research and development of motivation and the use of gamification in a mobile application.

7.3 Future work

In the design overview section in chapter 4, due to time restraints and limitations, there have been features that were not implemented into the final prototype application such as the accessibility features. While the scope of this project was focused on the core features that make up the backbone of the prototype, there is room for development in other areas which would allow the prototype to feel more fleshed out and complete for example adding Account creation and security, earnable currency and more.

Player accounts are a feature that can be implemented to give users their own identity when accessing the app along with an avatar to represent the user in question and allowing users the freedom to express themselves. These accounts will have profile boards displaying the user's unique information such as their name, achievements they have earned and artwork. With player accounts, future researchers can also include account security to better secure users and the rewards they earn.

Feedback provided by participants in the survey carried out in section 6.2 are potential areas that can be worked on in the future should the prototype receive further development. Feedback includes designing the progression system to not be daunting for users and instead encouraging them to try and reach their goals. To encourage motivation within people early on, users can be rewarded at increments throughout their progression until they reach the end goal which will provide a larger reward. Another point of contention is making sure gamification features do not distract from the main goal: Completing assignments on time. To prevent the

game features from overshadowing the assignments and main goals, work can be put into making sure that the game provides an emphasis on completing assignments, creating reminders and notifications to alert the user to their assignments and designing UI elements so that they are not intrusive onscreen. Rewards earned from completing assignments, progression, and challenges should have tangible value attached to it rather than just be visually appealing as a collectible. An example of this would be earning extra time on an assignment or earning points toward an overall grade.

Progression features that can be worked on in the future include an earnable currency that is linked to rewards earned from users that complete assignments, challenges/missions, and milestones. A shop which can be accessed by users in the app and in-game items can be purchased using the unique currency that have been earned from rewards. Items would include artwork that can be displayed in user profiles, avatar clothing items as well as boosters that can be used to earn progression rewards faster.

Social features such as a friends list could be introduced to generate a community of users that can socialise and compete against one another. Competitive leaderboards are a feature that can provide healthy competition for users to engage against each other in challenges, the top 3 users who take part in these challenges could earn special rewards and currency.

To create more interest between users and their assignments, the idea of a story mode can be entertained by creating a storyline and locking progression through the story behind assignments that are story specific and need to be completed. Users that are interested in the story will want to know more therefore would be motivated to complete assignments therefore progressing through the story allowing them to learn more of the lore that they are interested in. As users progress through their story, they can see unique artboards that are tied with each story mission and when users complete those story missions through completion of assignments they can unlock and earn those unique art boards to display in their user profiles.

Virtual Learning Environments were discussed at the beginning of this project for the researcher to potentially use and integrate it with the prototype mobile application. Due to the limitations the researcher had faced, they were unable to carry out their intentions with VLEs, however while VLEs were unable to see much use and research in this project, it is important to note that for future projects that follow the same and/or similar theme as this, VLEs can still be researched and put to use in the design process with the prototype.

7.4 Project Review

In this section, an analytical review of the aims, objectives and project overall is provided. At the end it concludes, giving the researcher's thoughts on the results and what changes can be taken with the project for the future.

7.4.1 Objectives Review

In this section, a review of the 4 aims and objectives laid out previously is conducted, a discussion takes place describing how each object was achieved.

The main aim for this project was to create a prototype mobile application that makes use of gamification and motivational techniques to help encourage university students to start working

on their assignments earlier and submit them before their due date. This aim was achieved through 4 objectives:

> Objective 1: Research motivation and understand the struggles students face when working on assignments
>
> Objective 2: Investigate motivational techniques and identify how they can be implemented as features to help encourage students to keep working on assignments
>
> Objective 3: Research gamification to learn about its application so as to gain a deeper understanding of the positive and negatives of gamification
>
> Objective 4: Research existing case studies and user needs and identify features that would help promote a better user experience
>
> Objective 5: Design a prototype application using a curated list of requirements from user needs research and literature review on motivation and gamification

Objective 1 was achieved through a literature review that was conducted on multiple studies centred around motivation. The scope of the research started by exploring all aspects of motivation from its meanings, known theories, perspectives and external factors and narrowed its scope to focusing on procrastination and the impact of motivation in an educational context. Objective 2 was also achieved through the use of the literature review, studies on motivational strategies were researched and analysed for features deemed useful and helpful to promote motivation within students. These features were identified and curated into a list which would then be used by the researcher during the design process. Objective 3 followed the same process as objectives 1 & 2 with the use of a literature review, studies on gamification were researched for their use in real world applications and how they affect motivation. Features that were shown to promote positive motivation were identified and to help the researcher guide the design process. For objective 4, a study was carried out on existing solutions and the researcher identified features that were common amongst the majority of these studies, collated them into a list and used them to guide the design process. The researcher also studied the theory behind user journey maps and created a journey map for a consumer that is a part of the target audience. With everything that was learned during the achievement of the previous 4 objectives, these knowledge points were condensed into a single list with which the researcher used to guide the design process of the prototype.

7.4.2 Review & Conclusion

The main purpose behind this project was to create a mobile application that makes use of gamification and to test to see if this concept could help motivate students to start their assignments earlier and complete them on time rather than submit late. To achieve these aims, they first researched different methodologies to understand what approach they would take to create the framework necessary and after extensive reviews and research, a mixed methodology approach was taken combining both a qualitative approach with a design framework, a qualitative approach would allow the researcher to analyse opinions and thoughts gathered from surveys and the design framework would steer the prototype design process.

After the researcher decided on the methodology and their aims, they decided on what the main components were to focus on for the project, which was Motivation and Gamification, they carried out an extensive literature review of both concepts covering a wide range of topics but then reducing their scope and focusing on how they affect students and are implemented in education. The researcher found that motivation can be tied to multiple suggestions such as peoples' interest in the work they carry out, how difficult a task can be, the goals they set during that journey and the needs they have that require satisfaction. Some people can also be motivated using extrinsic rewards such as money and anything that provides a short-term gain; However, being reliant on this form of motivation could lead to people not wanting to do the work without some form of extrinsic reward as opposed to doing the work for their own self-benefit. Having instant feedback is also a factor that can influence peoples' motivation, people enjoy being rewarded for the work they put in and seeing these benefits will motivate them more to achieve more. From the review on gamification, the researcher found many factors that can lead to students being motivated from: extrinsic incentives, mastering challenges, game rewards such as points and badges, milestones, and progression.

Creating a list of requirements using what they have learned from the review on Motivation and Gamification, the researcher conducted a case study analysis on a multitude of applications that were aimed at assignment planning and task management such as Asana, Trello and more. The researcher set out to discover whether or not existing case studies can promote motivation within people to achieve the tasks and assignments they had set. Studies show that the majority of these case studies were made for people and teams who already are motivated to do the work they are tasked to do and rarely if not any of them include features that actually build motivation within a person who is not motivated. The strong and weak points for the case studies were noted down and features that were proven to be useful for a management application would be added to the design process for the prototype.

Curating a list of requirements taking into account everything the researcher has learned from the literature review on Motivation and Gamification as well as existing case studies, the researcher designed a prototype to help motivate students in starting their assignments earlier and completing them on time. After the initial prototype was designed, it was given to a number of students to test its functionality and usability and the design was iterated using feedback taken from video tests recorded by students using the thinking aloud method. Due to time restraints and limitations however, the researcher was unable to create a fully functional prototype and was forced to change their approach on how they could prove if gamification can help motivate people to start assignments earlier and complete them on time. The researcher came to a conclusion of using surveys to test peoples' opinions on specific gamification features that have been implemented into the prototype and if used in a real-world application, would their motivation increase or decrease.

Results from the survey carried out showed that the majority of users who took part in the survey decided that gamification does help motivate them to start their assignments earlier and complete them on time even though there was a vocal portion of users who were of the opinion that specific game features would not help motivate them due to their value not holding much weight within the application itself and instead of motivating them for some it would cause the opposite effect. For this project, my stake in this was not very large, the question remains: Would I still carry out this project and believe in gamification if I was heavily invested? My opinion

would be yes due to the bias of my upbringing on videogames, having fun whilst tackling difficult tasks has always been my preferred way of working hence why gamification works so well with me personally, but carrying out the surveys and getting to know other people's opinions, it is clear that there are people who don't need to have fun in order to get a task done, some people can be considered a genius that don't need any extra motivation. If I were to carry out this project again, I would make use of a larger sample size with a broader range of students from different fields in order to get a wider range of opinions surrounding the use of gamification.

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Appendix

QR code for Prototype application :