## *Students' Perception of Motivation to Learn: Does an Avatar Motivate?*

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# Students' Perception of Motivation to Learn: Does an Avatar Motivate?

Ph.D. Thesis

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# Abstract

**Context**: This research investigates students' perception of motivation to learn among students at one of the public university in Malaysia. Students were provided with an avatar as well as an avatar environment called the Avatar Hall. The Avatar Hall was developed in order for the student to access their avatar. Although other studies have been carried out when an avatar is constantly displayed on the screen, while students having their learning with Computer-based Learning (CBL) environment, where learning is conducted fully on the CBL, this research is primarily focused on the context of having an avatar when it is not displayed constantly to the students when students is having their learning in conventional learning environment (attending lecture).

**Aim**: The aim of the research is to investigate the effect of having an avatar alongside learning activities.

**Method**: This research is an empirical research where students have been given access to the Avatar Hall alongside their learning activities. There were two experiments conducted in this research, Experiment 1 and Experiment 2. A total number of 71 first year students from the Department of Cognitive Science and 45 first year students from the Department of Human Resource Development were selected to participate in this research. These students were further grouped into three: human character avatar (treatment 1), text avatar (treatment 2) and non-avatar (control group). As the name implied, students who were in treatment 1 will be offered a human-type avatar character, whereas students in treatment 2 had a text as their avatar. Students in the control group did not get any of avatar character or avatar name.

The Avatar Hall was developed and categorised into two: attribute-based environment (AbE) and ranking-based environment (RbE). The AbE environment was designed for treatment 1 whereas the RbE environment was designed for treatment 2. In the AbE environment, students were offered an opportunity to view and personalise their human avatar character. Students who were in the RbE environment, on the other hand, were presented of a ranking board where their text avatar was placed.

The research instrument used in this research was a motivation inventory, designed and developed by Ryan and Deci (2008). This inventory was modified according to the needs of the research. It was used to measure students' perceptions of motivation to learn. The inventory was consisted of Likert-type statements, each with five choices of response from "strongly disagree" to "strongly agree".

**Results**: The results from the statistical analysis indicate that students in Experiment 2 were more motivated than students in Experiment 1, specifically from the human character avatar group. In addition, students who used the text avatar in Experiment 1 were accessing the Avatar Hall more often than students who used the text avatar in Experiment 2.

**Conclusions**: This research has shown that having a human character avatar, in comparison with a text avatar and non-avatar, in their learning environment does give an opportunity to offer an alternative factor to motivate students to learn, even though the existence of an avatar and the Avatar Hall environments was applied in the conventional learning environment.

# Declaration of Authorship

I, Mohammad Nur Azhar Mazlan, declare that this thesis titled, 'Students' Perception of Motivation to Learn: Does an Avatar Motivate?' and the works presented in it are my own. I confirm that no part of the material provided has previously been submitted by the author for a higher degree in Durham University or any other University. All the work presented here is the sole work of the author.

This research has been documented or is related, in part, within the publications listed below:

- Mazlan, Mohammad Nur Azhar and Burd, L. (2011). Does an avatar motivate? In Proceeding of the 41st ASEE/IEEE Frontiers in Education Conference, October 12 – 15, 2011, Rapid City, SD.

# Copyright

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# CONTENT

# Chapter 1

# Introduction

## 1.1 Introduction

The topic of motivation has been widely studied by researchers in a variety of academic disciplines such as education, psychology, business and management.

Collins, Perkins, Wellman and Wellman (2011) mentioned there are many studies conducted on the use of technology as to enhance students' motivation in learning. The discipline of educational technology, Computer-Based Learning (CBL) and Computer-Games Based Learning (CGBL) are fields that have seen a particular focus on motivation. Studies in CBL, in areas such as CD-Based Learning and Web-Based Learning, have identified interactivity, feedback and multimedia elements as the factors that contribute to students' motivation to learn (Klassen and Drummond, 2000). Multimedia includes elements such as graphic, audio, video, animation, simulation and text. On the other hand, studies in CGBL suggest that curiosity, fantasy and challenge are the motivating factors (Malone, 1981).

In addition to the motivational factors presented above, some studies claim that the use of an avatar can contribute to students' motivation to learn. This is due, it is said, to an avatar's characteristic of being able to represent a user in an online environment and thus, make the learning more realistic (Frery, Kelner, Moreira and Teichrieb, 2002). Inal and Cagiltay (2006) claimed that educators prefer to use an avatar as a catalyst to increase learners' motivation in online environments.

## 1.2 Overview of Research

Figure 1.1, which illustrates an overview of this research, shows that it will have three environment categories, an influential environment, a research environment and a learning environment. In an influential environment, [#1] A computer game is used to motivate students to learn. A study by Malone (1981) has reported that the three factors that make computer games motivating are curiosity, fantasy and challenge. [#2] In addition, the presence of an avatar can also be motivating, due to the familiar use of an avatar in computer games to represent a game player. An avatar makes the game player feel involved in the game world. The availability of avatar is to enhance the experience of the game player and to create motivation (Shelton and Scoresby, 2011). [#3] Apart of having avatars in computer games, avatars also exist in social networking sites, such as Second Life, where users are allowed to personalise their avatars.

In a research environment, [#4] by examining the use of avatars in computer games and social networking, this research is will apply the concepts of those environments into an avatar environment called Avatar Hall. [#5] By having an avatar in the Avatar Hall this research hopes to increase the motivation of its users.

In a learning environment, on the other hand, there are four important elements. These are learning activities, score, points and personalising an avatar. [#1] Through learning activities, students will earn a score or marks for their course [#2]. [#3] These scores later can be converted into points, which enable the students to personalise and view their avatar within the Avatar Hall [#4]. [#5] It is expected that this process will motivate students to engage more actively in their learning process.

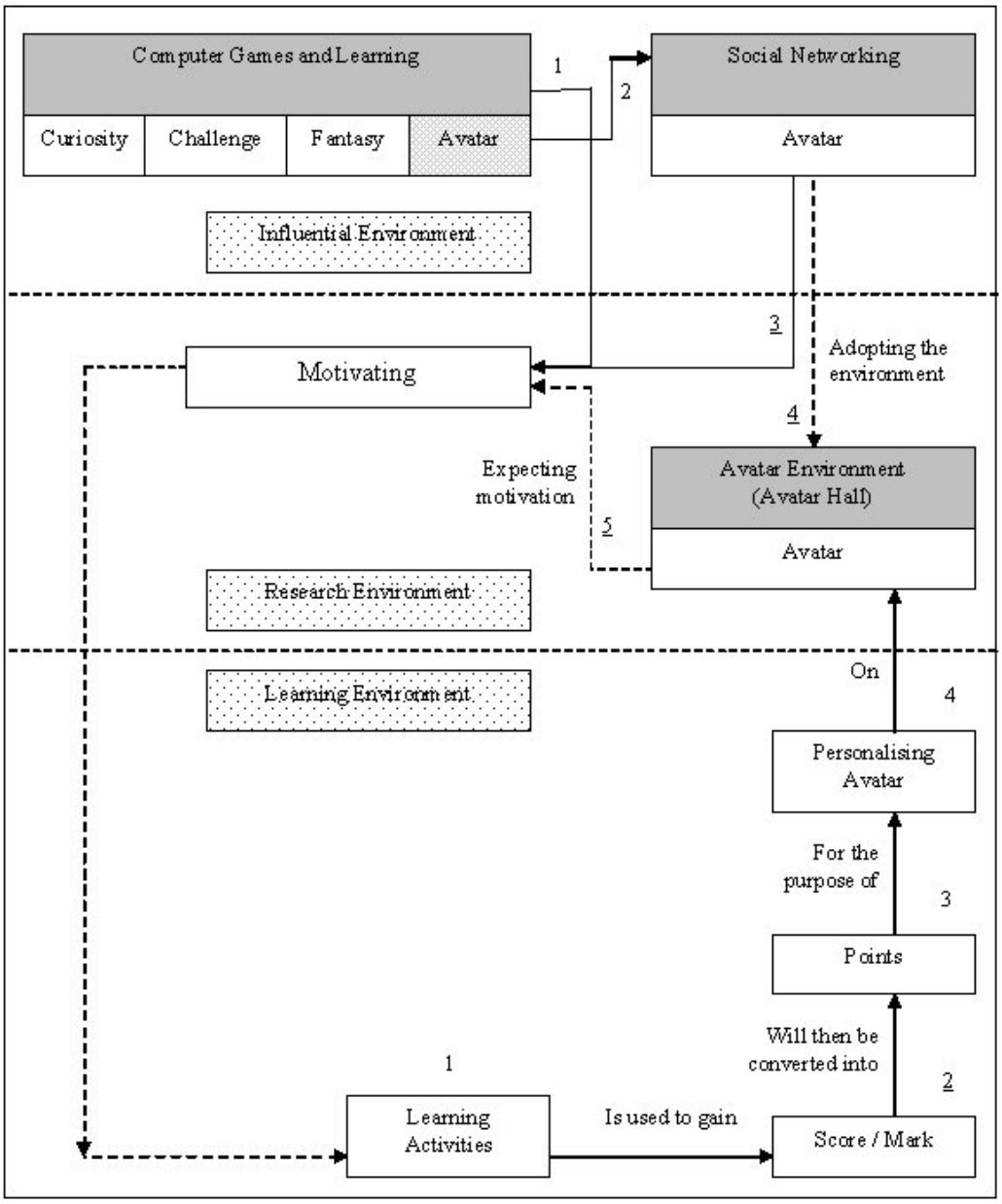


Figure 1.1: Overview of Research

## 1.3 Statement of Problem

Most previous studies on the use of an avatar have been conducted within commercial settings such as “online games, mailing systems, 3D chat rooms, online communities and web forums” (Boberg, Piippo, and Ollila, 2008). A study of avatar use in education is conducted around the use of a computer in a learning environment. Previous study focuses on using an avatar that it is constantly displayed on the screen

within a CBL environment, as in a study by Furukawa (2010). However, there is limited study conducted focusing of an avatar use in a conventional learning environment. A Conventional Learning Environment (CLE) is a non-CBL environment where an avatar is not present for most of the learning activities. The existence of an avatar in the CBL and in the CLE environments is visualised in Figure 1.2.

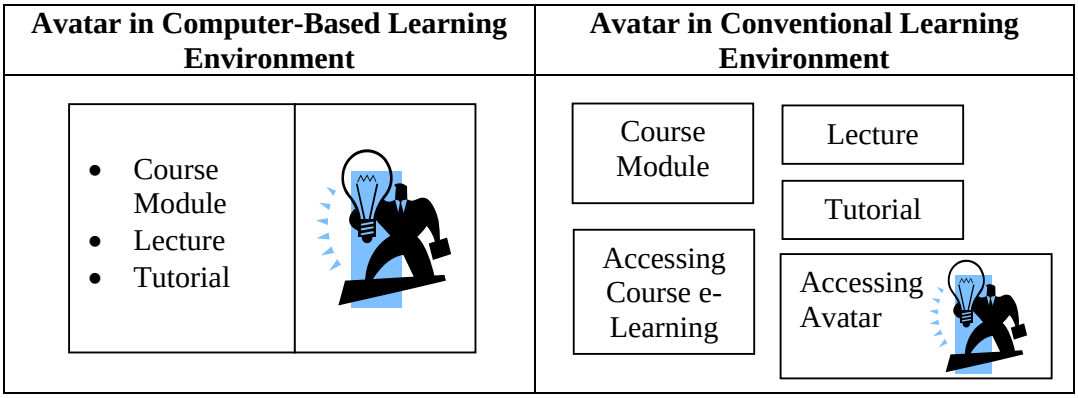


Figure 1.2: The Presence of an Avatar in Two Different Learning Environment

From Figure 1.2, it can be seen that avatars exist in both learning environments. However, in the CBL environment, the avatar is constantly present on the screen throughout the lesson. In the CLE environment, the avatar is not present when the students start their lesson; it appears only when students start to access an avatar.

The outcome from the investigation of students' perception of motivation to an avatar in CBL can be unreliable. As the avatar is constantly present on the screen in CBL, it may influence the outcome of the research. In this outcome, students may agree that the avatar motivated their learning, but this agreement may be influenced by the nature of an avatar which is constantly present on the screen while they learn. However, will the outcome of 'an avatar is motivating and thus motivate to learn' the same when an avatar is used in the CLE environment, involving listening to a lecture in the classroom without the presence of an avatar? Therefore, this research will explore this question.

### 1.3.1 Motivation to Learn

Leutner and Wirth (2010) commented that motivation is essential at all stages of the learning process. According to Ormrod (2008), motivation to learn is something that instructors can develop in their students. She stated that intrinsic motivation and instructor approaches to learning assessment influence how students are motivated to learn. She explained that intrinsic motivation exists within the person. The key factors in intrinsic motivation are enjoyment, interest and worthiness. Extrinsic motivation, on the other hand, comes from outside the person and its key elements are reward and punishment. For example, students are likely to attend a lecture to improve their understanding of the subject if doing so enables them to sit the exam and to score well in it.

Ormrod (2008) listed the following guidelines for students' motivation to learn.

- Students are likely to be intrinsically motivated when they feel confident of their performance in the subject being taught.

- Students are intrinsically motivated when they have some degree of autonomy in their learning activities. For example, students are allowed to give an input on how learning activities could be improved.

- Learning assessment is used as a means of enhancing future achievement rather than as judgements of ability and worth.

The integration of an avatar within CBL is believed to provide enjoyment to the students while they learn. This enjoyment is believed to increase students' motivation to learn. According to Mendez, Burden and de Freitas (2008), the use of an avatar in Computer-Aided Instruction (CAI) has been shown to be intrinsically motivating and to help the learner to learn.

Therefore, one of the objectives of this research is to investigate students' motivation to learn when the use of an avatar is applied in the CLE environment. This objective generates the first research question of this research and this is shown in Figure 1.3.

| Research Question | |
|---|---|
| RQ1. | Are students motivated to learn when an avatar is applied in a conventional learning environment? |

Figure 1.3: Research Question 1 for Motivation to Learn

### 1.3.2 Motivation to view an Avatar

In addition to the presence of avatars in the computer games environment, they are also used in other computing environments, such as social networking. The existence of an avatar is said to allow the user to:

- represent themselves in an online environment (Lee and Shin, 2004; Lee, 2003).
- act and express themselves (Boberg et al., 2008).
- build a reputation among other avatar users (Boberg et al., 2008).

Lee and Shin (2004) reported that teenagers are often willing to spend money to improve their avatar. Similarly, Hemp (2006) said that many game players who own an avatar try to buy avatar accessories for performance enhancement and presentation. Moreover, some players sell their accessories at very good prices on auction sites such as eBay.

From this information, it can be seen that the presence of an avatar in these environments is similar to its presence in the CBL environment. Moreover, in computer games and social networking, the avatar is always on the screen. Therefore, one of the objectives of this research is to investigate students' motivation to view the avatar when an avatar is used in the CLE environment. This objective generates the second research question of this research and this is shown in Figure 1.4.

| Research Question | |
|---|---|
| RQ2. | Are students motivated to view their avatar when an avatar is applied in a conventional learning environment? |

Figure 1.4: Research Question 2 for Motivation to view an Avatar

Personalisation of an avatar suggests the projection of its owner's self-image onto an avatar. Motivation could be derived from the way an avatar is presented and embellished. As suggested by Kellar, Watters and Duffy (2005), users should have the ability to personalise the behaviour and appearance of their avatar characters. In a computer game, the personalisation of an avatar is typically for the purpose of utilities such as weaponry whereas, in a social networking, personalisation is primarily for decorative purposes. This is due to the nature of both a computer game and social networking, where the purpose of a computer game is to achieve goals such as saving the kingdom from evil, whereas social networking aims to achieve goals such as social status and to maximise relationships with the owners of other avatars.

Personalisation of an avatar has also been applied in CBL. A study by Kao, Galas and Kafai (2005) showed that students who are able to personalise their avatars enjoyed their learning more than students who were presented with ready-made avatars.

Following this work on avatar personalisation, one of the objectives of this research is to investigate whether students' motivation to view the avatar is due to personalisation. This objective generates the third research question of this research and this is shown in Figure 1.5.

| Research Question | |
|---|---|
| RQ3. | Are students motivated to personalise their avatar? |

Figure 1.5: Research Question 3 for Motivation to personalise an Avatar

### 1.3.3 Motivation to access an Avatar Environment

Piotr and Bozena (2008) reported that an avatar is usually best used within an online environment. According to Frery, Kelner, Moreira and Teichrieb (2002), using an

avatar in an online environment, such as computer games and social networking, makes a user's experience more realistic.

In this research, avatars appear in an online environment called an Avatar Hall. This environment is divided into two types, based on attributes and ranking.

- In the attribute-based Avatar Hall, the online environment is populated with avatar accessories, such as clothing, hairstyle, and many more.

- In the ranking-based Avatar Hall, the online environment shows avatars that are positioned in a ranking system. This is similar to a conventional ranking board of students' scores where students' names are listed according to their assessment scores, with the most successful student at the top of the list.

The design and the development of the Avatar Hall based on attribute and ranking aims to achieve one objective, namely, presenting students learning performance, but this is translated in two ways, as shown in Figure 1.6.

| Environment | Purpose | How |
|---|---|---|
| Avatar Hall (Attribute-based) | Learning Performance | Identify through avatar accessories |
| Avatar Hall (Ranking-based) | Learning Performance | Identify through avatar position in a ranking system |

Figure 1.6: The Purpose of the Development of an Avatar Environment

Based on Figure 1.6, the purpose of accessing the Avatar Hall by students in a CLE environment is to see their learning performance. In the attribute-based Avatar Hall, learning performance is indicated by the student's avatar accessories whereas, in the ranking-based Avatar Hall, a student's learning performance is shown by his or her avatar's position in the ranking list.

Therefore, the objective of this research is to investigate students' motivation to access an avatar environment between the attribute-based environment and the ranking-based environment. . This prompts the fourth research question of this research, which is shown in Figure 1.5.

| Research Question | |
|---|---|
| RQ4. | Are students motivated to access an Avatar Environment using the attribute-based environment or the ranking-based environment? |

Figure 1.5: Research Question 4 for Motivation to access an Avatar Environment

### 1.3.4 Research Question Summary

The questions of this research are summarised in Figure 1.6.

| Research Question | |
|---|---|
| RQ1. | Are students motivated to learn when an avatar is applied in a conventional learning environment? |
| RQ2. | Are students motivated to view their avatar when an avatar is applied in a conventional learning environment? |
| RQ3. | Are students motivated to personalise their avatar? |
| RQ4. | Are students motivated to access an Avatar Environment using the attribute-based environment and the ranking-based environment? |

Figure 1.6: The Summary of Research Questions

## 1.4 Conceptual Framework

This section describes the conceptual framework of this research. In general, there are two types of variables involved in relation to describing the research framework. These are the independent and dependent variable. The independent variable is a variable that can be manipulated, whereas dependent variable is a variable that is going to be measured. As described by Harris (2008), an independent variable is the "causal variable" and the dependent variable is a variable that could present the effect of changing the value of the independent variable.

The conceptual framework of this research is based on the research questions, stated in Figure 1.6, which arise from the main aim of this research, namely, to investigate the impact on students' motivation to learn by using an avatar.

Therefore, the conceptual framework of this research is illustrated in Figure 1.7.

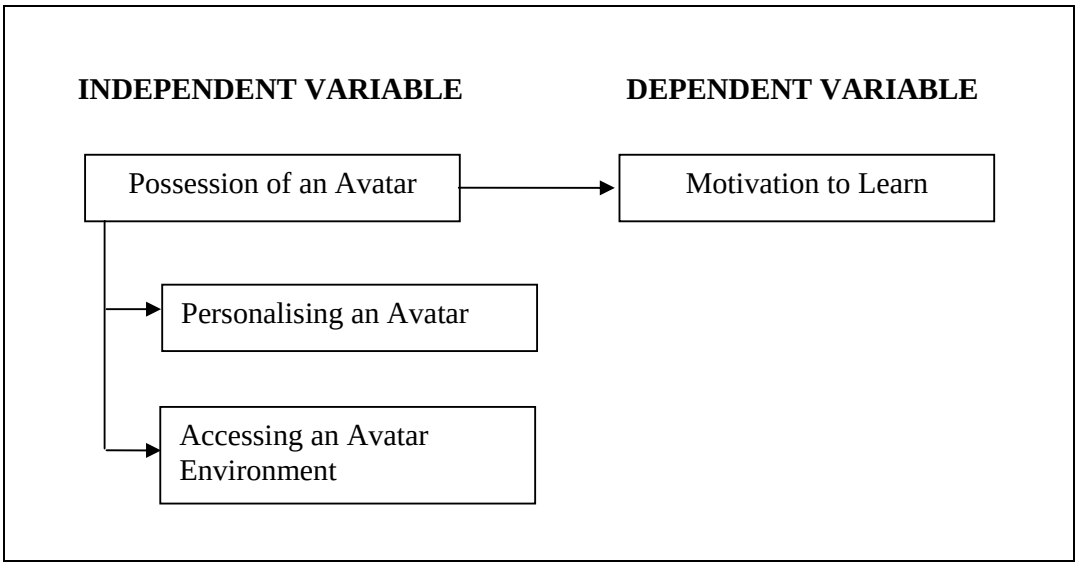


Figure 1.7: The Conceptual Framework of the Research

As shown in Figure 1.7, the independent variable is possession of an avatar. The dependent variable, on the other hand, is stated as motivation to learn. The possession of an avatar consists of two parts, motivation to personalise an avatar and motivation to access the Avatar Hall. These two sub-categories are positioned under the main category of possession of an avatar because they are believed to have a direct impact on an avatar. For example, personalisation is not possible if there is no avatar. Similarly, accessing the Avatar Hall is necessary in order to view and personalise an avatar. An avatar cannot exist without its environment which, in this case, is Avatar Hall.

## 1.5 Definition

### 1.5.1 Course

According to the Oxford English Dictionary, a course is "a planned or prescribed series of actions or proceedings, as of study or lecture." In this research, a course refers to set of lectures in either IT for Knowledge Worker (coded TMX2012) and Personality Development (coded KMC1093) undertaken by participants in the research.

### 1.5.2 Avatar

Inal et al. (2006) defined an avatar as a character representing an individual in an online environment. Moreover, an avatar can be presented as a graphical image of the user in the online environments as a basis for communication and interaction (Cannon-Bowers and Bowers, 2007). Hence, in this research, an avatar is a character that represents a student in an online environment called the Avatar Hall.

### 1.5.3 Avatar Type

According to McCue (2008), avatars can be categorised into three types: a real self, a modified self and a fantasy self. Additionally, there are static avatars and controllable avatars. At the time of writing, static avatars can be found on social networking sites such as Facebook, Friendster and Zwinky. Controllable avatars can be found on social networking sites such as Second Life and IMVU, and in computer games such as Lineage and World of Warcraft.

According to Boberg et al. (2008), avatar can be seen as a controllable character as in games, an icon or a textual description, such as a name. In this research two types of avatar were used, a static-type avatar with human-like features, and a text-type avatar.

### 1.5.4 Personalisation of an Avatar

There is no specific definition on personalisation but Steuer (1992) definition of interactivity has almost the same meaning as personalisation in this research. Steuer (1992) described interactivity as “the degree to which users of a medium can influence the form and content of the media environment”.

In this research, personalisation means an activity by which users can manipulate their avatars (the medium) according to their needs.

### 1.5.5 Environment

In Information Technology (IT), an environment can be categorised as either online or virtual. An online environment is defined as a computer-generated setting in which users choose to be involved and within which interaction take place. It includes courses, discussions, and other communication occurring in an electronic format via the internet (www.coloradomtn.edu/distlearn/resources/glossary.html). Contexts associated with an online environment include teaching in classrooms, informal learning, distance learning, business, e-commerce, and social community.

A virtual environment, on the other hand, can be categorised as immersive or non-immersive. The former is a highly realistic simulated environment which uses, as a medium of communication delivery, expensive technology such as a high-speed graphic supercomputer, head-mounted display devices, a three-dimensional graphics accelerator, wired gloves, and spatial audio processing (Pimentel and Teixeira, as cited in Tan, Chen and Mazlan, 2007).

A non-immersive virtual environment is a simulated environment which uses an affordable technology, such as keyboard and mouse, as input devices to navigate a three-dimensional environment that is displayed on a computer monitor (Pimentel and Teixeira, as cited in Tan et al., 2007).

Therefore, in this research, environment is referring to the online environment.

### 1.5.6 Avatar Environment

An avatar environment is an online environment where an avatar is present. In this research, this online environment is called the Avatar Hall. It is composed of two types of environment, namely, the Attribute-based Environment (AbE) and the Ranking-based Environment (RbE).

The AbE environment contains an avatar for each student, with an avatar name and all the items needed for their avatar's personalisation and enhancement. In the RbE environment, students will be presented only with their avatar's name and their scores in a ranked order. Students who score well in their learning activities will see their avatar's name above the avatar names of students who score less well.

### 1.5.7 Perception of Motivation

According to the Oxford English Dictionary, the word ‘perceive’ is defined as “the process of apprehending the mind or to become aware or conscious of something” whereas ‘perception’ is defined as “the process of becoming aware or conscious of a thing or things in general.”

Motivation, on the other hand, is defined as “the general desire or willingness of someone to do something; drive and enthusiasm” (Oxford English Dictionary).

In this research, perception of motivation is defined as the awareness by an individual of his or her desire to do something, such as learning, getting an avatar, accessing an avatar environment, or personalising an avatar.

## 1.6 Chapter Summary

This chapter has described the issues relating to motivation, avatars and learning. These have resulted in the formation of four research questions, as well as developing the independent and dependent variables of the research. Reviews of related research will be presented in the next chapter.

# Chapter 2

# Literature Review

## 2.1 Overview

This chapter will review the past research on the use and application of avatars, which consists of the definition; history; avatar elements such as type, personalisation, environment; and past studies of avatars such as within the context of computer games, social networking, business and education. The introduction of computer games and their application in an educational setting is also presented. This introduction will help to explain how avatars form part of computer games. Finally, the review will discuss the theories of motivation such as intrinsic and extrinsic motivation, and its relationship to avatar and technology enhanced learning.

## 2.2 Introduction

The concept of having an avatar is believed to enhance the user's sense of presence. Avatars not only exist in a virtual world, but also appeared in many communication media such as Internet Relay Chat (IRC), online chat, and email (Schultze, 2010). Additionally, avatars also play an important role within computing gaming. They are the way in which the game player represents themselves in the game world. They also help to enhance the narrative elements of the games. As stated by Meadows (2008), avatars are used to control the story of games and having an avatar will make the

game more interesting, personal, and attractive. Some games allow their players to choose the types of avatar they prefer. In general, the introduction of an avatar is to represent the role of a game player and each role will be presented by having a character.

The appearance of an avatar is mostly found in computer games, specifically in an online computer games such as Massively Multiplayer Online Role-Playing Games (MMORPGs). MMORPGs are an immersive, persistent gaming environment which offers synchronous communication among players all over the world via an internet connection (McManus, 2002; Beedle, 2004). In general, it is an online games that is played simultaneously by thousands of people all over the world. Examples of MMORPGs are the World of Warcraft (WoW), Half-Life, and Lineage.

## 2.3 What is a Computer Game?

Computer games can be defined as an activity which involves characters (game player), goals, rules, and competition. As defined by Dempsey, Haynes, Lucassen and Casey (2002), a game is "a set of activities involving one or more players. It has goals, constraints, payoff, and consequences. A game is rule-guided and artificial in some respects. It involves some aspect of competition, even if that competition is with oneself". Prensky (2004) has listed six key elements that a game must have in order to be classified as a game. These six elements are rules, goals and objectives, outcomes and feedback, conflict/competition/challenge/opposition, interaction, and representation or story.

The rules are something that must be followed and accepted by the game player in order to achieve the goals of the game. As mentioned by Prensky (2004) rules are what differentiate one game from another. Rules are important to games because they have the ability to limit the game player. This means that the rules will require the game player to take specific paths to reach certain goals and will ensure that all of the game players do the same. Goals or objectives, on the other hand, are what the game player needs to achieve in order to meet the requirements of the game. The goals could be to enhance skills, to proceed to the next level of the game, to collect more points in order to personalise the avatars, and so on. In a game, achieving the goals is what motivates the game player to play.

Outcomes and feedback are how game players measure their progress against the goals. The basic outcomes of a game are either win or lose. Feedback, on the other hand, occurs when something in the game changes in response to what the game player does. As mentioned by Prensky (2004), feedback will give the game player information about whether the action taken is positive or negative, whether the game players are staying within or breaking the rules, and whether the game players are moving closer to their goal or further away. Feedback can come in many forms such as numerical (points), graphical (clothing, weaponry), size (size of the city in Sims City or Age of Empires), and so on.

Conflict/competition/challenge and opposition are the elements that provide problems in a game that the game players are trying to solve. The problems consist of fighting opponents, a puzzle or anything that stands in the way of the game player's progress. Interaction, on the other hand, can be categorised into two groups; interaction between the computer and interaction between the game players. The last key element is representation. According to Prensky (2004), representation "means that the game is about something". It includes the narrative or story elements in the game. He has identified a set of games that represent a theme of the game, as shown in Table 2.1.

| Game | Representation |
|---|---|
| Chess | • Is about conflict. |
| Tetris | • Is about building and recognising patterns. |
| The Age of Empires | • Is about the history of the art of warfare. |

Table 2.1: Representation Element (Prensky, 2004)

### 2.3.1 Game Genre

Games can be divided into two categories, which are console-based and computer-based (Dipietro, Ferdig, Boyer & Black, 2007). According to Asgari and Kaufman (2004), the computer has been used as a platform for gaming for 40 years. It started with a floppy disk, then a CD-ROM and now is frequently delivered through the internet. Generally, there are seven types of game, which are normally referred to as

genres. These genres are: action, strategy, adventure, role-play, sport, simulator and classic games (Gros, 2003). Details and examples of each genre are shown in Table 2.2.

| Genre | Details |
|---|---|
| Action | • Usually depends more on hand/eye coordination than on the content of the game.<br>• E.g.: Tekken, Mortal Combat |
| Strategy | • Stresses the important of logical thinking and planning.<br>• E.g.: Age of Empires |
| Adventure | • Usually involves exploration and problem solving.<br>• E.g.: Indiana Jones, CSI |
| Role-Play | • Similar to adventure games but has an added feature – the evolution of the characters, normally called Avatars.<br>• Also called MUDs (Multi-User Domains) because several players can play online simultaneously.<br>• E.g.: Final Fantasy |
| Sport | • Simulates basic strategies, from individual to group sports.<br>• E.g.: Golf, Football |
| Simulator | • Recreates an object or process in great details.<br>• E.g.: SimCity 3000 |
| Classic | • Normally a computerised version of well-known board games.<br>• E.g.: Minesweepers, Solitaire |

Table 2.2: Computer Games Genre

## 2.4 The Meaning of Avatars

The term ‘avatar’ is originated from the Sanskrit languages, and means an incarnation or God’s appearance on earth (Boberg et al., 2008; and Lee & Moon, 2007). In the context of computing, an avatar is defined as a representative character of the user (Castronova, 2003; Inal & Cagiltay, 2006; Lee & Moon, 2007; Yee & Bailenson, 2007; Boberg, et al., 2008; and Samsonov & McCartney, 2011) such as in computer/video games like The Sims and virtual environments such as Second Life (Kim, Baker & Song, 2007); and computer-based learning. Apart from that, Holzwarth, Janiszewski and Neumann (2006) have described an avatar as a graphic representation that is personified by computer technology.

According to Seth (2003), the use of an avatar in an online environment began as early as the mid 1980s as a marketing tool and, in a computer game called Ultima IV (Farmer, in Mulligan & Patrovsky, 2003). However, game players started to have the ability to represent themselves as character-players, with custom-built body parts and facial features, in games and online communities about ten years ago (Apter, 2008).

Accordingly, any elements can become an avatar as long as they are used as a representative character of the user. It could be a controllable character, as in digital games, an icon or a textual description, such as a name (Boberg et al., 2008). Moreover, many games will offer players a choice of identity in order to represent themselves. According to de Zwart, Collins, and Lindsay (2010), the identity of the players will be represented by the colour of black and white pieces in a chess game, whereas in Monopoly, the choice of identity will be a racing car, a dog or a shoe. Meadows (2008) described an avatar as “an interactive, social representation of a user”. An avatar can be represented by a photo of a real person’s appearance or be nothing like them. Mostly, avatars are a combination of the real and the imagined. The most important aspect is that an avatar represents an internet user.

## 2.5 Avatar Practices

According to Walmsley (2008), avatars exist on web pages to represent the users in an online environment. They have been developed and used for some time in the fields of computer science, education and business (Kramer and Bente, 2010).

### 2.5.1 Avatar Practices in the Business Sector

In the business sector, an avatar is used as a communication platform between the business owner and the customer, to deliver announcements and news. Moreover, it is also used as a virtual marketing or sales tool, where it is similar to what marketing and sales executives do in real life. As mentioned by Wood, Solomon and Englis (2005), avatars can be found in online advertisements, on e-commerce sites and on vending machines, for the purpose of relaying messages and increasing the purchase experience.

Based on the study by Keeling, McGoldrick and Beatty (2010) on the use of avatars as salespeople in online shopping or, as they named it, as 'e-tailing', most of the participants preferred to shop on the internet with an avatar as their shopping assistant.

As stated by Rintels (2001), "an avatar serve the same purpose that any live customer service or sales representative would and can interact in real time to answer customers' questions". Rintels (2001) points to a situation where, in the future, businesses will use avatars to represent the customers as they try on goods virtually. These goods are normally within the range of clothing, trousers, shoes and glasses.

Hemp (2006) described the scenario of online shopping as follows; "In the shopping mall of a virtual world, for example, an avatar could try-on and try-out in front of virtual friends real-world clothing brands. If she got rare reviews from her pals and became comfortable with the ideas of wearing a particular outfit, a purchase in the real world might follow".

Although the use of an avatar in online shopping is growing in popularity, however, according to Keeling, McGoldrick and Beatty (2010), there is little information available in this area of study.

### 2.5.2 Avatar Practices in the Education Sector

In the education sector, avatars are used to represent teachers or instructors in an online and virtual learning environment. The instruction is delivered via computer technology, such as Computer-based Learning. In a CBL environment, regardless of

what environment it is, an avatar will play a role as a tutor to guide learners through the learning process.

Apart from having an avatar as a tutor or an instructor for learners, an avatar can also be owned by the learners. Therefore, the learners can experience their learning through their avatars and also observe other avatars' activities (Choi, 2010).

The use of an avatar in the education sector is not only applied in the school environment, but also applied the medical environment as a training mediator. A study conducted by Andrade, Bagri, Zaw, Roos and Ruiz (2010) on the use of avatars for training physicians to deliver bad news to patients have indicated that the participants were able to deliver bad news effectively to the patient. According to Andrade et al. (2010), the use of an avatar as a training mediator is used to reduce the training costs for the hospital, such as hiring an actor and the logistical costs such as travel and scheduling, and also reduce the limits to the characters and conditions that an actor can portray during training. They further commented that the use of avatars is favourable since the avatar itself is easily customised for different scenarios and also is benefits distance learning, where communications between avatars are in real-time via the Voice-Over-Internet Protocol (VOIP). Their study employed Second Life as their virtual environment.

> "Learners, who have personality which often is shy and nervous, and so couldn't display sufficiently their abilities in traditional class, may be able to take more advantage from virtual world".
>
> Choi (2007)

### 2.5.3 Avatar Practices in the Entertainment Sector

In the entertainment sector, avatars can be found in games. In the games environment, an avatar is presented as a game player itself. Players have lots of choice over which type of avatar to use. It can be a human-like avatar, a fantasy-like avatar or an animal avatar. According to Jin (2009) "avatars in video games are visual representations of game players' selves. Avatars are increasingly being used in interactive media environments, including console-based video games (e.g. Wii and X-Box) and 3D virtual environment-based multiplayer online games (e.g. WOW, Second Life and

Sims)". Besides computer and console games, avatars are also found in social networking environments, such as thepalace.com and IMVU.

Studies on the use of avatars in social networking have generally focused on topics like the communication, appearance and personality of the avatar. For instance, a study conducted by Banakon, Chorianopoulos and Anagnostou (2009) examined the effect of an avatar's appearance on user sociability in Second Life and found that those avatars that had undergone vast customisation from the default avatar's appearance had been more successful in social encounters. This means that avatars' appearance does influence their acceptance and sociability in Second Life.

However, Banakon, Chorianopoulos and Anagnostou (2009) also found that, although at the beginning of the study some of the participants agreed that they preferred to have an attractive avatar in the virtual world, however, towards the end of the study, later they all claimed that their avatar's appearance was unimportant to them. This can be supported by a study conducted by Baylor (2011) in regards to the use of an avatar as a motivational agent where she found that the appearance of an avatar was not important to the learners.

In regards to their findings on avatar's appearances (Banakon, Chorianopoulos and Anagnostou, 2009; and Baylor, 2011) it can be inferred that the appearance of an avatar to the learners is not important.

## 2.6 Avatar Elements

There are two elements that are discussed when describing an avatar, such as avatar type and avatar personalisation.

### 2.6.1 Type of Avatar

In general, avatars are created with computer programs and appeared in many forms, such as "animals, fantasy figures, holiday illustrations and science fiction characters" (Samsonov and McCartney, 2011). A study conducted by Nenstaedfer and Fedorovskaya (2009) found that there are four types of avatar. These are realistic, ideal, fantasy and role play.

*Realistic*: The avatar is as similar as possible to the user's real life identity. As Nenstaedfer and Fedorovskaya (2009) put it, "It is just you".

*Ideal*: The users modified their avatars to be slightly different from their real life identity. As Nenstaedfer and Fedorovskaya (2009) put it, "A better you". Users will modify their avatars' identity based on their weight, height, or age.

*Fantasy*: The users have modified their avatars to be different from their real life identity. "It is a fantasy you" (Nenstaedfer and Fedorovskaya, 2009).

*Role play*: The users have a different identity from their real life identity. "It is a many fantasy you" (Nenstaedfer and Fedorovskaya, 2009).

Similarly, McCue (2008) categorised avatars into three types: real-self, modified-self, and fantasy-self. Real-self is described as a photo-realistic avatar which is as identical as possible to its owner. Modified-self, on the other hand, is an avatar that is very similar to its owner but differs in one or more attributes from the owner's actual appearance, such as having long, instead of short hair. Lastly, fantasy-self is an avatar that appears entirely different from its owner. It may take the form of a human that is not identical to its maker, but more often appears in a strange form such as an alien. Examples of real-self and fantasy-self avatars are shown in Figures 2.2 and 2.3 as follows.


Figure 2.2: Real-Self Avatar (McCue, 2008)

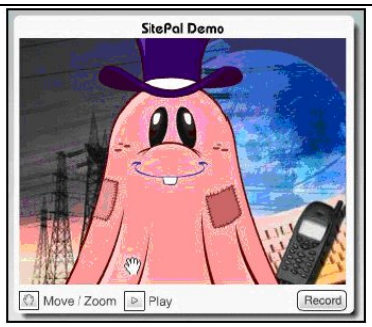


Figure 2.3: Fantasy-Self Avatar (McCue, 2008)

However, as suggested by Inal and Cagiltay (2006), a human-like avatar should be integrated into a virtual environment in order to increase the students' motivation and attention. This suggests that the real-self or modified-self avatar would be the best type for use in computer games and learning within educational setting.

Additionally, an avatar is further categorised into two types: a static avatar and a controllable avatar. These are explained as follows.

- With a static avatar, no movement occurs. Even so, users are still able to enhance their avatar attributes. This type of avatar can be seen in the Yahoo! Avatars. An example of Yahoo! Avatars is shown in Figure 2.4 as follows.

Figure 2.4: Yahoo! Avatars

- A controllable avatar, on the other hand, allows users to take control not only of their attributes but also their movement. This type of avatar is usually found in computer games, such as Lineage, and virtual environments, such as Second Life. An example of a Second Life avatar is shown in Figure 2.5 as follows.

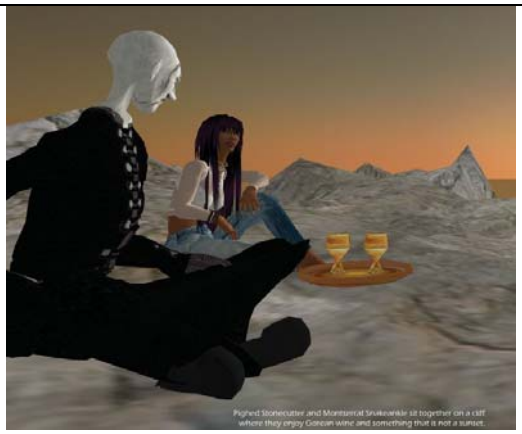

Figure 2.5: Second Life Avatar (Meadows, 2008)

According to Vasalou et al. (2008), there are three factors that users are inclined to use when creating a static 2D Yahoo! avatar. These are as follows.

- How the avatars are going to represent themselves in the virtual world, by mirroring either their actual self or idealised self.
- Taking advantage of the fantasy elements offered.
- Using their avatar's appearance to express a message.

### 2.6.2 Personalisation of Avatars

The element of personalisation or customisation is an activity whereby a user has the opportunity to customise their avatar attributes according to their needs. Turkay and Adinolf (2010) described customisation as allowing the game-players to take control on their avatars' appearance. In addition, the customisation of attributes is defined as the selection of species (human or non-human), gender, age, colouring (skin tone, eye colour, hair colour), facial features (eyes, nose, and lips), proportions (of face, facial features and shoulders), hair (style, length), and clothing (shirts, hats, and jewellery) (McCue, 2008). As explained by Hamilton (2004), the personalisation of an avatar's appearance involves its hair style, eye and hair colour, and clothing. Some personalisation also occurs through purchasing and receiving (as a gift from other avatars) (Hemp, 2006).

Additionally, as cited in Castronova (2003), having an opportunity to personalise an avatar's attributes has encouraged users to spend most of their time in the online environment. According to Robbins (2008), having the ability to make alterations to an avatar indicates that it has achieved a certain level of accomplishment and has also completed a difficult quest. A study conducted by Turkay and Adinolf (2010) suggested that personalisation was an important feature for participant's enjoyment.

Personalisation is important to some people. Personalising their avatar could reflect their feeling of self being projected onto the character. Some of the reasons why this activity is important are as follows.

- This activity has gained interest among students and is able to increase their sense of control and autonomy (Cordova and Lepper, cited in Foster, 2008).

- Chung and Lee (2008) stated that personalisation can bring pleasure, higher emotional arousal and more emotional effects to the game players when they are able to change their avatar without restriction.

- De-Lucia, Francese, Passero and Tortora (2009) commented that the customisation of an avatar will allow users to differentiate themselves from the other participants in the online environment.

- Shun-an Chung and Lee (2008) stated that the customisation of an avatar offers "differences, privacy, emotions and constructs the users' own identities."

- Personalisation affects enjoyment (Turkay and Adinolf, 2010).

## 2.7 Avatar Representation

Avatar representation is an identity that the users add themselves. Allmendinger (2010) stated that the aim of an avatar is to give identification to its user, such as to show the avatar's role, status and group membership.

> "In online environment, the avatar is not simply a uniform that is worn, the avatar is our entire self-representation".
>
> Yee & Bailenson (2007)

Foster (2008) described identity as an ability to identify oneself in another person or character, and within a specific situation. Goffman (in Nenstaedfer and Fedorovskaya, 2009) defined identity as a mental model that one has of oneself. The formation and presentation of identity is a social behaviour whereby people present their identity to others in everyday life, either in real life or in the virtual environment.

This identification phenomenon is similar to the activity explained in the theory of the possible self. According to this theory, as cited from Markus and Nurius (1986), "an individual is free to create any variety of possible selves, where it derives from individual's sociocultural and historical context and from the models, images, and symbols provided by the media and by the individual's immediate social experiences". As seen in many avatar personalisation activities, users are free to create their avatar. They will use their imagination to personalise their avatar accordingly, in relation to the environment, for example, as in games and the social networking community.

According to Nenstaedfer and Fedorovskaya (2009), the first thing that users must do once they arrive in a virtual environment is to create an avatar identity. Additionally, they added that there are three types of identity in the virtual environment. These identities are as follows.

- Creating an avatar identity as their real life identity
- Creating a different avatar identity to their real life identity
- Creating a better and more ideal avatar self-identity

Similarly, Walmsley (2008) stated that some people like to present themselves as non-human avatars, through their own creation and innovation. However, Kafai et al. (2010) claimed that "most users' avatars were in their actual-self".

A study conducted by Kim et al. (2007) found that how people represent themselves will depend on the online group community to which they belong. Inal and Cagiltay (2006) reported that personality plays an important role in how people

represent their avatar. Inal and Cagiltay (2006) conducted a study on personality and avatar preference among students aged between 7 and 13 years, and concluded that students tend to present their avatar based on their personality traits. For example, a personality trait of conscientiousness assesses the person's reliability, discipline and carefulness.

A study performed by Soukup (2004) on avatars in The Palace, a 2D graphical virtual world, found that the users' avatars tend to walk away from other avatars which are strangers to the user's avatar. This shows that the behaviour of avatars in the virtual world is tied to the user's behaviour in real life.

Bartle (in Nenstaedfer and Fedorovskaya, 2009) has described a series of identifications that the users presented through their avatar when they were involved in the virtual environment. These series are described as follows.

- Series 1: Players

  Users begin their journey as players who control objects associated with them. This is referred to as the creation of an avatar. At this point, the avatar and the player are two separate identities and the player has little identification with their avatar.

- Series 2: Avatars

  Users start to feel that their avatar is representing them in the virtual environment. Users are becoming their avatar. However, at this point, the user and avatar are still two separate identities.

- Series 3: Character

  Users are creating a character for their avatar. This is where an avatar will represent one aspect of the user's identity. This identity is an extension of the user's self.

- Series 4: Personas

  Users are becoming one with their avatars. The users' real life identity overlaps their avatars' identity.

## 2.8 Avatar Attributes

Attribute is defined in Oxford English Dictionary as “a material object recognised as appropriate to, and thus symbolic of, any office or actor; to denote the character or show the identity of the personage represented.” In computer games, attributes are referred to as an object or accessory that is used by users to personalise their avatar. It consists of clothing, shoes, and other accessories, such as glasses, earrings, and electronic gadgets. Similarly, Meadows (2008) categorised accessories into two groups of environments, such as the game and social environment.

- *In the game environment*, such as World of Warcraft (WOW) and Eve Online, accessories are typically utilities (“things that help achieve goals and maximise what liberty the rules offer”).

- *In the social environment*, on the other hand, the primary accessories are decorative (“things that help achieve social status and maximise the relationships with other avatars”).

There are many classes of avatar attribute found in an online and virtual environment, such as social networking, computer games, and console games. These environments offer various amounts of attribute classes respectively. These classes can be summarised in Table 2.3 as follows.

| Classes | Environments | | | |
|---|---|---|---|---|
| | **Zwinky** | **Meez** | **IMVU** | **Xbox360 NXE** |
| Species | | | | |
| Gender | X | X | X | X |
| Age | | | | X |
| Colouring | X | X | X | X |
| Facial Features | X | X | X | X |
| Proportions | X | X | X | X |
| Hair | X | X | X | X |
| Clothing | X | X | X | X |

Table 2.3: Summary of Avatar Attribute Classes

Table 2.3 shows the attribute classes which are based on McCue (2008), who has given eight classes of avatar attribute, such as species, gender, age, colouring, facial features, proportions, hair, and clothing. These classes have been applied into various environments such as social networking sites and the console virtual environment. The species classes would be populated if the computer games environment is presented. The features of a fantasy-self species, such as an elf, can only be found in the computer games environment, as in Lineage.

## 2.9 Computer Games and Learning

Although computer games have always been depicted as anti-social and have a violent content that could lead to violent behaviour (Holmes, 2008), however, some studies have shown that playing games can also have a positive impact on their game players, such as in the area of learning and motivation. Salguero and Moran (2000) claimed that not all research has found a positive relationship between computer games and aggressive behaviour. Hart et al. (2009) reported that there was no relationship between computer games and aggressive behaviour. As mentioned by Facer (2003), computer games have the potential to motivate students to learn in a way that formal education does not offer. Similarly, Eck (2006) added that computer game-based learning (CGBL) offers the ability to promote learning and reduce the instructional time for multiple disciplines and ages. Parnnese and Carlesi (2007) stated that the

ability to promote learning is because of the opportunities given to the game players for 'learning by doing'.

According to the Entertainment Software Association (as cited in Nonis, 2006), what makes computer games suitable for and beneficial to the educational setting is that fact that games are fun, challenging, an interactive social experience that can be shared with friends and family, and they provide a lot of entertainment.

Garris, Ahlers and Driskell (2002) listed three reasons that make educators and training professionals interested in computer games. These reasons are as follows.

i. There are major shifts in the field of learning, from traditional to learner-centred modes of instruction. This is supported by the availability of new technologies in an educational setting, i.e. the integration of multimedia and interactivity in computer-based learning.

ii. The ability of computer games to enhance the learning and understanding of complex subject matter.

iii. The ability of computer games to increase the level of involvement and engagement among game players.

Similarly, Oblinger (2004) explained that a computer game has the ability to offer a powerful learning environment, such as allowing learners to immerse themselves within 2D and 3D environments. Moreover, as stated by Nonis (2006), the ability to integrate computer games in learning could enhance students' learning as follows.

i. To build a deeper level of learning when students learn to take information from many sources.

ii. To create strategies for overcoming obstacles.

iii. To understand a complex system through experimentation.

iv. To create a constructive learning platform in an education setting.

Additionally, studies have shown that the integration of computer games with learning did bring some benefits to the educational setting, such as enhancing student motivation and learning improvement. A study conducted by Whitehall et al. in 1993 and Ricci et al. in 1996 (as cited in Garris et al., 2002) found that computer game-based learning can lead to improved learning by enhancing student motivation which could lead to greater attention and retention. Furthermore, it is mentioned that many researchers have been working closely towards building a learning framework of computer games (Siang & Radha Krishna, 2003). Thus, using computer games for learning could significantly enhance the learners' level of learning (Kang & Tan, 2008). As mentioned by Paras and Bizzocchi (2005), games are able to provide an effective learning environment such as active experience and a capacity to provide intrinsic motivation.

The integration of technology with learning would be impossible without understanding its foundation. This refers to the theories of learning. Most prevailing theories about technology and learning come from the fields of behaviourism, cognitivism and constructivism.

## 2.10 Theories of Learning

There is no definitive definition of learning. Many psychologists, such as behaviourists, cognitivists and constructivists have their own definition of learning (Houston, 1985; Ormrod, 2008). Psychologists would prefer learning to be defined as a change in behaviour as a consequence of practice. Kimble (as cited in Houston, 1985) defined learning as 'a relatively permanent change in behaviour potentiality that occurs as a result of reinforced practice'. Learning has occurred when behaviour is changed. Ormrod (2008) cognitively defined learning as 'a long-term change in mental representations or associations as a result of experience'. The learning occurs when there is a change in the mental representations or associations due to experience. Contrastingly, Driscoll (as cited in Robinson, Molenda & Rezabek, 2008) has defined learning as "a persisting change in human performance or performance potential…as a result of the learner's experience and interaction with the world", which means that learning is believed to occur when people are socially communicating and working collaboratively with others.

Learning is a process which involves principle and theory. According to Ormrod (2008), principles could inform us of which factors are important for learning, whereas theories would inform us of why these factors are important. One basic principle of learning is reward or reinforcement. Learning is reinforced when people receives a positive reward as a result of their behaviour. On the other hand, learning is weakened when it involves a negative reward as a consequence of their behaviour. Rewards play an important role in the success of learning. Rewards could be perceived as internal or external rewards. Satisfaction is an example of an internal reward, whereas high grades would be an example of external rewards, to the learner.

While there are more than 100 theories that may be used to describe learning (Jonassen, 2006), and each of these theories has its own elements and vocabularies to describe the processes that are believed to be occurring within the learner (Robinson et al., 2008), three learning theories that are often being applied to the creation of instructional environments are behaviourism, cognitivism, and constructivism (Siemens, 2005).

According to Wild et al. (as cited in Deubel, 2003), incorporating a variety of learning theories is necessary when trying to integrate technology into teaching and learning. A study conducted by Ritchie and Baylor (1997), in their attempt to integrate technology and the constructive theory of learning in the classroom, has shown that there are difficulties in terms of gaining knowledge and skills. However, after combining three theories of learning, such as behaviourism, cognitivism and constructivism, the result has shown better learning compared to their previous attempt to integrate only one theory of learning into computer technology.

i. Behaviourism is focusing on behavioural change. It can be recognised or seen (Smith, 1999), focusing on the learning of tangible and observable behaviours and is associated with a body (Deubel, 2003), such as writing and walking (Ormrod, 2008).

ii. Cognitivism (also known as cognitive psychology) is focusing on the thought processes involved in human learning and generally associated with the study of the mind (Deubel, 2003), such as how people perceive, interpret and remember.

iii. The theory of constructivism is looking at how learners construct their own knowledge based on their previous learning and experiences. Problem-based learning and collaborative learning have been described as representations of the constructivist theory of learning (Robinson et al., 2008).

### 2.10.1 Behavioural Theory of Learning

The term behaviourism was first introduced by John Watson in 1913. He was the founder of the behaviourist movement (Richelle, 2001) and was interested in focusing scientific inquiry on observable behaviours rather than non-observable ones, i.e. thinking. He is an extreme environmentalist, who denied that hereditary factors had any effect on behaviour. His study was influenced by the work of Pavlov and Vladimir Bechterev in 1913 – Stimulus-Response (S-R) Habit.

As stated by Ormrod (2008), the behaviourist principles of learning are always described by the relationship between a stimulus (S) and a response (R) and, therefore, are sometimes called S-R psychology. According to the Oxford English Dictionary, a stimulus can be described as "any specific change in physical energy or an event (whether internal or external to the organism) which excites a nerve impulse and gives rise to a reaction", whereas a response is described as "an action or feeling caused by a stimulus or influence; a reaction". Stipek (2002) presented a good example to show the relationship between S-R, as follows.

> "A teacher standing in front of the classroom may cause students to pay attention if, in the past, students were rewarded for applying attention or punished for not paying attention when the teacher stood in front of the class. A change in the stimulus, such as a substitute teacher standing in front of the class, may not cue students to pay attention because these individuals were not previously associated with positive reinforcers or punishment".

Based on the example given by Stipek (2002) above, the stimulus and response are:

- Stimulus: Teacher standing in front of the class.

- Response: The attention paid by the students when a teacher stands in front of the class.

In 1890, William James defined habit not as an unthinking stimulus-response relationship, but rather as a behaviour that requires relatively little conscious control: "A strictly voluntary act has to be guided by idea, perception, and volition, throughout its whole course (as cited in Ormrod, 2008). In a habitual action, mere sensation is a sufficient guide, and the upper regions of brain and mind are set comparatively free". Watson adopted the classically conditioned S-R habit as the basic unit of learning and extended it to human learning, e.g. through a study with an infant named Albert. He proposed two laws describing how such habits develop; the law of frequency and the law of recency. These are as follows.

- The law of frequency stresses the importance of repetition.

- The law of recency emphasises the importance of timing.

#### 2.10.1.1 The Contiguity Theory of Behaviour

According to Case and Bereiter (1984), the foundation of behaviourist learning theory was that behaviours are learnt (become habitual) as a result of reinforcement. The continuity of reinforcement activities will help a person to learn. The contiguity theory was proposed by Edwin Guthrie in 1935 (as cited in Ormrod, 2008), and is similar to John Watson's perspective in that it placed S-R connections at the centre of the learning process. The implementation of contiguity theory, in the end, could form a habitual activity.

#### 2.10.1.2 The Organismic Characteristic of Behavioural Theory

Another aspect of behavioural theory that is worthy acknowledging is the introduction of the "organismic characteristic" by the work of Clark Hull in 1943 (as cited in Ormrod, 2008). The organismic characteristic, which Hull refers to as intervening

variables, consists of three factors. These are habit strength, the organism's drive and incentive.

- Habit strength examines the degree of association between the stimulus and response. The greater the response is being rewarded in the presence of the stimulus, the greater the strength of the habit, and the greater the chance that the response will occur.

- The organism's drive, on the other hand, is an internal state of arousal that motivates the behaviour of individuals.

- An incentive is a token or reward given to the individual, usually for their positive behaviour. According to Hull, these factors need to be considered in order to predict the likelihood and strength of a response's occurrence. Thus, Hull's ideas comprised an S-O-R theory, rather than an S-R theory of learning. Additionally, these organismic characteristics have created a general concept of motivation and incentive in learning research.

#### 2.10.1.3 Behavioural Theory and Computers as a Tool to Support Learning

The lack of balance between resources dedicated to education, the poor outcomes and the need for a more efficient method than those currently in use in the classroom has made the development of technology in education a reality. According to Deubel (2003), the early computer-based materials are seen to be influenced by behaviourist concepts, and the individual behind this innovation was Skinner in 1954 (Case et al., 1984; Richelle, 2001). Deubel (2003) further stated that the early technology innovation in teaching and learning was the "teaching machine".

A teaching machine is an old version of a technology-enhanced learning device, and is used to implement an instruction which was programmed in order to bring about changes in the learners' behaviour. This instruction was suggested by Skinner, who called it Programmed Instruction (PI) (Lockee, Larson, Burton & Moore, 2008).

According to Robinson et al. (2008), PI is a process of drill and practice or tutorial, and "it has a small unit of information followed by a question and the student's response. A correct response was confirmed, while an incorrect response might branch the learner to a remedial sequence or an easier question". PI provides an example of an instructional method that facilitates learning by utilising reinforcement and feedback, and teaching machines are used as a vehicle for facilitating this reinforcement process (Schuh & Barab, 2008).

As stated previously, the integration of the behavioural theory of learning and computers in education was begun with the introduction of the teaching machine and PI. Since then, many approaches have existed and evolved along with the advent of technology. These include Programmed Tutoring, Direct Instruction, Personalised System of Instruction (PSI) and Computer-Assisted Instruction (CAI) (Robinson et al., 2008).

Some of the general issues addressed by this implementation are looking at student achievement and attitudes. It was identified that the implementation of the teaching machine resulted in no significant differences compared to conventional classes. However, later studies have shown a positive result for students' attitudes towards the use of the teaching machine in education (as cited in Lockee et al., 2008). Other elements of interest when studying the effect of the teaching machine were: looking at the effectiveness of presenting the learning material in order or in a random manner and these studies has produced mixed results. Apart from that, a study conducted by Kulik et al. in 1979 (as cited in Lockee et al., 2008) on student achievement has identified a positive outcome, since the exam scores of the students are higher than those in exams for conventional classes.

Although the advantages of integrating the behavioural theory of learning and computers in education has had mixed results in terms of the students' performance, however, it is clearly stated that the effectiveness of a behavioural approach in instructional technology for higher-order learning and the transfer of learning is not yet proven (Deubel, 2003).

### 2.10.2 Cognitive Theory of Learning

The emergence of cognitive theory was in response to the belief that learning can occur without a change in behaviour. Some people would say that the appearance of cognitive theory was an extension of behavioural theory (Winn, 2004). The theory of cognitivism (also known as cognitive psychology) was influenced by the work of Jean Piaget and Lev Vygotsky, in the 1920s and 30s (Molenda, 2008). However, the impact of this theory only began when its translations were widely circulated in the 1960s, with the publication of Jerome Bruner's "The Process of Education" (Robinson et al., 2008) and the emergence of information-processing theory (an early learning theory in the cognitive perspective, Schuh et al., 2008), which lead to cognitive load theory (Molenda, 2008). Cognitive theory is concerned with meaning (Winn et al., as cited in Deubel, 2003), where learners use their memory and thought processes to generate strategies, and store and manipulate mental representations and ideas (Robinson et al., 2008).

#### 2.10.2.1 Information-Processing Theory

The idea of information-processing theory was proposed by Atkinson et al. in 1968 (as cited in Lohr & Gall, 2008). This is a theory which is based on three processes of memory: short-term memory (STM), working memory and long-term memory (LTM). Briefly, working memory is where information is processed and selected for STM and LTM. According to Lohr et al. (2008), the interaction of short-term and long-term memory is the focus of learning. She further explained that learning is dependent on the transfer of relevant information to the long-term memory and its retrieval when performance is required.

#### 2.10.2.2 Cognitive Load Theory

Another important theory of cognitivism that needs some elaboration is cognitive load theory. This theory was developed by John Sweller, while studying problem solving in 1988. The theory focuses on the limitation of the working memory, which is the core component of the information-processing theory (i.e. short-term, working and

long-term memory). According to Lohr et al. (2008), cognitive load refers to the amount of information presented and how well that amount of information compares with the size of the working memory, i.e. cognitive overload (a massive amount of information) will impair learning whereas cognitive underload (a small amount of information) does not generate interest.

#### 2.10.2.3 Cognitive Theory and Computers as a Tool to Support Learning

In relation to cognitive theory and computers, the focus is more on the aspect of the presentation of the learning, i.e. the organisation of the content. Most of the aspects which are of interest to researchers are audiovisual media, visual learning, auditory learning, and digital multimedia (Robinson et al., 2008).

### 2.10.3 Constructive Theory of Learning

The constructive theory of learning is concerned with how knowledge is constructed. Knowledge construction is a function of the person's experiences, mental structures and beliefs that an individual uses to interpret objects and events (Jonassen, 1991).

It is said that constructivism is derived from the cognitive theory of learning. According to Deubel (2003), the cognitive concept of learning is grouped into two trends, i.e. the individual cognitive trend and the sociocultural trend. She further explained that the individual cognitive trend is derived from Piaget's theory, where it emphasises the constructivist activity of individuals as they try to give meaning to their experiences. Piaget, described by Von Glasersfeld in 1989 as "the most prolific constructivist" (as cited in Schuh et al., 2008), was responsible for introducing the theory of assimilation and accommodation.

- Assimilation is a process by which individuals fit their objects and the events of their everyday experiences into their existing framework, structure or experiences.

- Accommodation, on the other hand, is a process by which individuals modify their existing framework, structure or experiences when experiencing a contradiction with objects and events that just do not fit.

The sociocultural trend, on the other hand, is derived from Vygotsky, where it emphasises the socially and culturally situated context of cognition. According to Vygotsky in 1978 (as cited in Schuh et al., 2008), learning takes place within the zone of proximal development. He defined this zone as "the distance between the actual developmental level of the learner and what he or she is capable of performing with the assistance of an adult or more capable peer" (as cited in Galloway, 2001). Knowledge is not developed in the individual but exists in the interactions between individuals.

Other researchers who shared similar views regarding this suggestion were Gijbels, van de Watering, Dochy and van den Bossche (2006). They listed two perspectives of constructivism. The first is the emphasis on individual cognitive processes, i.e. cognitive constructivism, which is related to the construction of knowledge by an individual. The second is the focus on the social constructions of knowledge, i.e. social constructivism, which is concerned with the construction of knowledge by collaborating with others.

As cited in Robinson et al. (2008), Deubel identified five principles of constructivism. These are as follows.

i. To embed learning in complex, realistic and relevant environments.

ii. To provide for social negotiation as an integral part of learning.

iii. To support multiple perspectives and the use of multiple modes of representation.

iv. To encourage ownership in learning.

v. To nurture self-awareness of the knowledge construction process.

According to Robinson et al. (2008), four types of instructional strategy (but not limited to these) derived from constructive principles are situated cognition, anchored instruction, problem-based learning, and collaborative learning.

- Situated cognition is a theory which emphasises the belief that all human thoughts are conceived within a specific context—a time, a place, and a social setting. An example is the classroom environment. (Robinson et al., 2008)

- Anchored instruction, on the other hand, was introduced by the Cognition and Technology Group at Vanderbilt (CGTV) in the 1990s as a strategy to incorporate the insights of situated cognition in classroom instruction (Robinson et al., 2008). It is referred to as "instruction in which the material to be learnt is presented in the context of a specific topic or anchor that serves to legitimise the material and further, allows it to be examined from multiple perspectives". (Barab & Dodge, 2008)

- Problem-based learning is an instructional strategy that allows students to learn by solving a problem. Students are expected to construct the knowledge and develop problem-solving skills, as well as having self-directed learning skills while working towards finding a solution to the problem (Hung, Jonnasen & Liu, 2008).

- Collaborative learning is described as an activity which involves a group of people working together to solve a common problem (Satwicz & Stevens, 2008). Computer-Supported Collaborative Learning (CSCL) is one of the computer-based technologies which come under the concept of collaborative learning (Robinson, et al., 2008).

#### 2.10.3.1 Constructive Theory and Computers as a Tool to Support Learning

In relation to constructivist theory and computer technology, the introduction of Alternate Reality Games (ARG) is one of the examples which integrate the

constructivist theory into the game. ARG, as cited in Dominik (2008), is defined as "cross-media genre of interactive fiction using multiple delivery and communications media". According to Dominik (2008), ARG "contains educational elements of multi-dimensional interaction, gaming, blending of online and face-to-face facilitation, situating learning within real world contexts and problem-based and case-based learning scenarios". Active engagement will occur among the players or learners. One of the ARG-type games is I Love Bees. This game is about a fictional drama set in the year 2552, where all the game characters were dependent on the players for their survival. In line with constructivist learning theory, learning occurs when the game players are able to solve the puzzle through discussion, which was an important source for the construction of new meaning and knowledge. Another study which was done by Sujo de Montes, Armfield and Blocher (2008), based on InQuizitor software, an educational video game developed by 3MRT, has shown that the use of the software has motivated students to engage in the practice of knowledge construction and collaboration.

### 2.10.4 Applying the Learning Theories

The integration of many theories within educational software is important in promoting students' learning performance. A suggested guideline for combining the theoretical perspectives was developed by Ertner et al. in 1993 (as cited in Robinson et al., 2008). Their suggestions are as follows.

- The behaviourist perspective can be employed in situations where learners have lower levels of task knowledge and for learning goals which require lower levels of cognitive processing.

- The cognitivist perspective, on the other hand, may be used when it involves intermediate levels of task knowledge and cognitive processing.

- As for the constructivist perspective, one could consider a situation in which learners have a higher level of prior knowledge and are working on higher level tasks, such as problem solving.

In relation to computer games and the theories of learning, Siang and Radha Krishna (2003) divided this integration into three categories. First, the behavioural theory of learning involves the needs of sensorimotor and eye-hand coordination skills. Examples of games genres are action games, fighting games and sports games. Second, the integration of the cognitive theory of learning usually involves internal mental processing. The learners will use their internal mental processing in order to play the games. This processing model, known as memory processing, and proposed by Atkinson and Shiffin in 1968, described how information is processed, stored and retrieved in the mind. Examples of the games genres are adventure games, strategy games and all forms of puzzle games. Third, the integration of the constructive theory of learning involves players in constructing their own learning based on their past experiences. As a result, a player is learning by doing and making mistakes.

Furthermore, Siang and Radha Krishna (2003) show the processes involved and how this integration is applied. Based on their statements, most of the initial learning in computer games is behavioural learning. Players will learn by trial and error. In addition, when the basic rules of the game are understood, players start to think cognitively about how they should respond in a new situation and actively update their existing knowledge to fit what is newly confronted in the game's environment.

## 2.11 Avatars and Motivation

In an educational setting, it is argued that avatars can provide motivation for students, such as in giving feedback or instruction (Wang, Chignell & Ishizuka, 2007). This motivation approach has allowed avatars to play the role of tutors. Mendez, Burden and de Freitas (2008) stated that the use of avatars in Computer-Aided Instruction (CAI) has been shown to be intrinsically motivating where it helps the learner to achieve higher degrees of learning. Mendez et al. (2008) further stated that an "avatar also possess its own motivation, which will be to teach, guide and motivate the learner. As such, the avatar can be thought of as teacher with motivational coaching capability". In a study conducted by Samsonov and McCartney (2011), avatars were integrated into teachers teaching materials such as in a PowerPoint slide. Their study has suggested that the use of avatars in the classroom has a good potential to become

motivator to students to learn. Moreover, all the participants were expressed their willingness to use the avatars into their teaching materials in the future.

Additionally, motivation also occurs based on an avatar itself, by looking at the way in which it is being presented and embellished. As suggested by Kellar, Watters and Duffy (2005), the users of avatars should have the ability to personalise the behaviour and appearance of their characters. A study done by Kao, Galas and Kafai (2005) has shown that students who are able to personalise their avatars are believed to have more enjoyment in comparison to other students who were presented with ready-made ones.

Several studies have identified the reasons why users, especially teenagers (Lee & Shin, 2004), are motivated to have an avatar as a representative character of themselves in a virtual environment. Lee (2003) and Lee and Shin (2004) stated that an avatar is used to represent the user in the online environment as their self-possession, whereas Boberg Piippo and Ollila (2008) added that having an avatar will allow the user to act, to express and to build a reputation among other avatars. An exploratory study on avatar use in games by Jang, Kim, and Ryu (2010) has shown that, when players feel their avatars has their identity, this will contribute to a better performance in gaming.

## 2.12 The Theory of Motivation

The word motivation was not used until the beginning of the 20th century (Hilgard, Atkinson & Atkinson, 1979). According to Harlen and Deakin-Crick (2003), motivation is a complex concept to understand. It is "closely aligned with 'the will to learn' and encompassing self-esteem, self-efficacy, effort, self-regulation, locus of control and goals orientation". Motivation theory is concerned with the processes that explain why and how human behaviour is activated.

Motivation can be defined as "the forces acting on or within a person that cause the arousal, direction and persistence of goal-directed, voluntary effort" (Reference for Business (n.d.). Mitchel (1982) defined motivation as "the psychological processes that cause the arousal, direction and persistence of behaviour". Similarly, Ormrod (2008) defined motivation as "an internal state that arouses us to action, pushes us in particular directions and keeps us engaged in certain activities".

Ryan & Deci (2000a), on the other hand, divided motivation into two types: motivated and unmotivated individuals. A motivated individual is a person who is energised or activated towards a goal, whereas an unmotivated individual is a person who feels no inspiration to act to fulfil a goal.

Many motivation theories can be found in text books or journals across a variety of disciplines, such as psychology, education, business, and management. Basically, motivation can be categorised into two types: intrinsic motivation and extrinsic motivation.

### 2.12.1 Intrinsic Motivation

According to Ryan and Deci (2000a), intrinsic motivation refers to a person who is inherently doing something due to an interest in and enjoyment of the task, rather than because of external encouragement, pressure or reward. People are doing something for its own purpose and for the enjoyment of the task itself (Hennessey & Amabile, 2005; Lin, McKeachie & Kim, 2001). It exists within the individual itself (Ormrod, 2008).

Csikszentmihalyi, in 1997 (as cited in Hennessey & Amabile, 2005), highlighted that the highest level of intrinsic motivation is achieved when the person has reached optimal experience or 'flow'. Flow can be described as when the combination of fun and learning become so entangled that, at times, the students are unaware that they are learning (Tuzun, 2003). Dipietro et al. (2007), on the other hand, refer to flow as producing a feeling of immersion which results in increased motivation to continue playing. Kang and Tan (2008) refer to it as "mental processes that are fully absorbed in a task, characterised by personal experiences of concentration, energy and success".

As stated by Medina (2005), the intrinsic motivation theory has frequently been used by researchers to study computer games and learning. Kang and Tan (2008) reported in their study that a computer game significantly increases the students' intrinsic motivation. A study done by Sprague, Lambert, Berry and Siochi (2006) in 2000 has shown that computer games intrinsically motivate students to learn. Their study is focusing on the educational areas of Maths, Social Science and General Studies.

Although some studies have reported that students were intrinsically motivated when learning with computer games, there is a study that contradicts this result. A study conducted by Amory, Naicker, Vincent and Adams (1998) has found that some students were not intrinsically motivated when learning with computer games (however, the rest of the students in the study was reported to be intrinsically motivated). They argued that playing with computer games was one of the course requirements and not by choice. The event (to play computer games) was not voluntarily conducted. Thus, this argument was in line with how intrinsic motivation has been described. A person will become intrinsically motivated when the behaviour is driven by their own volition rather than external forces (Garris et al., 2002). As Okan (2003) mentioned in his article, to be able to achieve intrinsic motivation among students, they should engage in activities that they have an interest in, and from which they take pleasure and satisfaction.

Ryan and Deci (2008) have developed an instrument called the Intrinsic Motivation Inventory (IMI) for assessing the participants' intrinsic motivation related to an activity specifically in laboratory experiments. This instrument assesses various types of element that could contribute to intrinsic motivation. These are interest/enjoyment, effort/important and value/usefulness.

#### 2.12.1.1 Interest/Enjoyment

Interest is defined by Joseph and Nacu (2003) as "a specific kind of motivation having to do with an attraction to the specific content or processes involved in an activity", whereas Izard (1993) defined it as "the most basic and ubiquitous of universal motivating emotion for humans". Interest is an important form of intrinsic motivation. Based on the research done on motivation, it has shown that interest could lead to increased engagement, attention, and learning. In addition, it is specifically important to deep learning. However, the level of the strength of interest could be reduced by the difficulty of, as well as the length of time spent on the activity.

There are two type of interest; personal interest and situational interest.

- According to Alexander, Murphy, Woods, Duhon and Parker (1997), individual interest has been reported as playing a major role in intrinsic

motivation. The similarity between individual interest and intrinsic motivation is that they both create and hold a deepening involvement with content and effect over time (Bye, Pushkar & Conway, 2007).

- Situational interest, on the other hand, as mentioned by Hidi (2000), corresponds to extrinsic motivation where external stimuli are present.

In summary, situational interest is considered to incline towards a temporary basis, whereas individual interest is considered to be relatively stable and long lasting (Bye, et al., 2007).

Enjoyment, on the other hand, is defined in Oxford English Dictionary as "something which gives pleasure". In the context of this research, enjoyment is described as a condition where students feel that their learning experiences was pleasurable to them (Gomez, Wu and Passerini, 2010). Turkay and Adinolf (2010) suggested that, in entertainment, enjoyment is one of the most important motivation factors to engage game-players to play games. Thorsteinsen (2009) explained that enjoyment "has a function of rewarding by building attachments to familiar things and attaining goals". Thorsteinsen (2009) further explained that the meaning of interest and enjoyment sometimes are overlapping. As supported by Izard (1977), "a feeling of interest can cause a feeling of enjoyment."

#### 2.12.1.2 Effort/Important

Important is defined by Oxford English Dictionary as "having much import or significance, carrying with it great or serious consequences." In the context of this research, important is described as giving more attention to one activity than others. Effort, on the other hand, is defined as an attempt of physical or mental power where it is "often used for any kind of achievement or result of activity" (Oxford English Dictionary). In the context of this research, Boekaerts (2002) described effort as "an intentional act that increases commitment to a task, such as increasing attention, concentration and the amount of time spent on a task or by doing specific activities, such as rehearsal and re-reading". Additionally, Lakhani and Wolf (2005) defined effort as "the number of hours per week spent on a project".

Effort has played an important role in motivation theory, such as having a state of flow in intrinsic motivation. A state of flow occurs when enjoyment is maximised while doing the activity, regardless of the outcome. A person tends to flow themselves into an activity that they are interested in, and exert more effort to achieve it. An interview done by Csikszentmihalyi in 1975 has shown the situation where flow occurs with rock-climbers, chess players, basketball players and dancers. The result of the interview has shown the high level of effort devoted to their chosen activity (Waterman, 2005).

Waterman (2005) categorised effort into two types of activities: high effort-like activities and low effort-like activities. These types of effort activity are briefly described as follows.

*High effort-like activities*: involves activities such as athletics, dance and work.

*Low effort-like activities*: consists of activities such as watching TV, social activities, reading and shopping.

A study done on high effort-like in comparison to low effort-like activities showed that the former were "associated with greater interest, flow and feelings of personal expressiveness, greater perceived competence and higher scores for both self-realisation values and importance" (Waterman, 2005).

#### 2.12.1.3 Value/Usefulness

Usefulness is defined in Oxford English Dictionary as "the state or condition of being useful or serviceable." In the context of this research, usefulness is described as a condition which is perceived as useful when trying to achieve a set objective. Value, on the other hand, can be defined as "the relative status of a thing, or the estimate in which it is held, according to its real or supposed worth, usefulness, or importance" (Oxford English Dictionary). People tend to be motivated when one goal is valuable and important to achieve and, vice versa, when one is not valuable and unimportant. Thus the relationship between motivation and value is influenced by how one perceives the value of one activity or goal to themselves.

Rokeach (1973) categorised the concept of value into two categories. These are as follows.

> *The value of an object*: The value of an object can be separated into two types – economic and emotional. The economic value refers to the worthiness of an object to be exchanged. The emotional value, on the other hand, refers to the expression of feelings about the object. In the context of this research, the latter type of value is chosen.
>
> *The value as criterion*: This value refers to a personal value given by a person to an object. Rokeach (1973) described this type of value as "an enduring belief that a specific mode of conduct or end-state of existence is personally or socially preferable to an opposite or converse mode of conduct or end-state of existence".

Vinson, Scott and Lamont (1977) explained that certain values will be gained through experiences in specific situations which result in behaviour that can only be understood within the context of that environment.

### 2.12.2 Extrinsic Motivation

According to Lin et al. (2001), extrinsic motivation is motivation which is directed by rewards or punishments and depends on the success or failure of the given task. One example is grades. Hennessey and Amabile (2005), on the other hand, take a broad view of this definition. Their definition of extrinsic motivation is to do something in order to fulfil some external objective. It includes compliance, recognition, grades and rewards (Covington et al., 2001, as cited in Okan, 2003). The source of motivation lies outside the person itself (Ormrod, 2008).

Ryan et al. (2000a and 2000b) have illustrated the taxonomy of human motivation where the source of the extrinsic motivation comes under four regulations. These four regulations have been categorised into external and internal categories. The regulation which comes under the external category is external regulation and introjection

regulation, whereas identification regulation and integration regulation both come under the internal category. These regulations are described as follows.

- *An external regulation* refers to an external source of motivation, such as pride and rewards.

- *An introjection regulation* is where a person fulfils his/her self-esteem, such as a feeling of worth and pride.

- *Identification* is more towards the internal side of a person itself. A person is extrinsically motivated when s/he acknowledges the importance of the activity s/he pursues, such as doing extra work on a programming language because s/he believes the importance of success in that subject.

- *Integrated regulation* is where one person can integrate the important of two sources of motivation, which is usually occurring within the identification regulation.

A person is extrinsically motivated due to his/her ability to examine the values and needs of his/her motivation. Although the source of extrinsic motivation (identification and integration) is very similar to intrinsic motivation, it differs, however, based on the motive behind the activity conducted. An activity which is done due to interest and enjoyment is an example of intrinsic motivation, whereas an activity which is due to the ambitions of one person is an example of extrinsic motivation. Figure 2.1 below presents a summary of the taxonomy of human motivation.

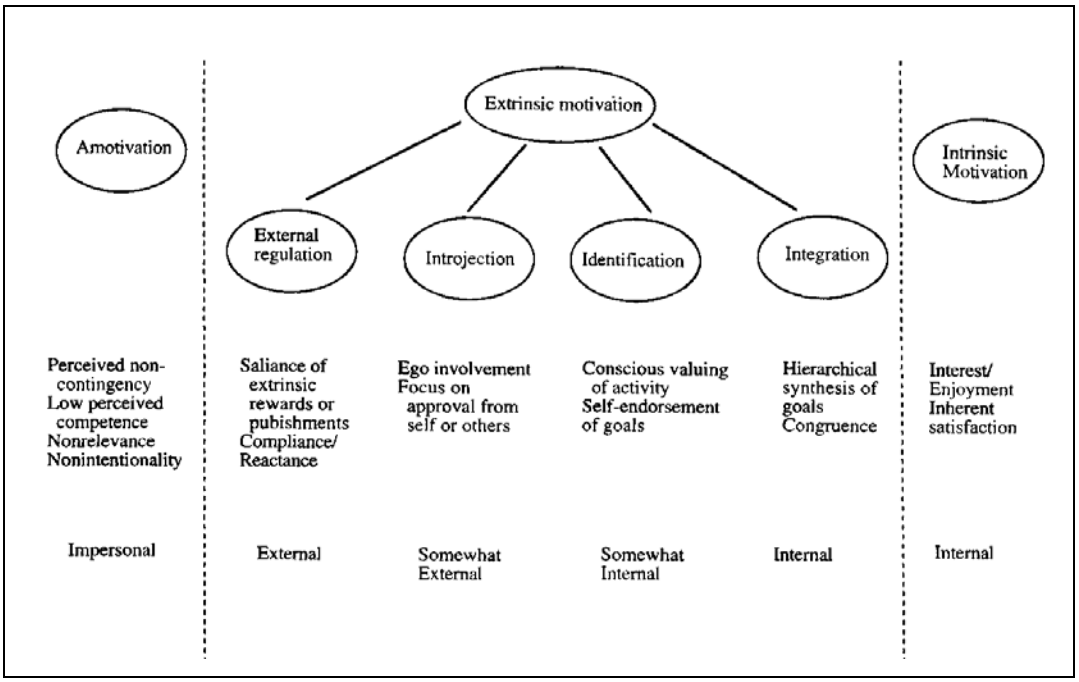


Figure 2.1: Taxonomy of Human Motivation (Ryan et al., 2000a and 2000b)

There were studies conducted regarding extrinsic motivation. The studies were looking at what motivates students to learn through computer games. Some studies were looking at their effects on students' performance. A study done by Lim, Nonis and Hedberg (2006) has resulted that the external factors of computer games such as 3D environments, the freedom to move around and interactivity, is what motivates students to learn.

### 2.12.3 Computer Games and Motivation

Although there are many factors which describe the relationship between computer games and motivation, however, these factors could be grouped into three categories. Malone (1981) has listed three factors underlining why computer games are motivating. These are curiosity, fantasy and challenge.

#### 2.12.3.1 Curiosity

Curiosity could be defined as a state in which one person has "a strong desire to know or learn something" (Oxford English Dictionary). In the context of this research,

curiosity can be described as follows. Malone (1981) described curiosity as a situation where it should be ‘novel’ and ‘surprising’. He further categorised curiosity into two types: sensory curiosity and cognitive curiosity.

Malone (1981) explained that sensory curiosity involves the attention of a person’s sensory system, such as the eye (light), ear (sound), and so on, towards an environment. This sensory system could easily be provided by the use of computer multimedia elements, such as graphics, animation and music, for the purpose of decoration, to enhance fantasy and as a reward.

Cognitive curiosity, on the other hand, involves the prospect of modifying a person’s level of cognitive structures. Malone (1981) claimed that there are three characteristics for defining cognitive structures. These are completeness, consistency and parsimony. He described that curiosity could be established when the information is incomplete, inconsistent or inaccurate. A person is expected to motivate to learn in order to make the information complete and produce better cognitive structures.

#### 2.12.3.2 Fantasy

The Oxford English Dictionary defined fantasy as a form of imagination that involves “the process or the faculty of forming mental representations of things not actually present”. In the context of this research, fantasy can be described as follows. Pivec and Dziabenko (2004) described fantasy as a “scenario and the virtual world in which the activity is embedded”. They further stated that fantasy could lead to the greater interest of one person. Additionally, Malone (1981) defined fantasy as a mental image of physical objects or social situations which may or may not be likely to occur in the learner’s environment.

#### 2.12.3.3 Challenge

The Oxford English Dictionary defined challenge as “a difficult or demanding task, especially one seen as a test of one's abilities or character”. In the context of this research, challenge can be described as follows. Pivec and Dziabenko (2004) stated that challenge is provided within each appropriate level of difficulty. They further explained that the player (in computer games) will lost interest in playing them if the

level of difficulty is too low or too high. Malone (1981) commented that some researchers have noted that, for a situation to be challenging, it must provide goals, where the process of achieving goals is uncertain.

Yee, Ellis and Ducheneaut (2008) believe that avatars are a mechanism that can prevent players from moving forward throughout the game. They also believed that this is the way to provide challenges for the players, by keeping them from achieving the game's goals easily. They have suggested that this scenario is applicable to online role-playing games which require a significant period of commitment.

> "Players often have to walk a significant distance from point A to point B to complete a quest. If players could complete task instantaneously, there would be no game. This is why online games can't run through dungeon walls, why they have to accumulate virtual gold for several weeks by killing hundreds of monsters before they can buy a horse that lets them move only 60% faster."
>
> Yee, Ellis and Ducheneaut (2008)

### 2.12.4 Section Summary

Studies have shown that many factors contribute to student motivation towards learning, such as curiosity, fantasy, and challenge, when involve motivation and computer games. In computer games, a game player will slowly learn how to solve the puzzle while playing the game. Their success in solving the puzzle has encouraged the game player to move forward to the next possible task. The motivation to continue playing the game has been influenced by the curiosity, fantasy and challenge (Malone, 1981) that the game has to offer. As stated by Foster (2008), allowing the game players to be involved in the game activities has made them discover the importance and value it offers to the learning process.

## 2.13 Motivation to Learn

Stipek (2002) stated that "motivation is relevant to learning because learning is an active process requiring conscious and deliberate activity". Boekaerts (2002) has listed a few principles behind the motivation to learn. These are as follows.

i. *Motivational belief*. Boekaerts (2002) described motivational belief as "a reference that guides students' thinking, feelings and actions in a subject area".

ii. *Unfavourable motivational beliefs prevent learning from occurring*. Students are not motivated to learn when they are failing.

iii. *Favourable motivational beliefs facilitate learning*. Students who are intrinsically motivated to learn are more independent and less attracted to rewards and incentives. They are more interested in learning something in which they are competent.

iv. *Different beliefs about effect affect learning intentions*. Under this principle, students are expecting value for the effort they put into their learning, such as allocating how much effort to devote to a learning task based on their ability.

v. *Keeping multiple goals in harmony*. Students are more committed to learning if the objective of learning is connected to their own goals.

The motivation to learn is not an easy task. It needs effort and passion. Creativity in learning tasks can encourage students' interest in learning. The availability of motivation to learn principles, as listed by Boekaerts (2002) above, has shown the importance of motivation to learn. The opportunity to offer an avatar alongside the student's learning activities is one of the ways to enhance the motivation to learn.

Wolters (1999) in his paper on motivation and classroom performance mentioned that students are more inclined to have an interest to learn due to encouragement from external rewards than from internal encouragement such as interest. Pursuant to this, he explained that this phenomenon occurred because the students are more familiar with this type of encouragement. A study done by Newby (1991) has shown that teachers are using extrinsic rewards as their primary method for motivating students.

## 2.14 Chapter Summary

This review of the literature comprises an introduction to avatars, and their relationship with computer games, learning and motivation. The reviews went on to explain the theories of learning and motivation. The methodology of how this research was conducted will be discussed in the next chapter.

# Chapter 3

# Methodology

## 3.1 Introduction

This chapter will discuss the methodology adopted for this research. It includes an overview of the research design, sampling, research instruments, procedures, and the data analysis framework.

## 3.2 Research Design

This research is a quantitative study based on an experimental design. As mentioned by Ross and Morrison (2007), an experimental design is used to “test hypotheses regarding causation, for example, that a particular instructional strategy leads to better student performance”. It involves quasi-experiments (Frey, 2006; Creswell, 2009) based on non-random sampling with two types of participant, a control group and a treatment group.

In regards to this research, two types of experiments have been implemented. These experiments were named Experiment 1 and Experiment 2.

## 3.3 Population

The population of this research is students in Universiti Malaysia Sarawak (UNIMAS), one of the public universities in Malaysia. The extensive usage of Information and Communication Technology (ICT) facilities in its teaching and learning has made UNIMAS a suitable location for this experiment. A previous study noted, "In UNIMAS, students are encouraged to internalise the use of technology in their campus activities through the provision of up-to-date computer facilities and generic information technology courses, which are compulsory for all students. Lecturers are also encouraged to use ICT and in particular, the Internet, in their instructional activities" (Hong, Ridzuan and Kuek, 2003).

## 3.4 Participants

This section will discuss the participants in these experiments. This discussion covers sampling type and criteria, the sample grouping process, and participants' details.

### 3.4.1 Sampling Type

The type of sampling used in this research is convenience sampling. It is a non-probability and non-random sampling method. As stated by Creswell (2009), convenience sampling is the method often used in quasi-experiments due to its "natural formed groups (e.g., a classroom, an organisation, a family unit) or volunteers."

Pursuant to the decision to use convenience sampling, two groups of undergraduate students were selected. These are described in Section 3.4.2 and Section 3.4.3.

### 3.4.2 Participants in Experiment 1

There were 71 participants in this experiment. All were undergraduate students in the Department of Cognitive Science, Faculty of Cognitive Science and Human

Development, who were registered for the course module IT for Knowledge Worker, coded TMX2012. There is no relationship between the students and the researcher.

These students were divided into three groups; labelled Treatment 1, Treatment 2 and Control. Students assigned to the Treatment 1 group will have a human character avatar, whereas students in the Treatment 2 group will have a text avatar, and students in the Control group will not have any kind of avatar. Table 3.1 gives a brief summary of these groups.

| Group | Number of Students | Type of Avatar |
|---|---|---|
| Treatment 1 | 24 | Human Character |
| Treatment 2 | 24 | Text |
| Control | 23 | None |
| **Total Students** | **71** | |

Table 3.1: Summary of Participants in Experiment 1

### 3.4.3 Participants in Experiment 2

A total of 110 undergraduate students in the Department of Human Resource Development, Faculty of Cognitive Science and Human Development registered for the course module Personality Development, coded KMC1093. It was hoped that all would participate in this research and make up three groups, each with 35 students. However, only 45 students participated in this experiment. Again, there is no relationship between the students and the researcher.

These students were divided into two groups, labelled Treatment 1 and Treatment 2. As in Experiment 1, students assigned to the Treatment 1 group will have a human character avatar, and students in the Treatment 2 group will have a text avatar. Table 3.2 summarises the groups for Experiment 2.

| Group | Number of Students | Type of Avatar |
|---|---|---|
| Treatment 1 | 35 | Human Character |
| Treatment 2 | 10 | Text |
| **Total Students** | **45** | |

Table 3.2: Summary of Participants in Experiment 2

Table 3.2 shows that there were two groups of students involved in this study. First, is the treatment 1 group which has 35 students, and second, is the treatment 2 group which has 10 students. In this table, there was no control group involved, as compared to 'Participants in Experiment 1'. This is because at the time of registration, there were only 45 students attended the course for the first time.

### 3.4.4 Sampling Criteria

The selection of participants was based on two factors, as follows.

Firstly, the application to conduct these experiments at the Faculty of Cognitive Science and Human Development was approved by the Dean of the Faculty, and he give his full support to the use of any facility required. Therefore, a computer lab was booked for the whole semester for the purpose of these experiments.

Secondly, all the participating students had studied the module End User Computing (Code TMX1010), so they understood how information technology can be used for activities such as document preparation, spreadsheets, databases, graphics and electronic mail, and they all had experience of using common computer hardware. This knowledge was being extended by studying the module IT for Knowledge Worker (Code TMX2012) while this research was being conducted. Both of these courses are taught through hands-on learning, in order to enhance students' understanding of computing.

### 3.4.5 How Participants were divided into Groups

As reported in Section 3.4.2 and Section 3.4.3, participants were divided into groups. Students were required to register in order to participate in these experiments and the registration system allocated them to groups randomly on a sequential basis. Each group had its own maximum quota and, when that was reached, the system allocated the next registered student to the next available group.

The registration process was conducted at the same time for all the students who were attended both courses. During the course, students were given less than 10 minutes to do the registration, and this process was done almost at the same time for

all the students. This was done to avoid any assumption that students who are keen to participate will influence their motivation to the variable in this study, namely motivation to view an avatar and motivation to learn.

This allocation process is illustrated in Figure 3.1 and it applied to both Experiment 1 and Experiment 2.

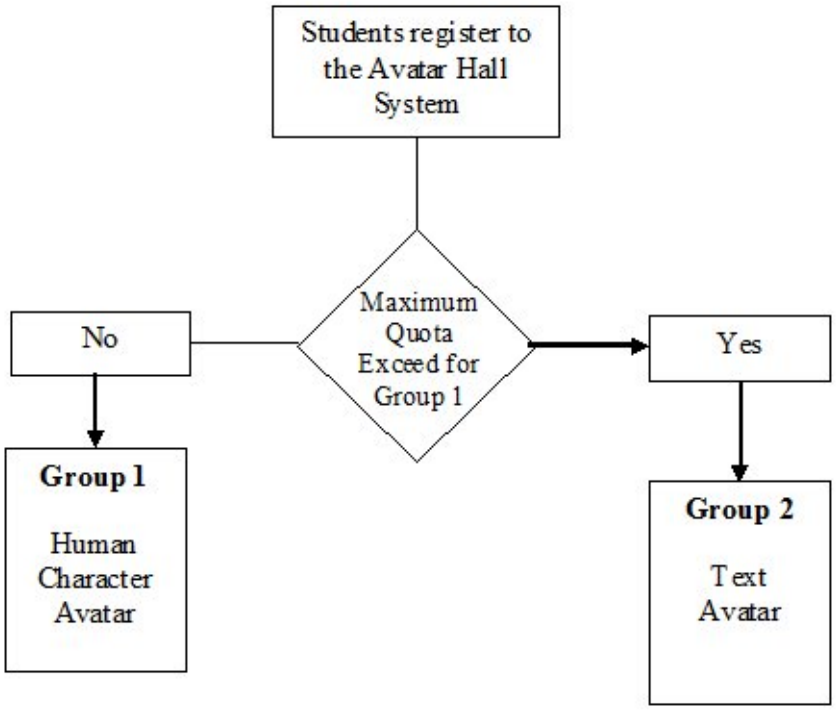


Figure 3.1: Group Selection System Diagram

## 3.5 Research Instruments

There were two types of instruments used in this research: an avatar environment and a questionnaire.

### 3.5.1 An Avatar Environment

An avatar environment, the Avatar Hall, was developed and used by students in Treatment 1 and Treatment 2. The Attribute-based Environment (AbE) was assigned

to Treatment 1, whereas the Ranking-based Environment (RbE) was assigned to Treatment 2.

The development of the avatar environment was based on three elements:

- Attribute-based Environment (AbE) - to provide each student with a human character avatar and avatar attributes (such as clothing, trousers, etc.).

- Ranking-based Environment (RbE) – to provide each student with a text avatar. It was used to show the position of each student's avatar name on a ranking board.

- Data on usage of the Avatar Environment for both AbE and RbE – to gather information on students' usage of the avatar environment through an automatic tracking feature and to keep the data for each student in the system's database.

### 3.5.2 Questionnaire

The second research instrument used in this research was a questionnaire. This questionnaire is divided into three categories: demography, motivation inventory, and open-ended question. The demography section is about participant's age, gender, usage of internet and etc. The motivation inventory, on the other hand, is a modified motivation inventory originally developed by Ryan and Deci (2008). This motivation inventory, called Intrinsic Motivation Inventory (IMI) has been used in several experiments related to intrinsic motivation, such as in a computer-related task (Deci, Eghrari, Patrick, & Leone, 1994), sport (McAuley, Duncan, & Tammen, 1989) and computer games development (Wan Ali, Eow, Mahmud & Baki, 2011).

Ryan and Deci (2008) used many subscales of motivation but three were selected for this research. These subscales are Interest/Enjoyment, Effort/Important, and Value/Usefulness. The IMI was divided into four sections: students' perception of motivation to learn, students' perception of motivation to view an avatar, students' perception of motivation to personalise an avatar, and students' perception of motivation to access an avatar environment (see Appendix 3.0 for Questionnaire).

The measurement scale used in the IMI was based on an ordinal measurement - a 5-point Likert scale of agreement. As stated by Dawes (2007), the 5-point Likert scale is the most commonly used scale in any research and its reliability and validity are better than scales that use fewer points. The scale used in this research was as follows.

1 = Strongly Disagree
2 = Disagree
3 = Neutral or Undecided
4 = Agree
5 = Strongly Agree

An open-ended question is given to ask the participants about their opinion towards having an avatar alongside their learning activity.

#### 3.5.2.1 Purpose and Design of Questionnaire

The main purpose of distributing the questionnaire to all the participants in this research was to gather data that would enable answers to be given to all the research questions listed in Section 1.3.4. Its overall design is visualised in Figure 3.2.

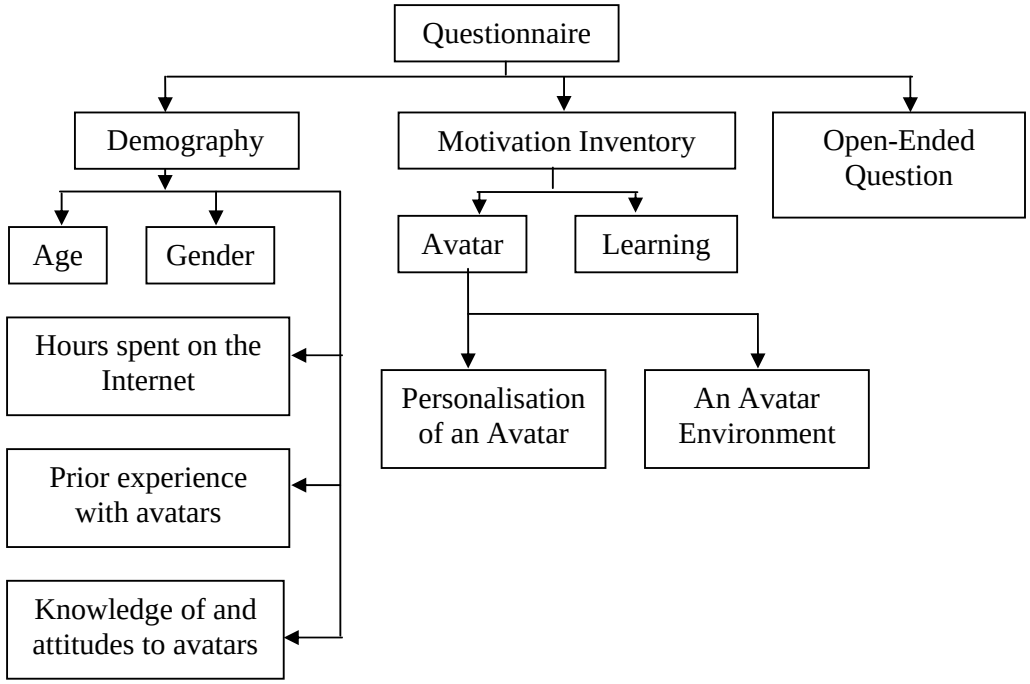


Figure 3.2: The Layout of Questionnaire

Figure 3.2 shows that the questionnaire had three main categories, demography, motivation inventory, and open-ended question. The demography section collected data from the participants about their age, gender, hours spent on the internet, prior experience with avatars, and knowledge of and attitudes to avatars. The motivation inventory section asked participants about four issues related to their motivation. These issues are motivation to learn, motivation to view an avatar, motivation to personalise an avatar, and motivation to access an avatar environment; each issue was addressed by a separate section in the questionnaire. As Figure 3.2 shows, the main objectives of this questionnaire were to identify participants' motivation to view an avatar and their motivation to learn. An open-ended question is given in order to gather participants' opinion towards having an avatar in their learning activity.

The following sections present the questions in the demography section, the motivation inventory sections, and an open-ended question sections.

### 3.5.2.2 Demography

In this section, students were asked about their age, gender, hours spent on the internet, prior experience with avatars, and knowledge of and attitudes to avatars.

### 3.5.2.3 Students' Perception of Motivation to Learn

*This section was designed to answer RQ1: Are students motivated to learn when an avatar is applied in a conventional learning environment?*

Table 3.3 lists the questions in this section.

| No. | Items | Motivation Subscales |
|---|---|---|
| 1. | I enjoyed studying this course. | Interest/Enjoyment |
| 2. | This course was fun. | |
| 3. | I would describe this course as very interesting. | |
| 4. | I put a lot of effort into this course. | Effort/Important |
| 5. | I tried harder on this course. | |
| 6. | It was important to me to do well on this course. | |
| 7. | I believe this course could be of some value to me. | Value/Usefulness |
| 8. | I think this is an important course to me. | |
| 9. | I believe attending this course could be beneficial to me. | |

Table 3.3: Questions on Students' Perception of Motivation to Learn

In Table 3.3, all the questions are categorised into three subscales of motivation, namely, interest/enjoyment, effort/important, and value/usefulness. These subscales are used to describe how students perceived their motivation to learn.

### 3.5.2.4 Students' Perception of Motivation to view an Avatar

*This section was designed to answer RQ2: Are students motivated to view their avatar when an avatar is applied in a conventional learning environment?*

Table 3.4 lists the questions in this section.

| No. | Items | Variable |
|---|---|---|
| 1. | I like my avatar. | Interest/Enjoyment |
| 2. | Having an avatar was fun. | |
| 3. | I would describe an avatar as very interesting. | |
| 4. | I put a lot of effort into my avatar. | Effort/Important |
| 5. | I tried very hard to have a good avatar. | |
| 6. | It was important to me to have an avatar. | |
| 7. | I believe an avatar could be of some value to me. | Value/Usefulness |
| 8. | I think an avatar could help me to describe myself. | |
| 9. | I believe having an avatar could be beneficial to me. | |

Table 3.4: Questions on Students' Perception of Motivation to view an Avatar

### 3.5.2.5 Students' Perception of Motivation to Personalise an Avatar

*This section was designed to answer RQ3: Are students motivated to personalise their avatar?*

Table 3.5 lists the questions in this section.

| No. | Items | Variable |
|---|---|---|
| 1. | I enjoyed personalising my avatar. | Interest/Enjoyment |
| 2. | Personalising my avatar was fun. | |
| 3. | I would describe personalising my avatar as very interesting. | |
| 4. | I put a lot of effort into personalising my avatar. | Effort/Important |
| 5. | I tried very hard to personalise my avatar. | |
| 6. | It was important to me to personalise my avatar. | |
| 7. | I believe personalising an avatar could be useful to me. | Value/Usefulness |
| 8. | I think personalising an avatar is an important activity to me. | |
| 9. | I think personalising my avatar is useful to compare my avatar with other avatars. | |

Table 3.5: Questions on Students' Perception of Motivation to Personalise an Avatar

### 3.5.2.6 Students' Perception of Motivation to access an Avatar Environment

*This section was designed to answer RQ4: Are students motivated to access an avatar environment, the Avatar Hall using the Attribute-based Environment and the Ranking-based Environment?*

Table 3.6 lists the questions in this section.

| No. | Items | Variable |
|---|---|---|
| 1. | I enjoyed browsing the Avatar Hall. | Interest/Enjoyment |
| 2. | Browsing the Avatar Hall was fun. | |
| 3. | I would describe the Avatar Hall as very interesting. | |
| 4. | The implementation of the Avatar Hall is practicable. | Effort/Important |
| 5. | The Avatar Hall is fit for purpose. | |
| 6. | It was important to me to have the Avatar Hall. | |
| 7. | I believe the Avatar Hall could be of some value to me. | Value/Usefulness |
| 8. | I believe the 'Hall of Fame' concept is very useful for its purposes. | |
| 9. | I believe extending the concept of the Avatar Hall to other courses would be useful. | |

Table 3.6: Questions on Students' Perception of Motivation to access an Avatar Environment

### 3.5.2.7 Open-Ended Question

In this section, students were asked about their opinion towards having an avatar in their learning activity. This question is as follows.

| | |
|---|---|
| 1. | What is your opinion towards having an avatar alongside learning activity? |

Table 3.7: An Open-ended Question

## 3.6 Research Procedure

This section presents some procedures that were undertaken in the process of conducting this research. This section is divided into five subsections and these are described in Table 3.7.

| Phases | Activity | |
|---|---|---|
| 1 | Ethical Approval Procedure | |
| 2 | Activity 1 | Designing and Developing an Avatar and an Avatar Environment |
| | Activity 2 | Designing a Questionnaire |
| 3 | Implementation of Pilot Testing | |
| 4 | Implementation of Experiments | |
| 5 | Distribution of Questionnaire | |

Table 3.7: Five Phases of Research Procedure

### 3.6.1 Phase 1: Ethical Approval Procedure

All research studies should consider the ethical implications of their work. According to Harris (2008), ethics approval is required in order to look after the welfare, rights and dignity of the participants. He added that ethical principles include:

- The way in which people are approached and encouraged to take part in the research.
- Explaining the purpose of the research to participants.
- Deciding how the researcher will respond to potential participants who refuse to take part in the research.
- Confirming the confidentiality of the data gathered from the participants.

Many organisations, such as universities, have adopted ethical principles that must be followed by all its researchers. For this research, approval was obtained from the

Ethics Committee of the Department of Computer Science, Durham University. The Ethics Form is shown in Appendix 3.1. The research could not begin until this approval had been given.

> "All undergraduate, postgraduate or staff proposals for university work which involves human participation and/or gives rise to ethical issues must be assessed for ethics approval, whether it is for teaching, learning-related or research purposes"
>
> (Computer Science, Durham University)

Harris (2008) also stated that the most important feature of research ethics is informed consent. Informed consent require that the participants know enough about the research to enable them to make a decision about whether or not to participate. Appendix 3.2 shows the Consent Letter that was given to potential participants before the experiments began.

### 3.6.2 Phase 2: Design and Development

The design and the development of an avatar and its environment, the Avatar Hall, and also the questionnaire were implemented in this phase. The details of the questionnaire were described in Section 3.4.2, and the design and the development of Avatar Hall is explained in Chapter 4.

### 3.6.3 Phase 3: Pilot Testing

Pilot testing is implemented in order to ensure that all the instruments used in the research are working properly. As stated by Harris (2008), pilot testing is "to try the experiment on a few participants first to see whether it makes sense to them, to uncover any serious flaws or problems that might have been overlooked at the design stage and to generally 'fine-tune' the procedure". In the study conducted by Turkay and Adinolf (2010), pilot testing is important as to ensure the clearness and appropriateness of the questions in the questionnaire.

In this research, pilot testing was performed for one element, which was the questionnaire. The purpose of testing pilot testing a questionnaire is to assess the reliability of the items presented in the questionnaire, in order to test:

- understanding of the meaning of the questions.
- the clarity of the questions.
- the adequacy of the instructions.

10 students were involved in this pilot testing. They were chosen from students who were studying the same course module as the actual participants in the research. As mentioned by Harris (2008), "a brief pilot test on a small sample of participants who are representative of the sample that will take part in the actual experiment can help researcher to identify the potential problems." He said that "Even one or two participants may tell you something useful about your research." But he advised that more than two participants should be used if possible.

A commonly used measure of the reliability of items is Cronbach's coefficient alpha. It ranges from 0 to 1, with 0.70 or above are generally considered to be sufficiently reliable (Harris, 2008). In this research, Cronbach's Alpha was calculated using the Statistical Package for Social Science (SPSS) version 17.

Figure 3.3 gives the values of Cronbach's alpha for the items in the questionnaire.

| No. | Sections | No. of Questions | Cronbach's Alpha |
|---|---|---|---|
| 1 | Students' Perception of Motivation to Learn | 9 | 0.743 |
| 2 | Students' Perception of Motivation to view an Avatar | 9 | 0.883 |
| 3 | Students' Perception of Motivation to Personalise an Avatar | 9 | 0.893 |

| | | | |
|---|---|---|---|
| 4 | Students' Perception of Motivation to access an Avatar Environment | 9 | 0.945 |

Figure 3.3: Values of Cronbach's Alpha

### 3.6.4 Phase 4: Experimentation

Students began their participation in the experiment by accessing the Avatar Hall. Treatment 1 group and Treatment 2 group were involved in this phase of the research. The former was assigned to the AbE environment whereas the latter was assigned to the RbE environment.

An email was sent to all the selected students inviting them to participate in the research. The email explained the purpose of the research and how to agree to participate (see Appendix 3.3 for Letter to Students) and it contained a link to the Avatar Hall webpage. Once the link was selected, students were presented with a consent letter which they needed to read and submit before they could participate. A student's username and password was displayed automatically once he or she submitted the consent agreement and student ID number. Students were then transferred automatically to the Avatar Hall and could start their experience with the Avatar Hall environment.

The students were also provided with a set of guidelines for accessing the Avatar Hall (see Appendix 3.4).

#### 3.6.4.1 Phase 4: Registering and Accessing the Avatar Hall Environment

The registration system for the Avatar Hall was explained in Section 3.3.1.

The online environment, the Avatar Hall, could be accessed by any type of internet browser including Internet Explorer (IE) and Mozilla Firefox. However, the IE version 7 (IE7) and above delivered the best view due to the use of the IE7 environment as its primary browser. IE7 was selected as the primary browser because:

- The IE7 is a standard browser for the Windows Operating System (OS).

- The computer provided by the University allows only IE as its primary browser, and students are not permitted to install other programmes without administrator approval.

When the Avatar Hall link page or address was clicked or entered, students were directed to a login page. A first-time user of the Avatar Hall needed to provide his or her gender and avatar name. Students were then transferred to the Avatar Hall environment according to their group.

#### 3.6.4.2 Phase 4: The Goal of the Avatar Hall Environment

As mentioned earlier, there are two types of Avatar Hall environment, one displaying avatars with human characteristics (AbE) and the other displaying avatars as text (RbE). The presentations of these groups were also varied.

Students in the AbE environment had their avatars set up and the ability to personalise their avatars, whereas, students in the RbE environment saw their avatar's name, together with other avatar names.

In summary, the goal of accessing the Avatar Hall for both AbE and RbE environments can be described as follows.

- In the RbE environment, a student's avatar's name is ranked according to the performance of that student relative to others, with the highest achieving student's avatar at the top.

- The AbE environment, on the other hand, does not employ any ranking. The points that individual students gain through their learning can be used in exchange for items with which they can personalise their avatars.

### 3.6.5. Phase 5: Distribution of Questionnaire

This phase involved the distribution of the questionnaire to all participants in this research, including the Control group. The aim of the questionnaire in this final phase was to gather data which would allow the researcher to achieve the goal of this

research, namely to measure differences in their perception of motivation to learn between the participants in each Treatment group and Control group. Section 3.5 provides details of the questionnaire.

In order to distribute the right set of questions to the right group of participants in Experiment 1 and Experiment 2, the questionnaires were distributed as shown in Table 3.8.

| No. | Sections | No. of Questions | Participant |
|---|---|---|---|
| 1. | Demography | 5 | All Participants |
| 2. | Motivation to Learn | 9 | All Participants |
| 3. | Motivation to view an Avatar | 9 | Human Character Avatar, Text Avatar |
| 4. | Motivation to Personalise an Avatar | 9 | Human Character Avatar |
| 5. | Motivation to Access Avatar Hall | 9 | Human Character Avatar, Text Avatar |

Table 3.8: Distribution of Questionnaire

The paper-based questionnaires were used and were distributed to the participants during the class. All the questionnaires were later be collected by the instructor at the end of the lecture. This method was applied to both experiments, Experiment 1 and Experiment 2.

#### 3.6.5.1 Phase 5: Post-Testing

The distribution of a questionnaire at the end of an experiment is commonly called a Post-Test. There were three reasons for deciding to use the questionnaire as a post-test.

First, none of the participants in these experiments had had previous experience of using an avatar in their learning environment. Thus, using a questionnaire about attitudes to avatar use at the beginning of the research could not have yield useful results.

Second, this research was investigating the effect of an avatar in the learning environment by comparing the results of the avatar group and the non-avatar group, as

well as within the avatar groups itself (human character avatar and text avatar). Since all the participants in both groups were attending the same course in the same programme of study, distributing a questionnaire at the beginning of the research (normally known as pre-test) would, again, not have yielded useful results.

Third, the use of a questionnaire at the beginning of the research may have affected its outcome (Werner and DeSimone, 2009). For example, they say, the distribution of a pre-test questionnaire "about attitudes toward sexual harassment before a workshop about sexual harassment may motivate participants to seek out more information or be more sensitive to the issue. Therefore, it is possible that changes in attitudes may be the result of the pre-test questionnaire rather than the training itself."

## 3.7 Data Analysis

This section describes the process of choosing the right type of statistical data analysis for this research. Data analysis is important in order to ensure the reliability of the results which are presented in Chapter 5. As stated by Coolican (2004), "inappropriate statistical procedures, or other statistical errors, may be responsible for the appearance of a difference that does not represent reality, such as data entered incorrectly and may have used the wrong kind of statistical analysis".

All the data in this research was analysed by using the Statistical Package for Social Science (SPSS) version 17.

### 3.7.1 Scale of Measurement

Generally, there are three types of scales: the nominal scale, the ordinal scale and the interval and ratio scale. According to Gravetter and Wallnau (2007), understanding the difference between these scales are important because "they underline the limitations of certain types of measurements and because certain statistical procedures are suitable for data collected on some scales but not on others." Table 3.9 gives a brief explanation of these scales.

| Scale | | Definition |
|---|---|---|
| 1. | Nominal | • Consists of a set of categories that have different names.<br>• Measurements on a nominal scale label and categorise observation, but do not make any quantitative distinctions between observations.<br>• Examples include: Year of study, Age, Gender, State, Hobbies. |
| 2. | Ordinal | • Consists of a set of categories that are organised in an ordered sequence.<br>• Measurements on an ordinal scale rank observations in terms of size or magnitude.<br>• Examples include: Small, Medium, Large / Upper, Middle, Lower |
| 3. | Interval and Ratio | • An interval scale consists of ordered categories that are all intervals of exactly the same size. With an interval scale, equal differences between numbers on the scale reflect equal differences in magnitude. However, ratios of magnitude are not meaningful.<br>• Example: Temperature, expressed in C or F.<br>• A ratio scale is an interval scale with the additional feature of an absolute zero point. With a ratio scale, ratios of numbers do reflect ratios of magnitude.<br>• Example: Height, Weight. |

Table 3.9: Brief Explanation of Scales of Measurement (Gravetter and Wallnau, 2007)

This research uses ordinal scales. This is because the data that was collected was based on a Likert Scale, coded 1 for “Strongly Disagree” to 5 for “Strongly Agree”.

According to SABLE (1999), in social and behavioural sciences, responses which are coded in this way are classified as an ordinal scale of measurement. This is because “Strongly Agree” reflects more agreement than “Strongly Disagree”. It is

impossible to say, for certain, that the interval between "Strongly Disagree" and "Slightly Disagree" is equivalent to the interval between "Slightly Disagree" and "Neutral"; thus it cannot be categorised as an interval or a ratio scale, nor is there an absolute zero point for the level of agreement (SABLE, 1999).

In analysing answers using the 5-point Likert scale, this research will combine 'strongly disagree' and 'disagree' responses as 'disagree', and 'agree' and 'strongly agree' responses as 'agree'. Hong, Ridzuan and Kuek (2003) applied this method when investigating student attitudes toward the use of the Internet for learning. The method is presented in Table 3.10.

| Coded Scale | Agreement | Conversion Category |
|---|---|---|
| 1 | Strongly Disagree | Disagree |
| 2 | Disagree | |
| 3 | Neutral | Neutral |
| 4 | Agree | Agree |
| 5 | Strongly Agree | |

Table 3.10: Conversion of 5-Point Likert Scale into Three Categories

## 3.8 Revisiting the Research Questions

Section 3.2 reported that this research included two types of experiment, Experiment 1 and Experiment 2, and Table 3.1 and Table 3.2 showed that more than one group was involved in both experiments.

Therefore, the research questions stated in Figure 1.6 are expanded as follows.

| Research Question | | | Statistics |
|---|---|---|---|
| RQ1. | Are students motivated to learn when an avatar is applied in a conventional learning environment, in Experiment 1 and Experiment 2? | | |
| | RQ1.1 | Are students motivated to learn when a human character avatar is applied in a conventional learning environment? | Percentage |
| | RQ1.2 | Are students motivated to learn when a text avatar is applied in a conventional learning | Percentage |

| | | | | |
|---|---|---|---|---|
| | | environment? | | |
| | RQ1.3 | Are students motivated to learn when there is no avatar in a conventional learning environment? | | Percentage |
| | RQ1.4 | Is there any difference between the groups in their motivation to learn? | | Independent-Samples T Test/Mann-Whitney Test |
| RQ2. | Are students motivated to view their avatar when an avatar is applied in a conventional learning environment, in Experiment 1 and Experiment 2? | | | |
| | RQ2.1 | Are students motivated to view their human character avatar when it is applied in a conventional learning environment? | | Percentage |
| | | RQ2.1.1 | Do students enjoy viewing their human character avatar? | Percentage |
| | | RQ2.1.2 | Do students put some effort into viewing their human character avatar? | Percentage |
| | | RQ2.1.3 | Do students value their human character avatar? | Percentage |
| | | RQ2.1.4 | Is there any relationship between students' motivation to view their human character avatar and their motivation to learn? | Pearson Correlation/Spearman Correlation |
| | | RQ2.1.5 | Is there any relationship between students' motivation to view their human character avatar and their motivation to personalise it? | Pearson Correlation/Spearman Correlation |
| | RQ2.2 | Are students motivated to view their text avatar when it is applied in a conventional learning environment? | | Percentage |
| | | RQ2.2.1 | Do students enjoy viewing their text avatar? | Percentage |
| | | RQ2.2.2 | Do students put some effort into | Percentage |

| | | | | |
|---|---|---|---|---|
| | | | viewing their text avatar? | |
| | | RQ2.2.3 | Do students value their text avatar? | Percentage |
| | | RQ2.2.4 | Is there any relationship between students' motivation to view their text avatar and their motivation to learn? | Pearson Correlation/Spearman Correlation |
| | RQ2.3 | Is there any difference in students' motivation to view their avatar depending on whether it is a human character avatar or a text avatar? | | Independent-Samples T Test/Mann-Whitney Test |
| RQ3. | Are students motivated to personalise their human character avatar in Experiment 1 and Experiment 2? | | | |
| | RQ3.1 | Are students motivated to personalise their human character avatar? | | Percentage |
| | RQ3.1 | Do students enjoy personalising their human character avatar? | | Percentage |
| | RQ3.2 | Is there any relationship between students' motivation to personalise their human character avatar and their motivation to access the Avatar Hall using the AbE environment? | | Pearson Correlation/Spearman Correlation |
| RQ4. | Are students motivated to access the Avatar Hall using the Attribute-based Environment (AbE) and the Ranking-based Environment (RbE), in Experiment 1 and Experiment 2? | | | |
| | RQ4.1 | Are students motivated to access the Avatar Hall using the Attribute-based Environment (AbE)? | | Percentage |
| | | RQ4.1.1 | Do students enjoy accessing the Avatar Hall using the AbE? | Percentage |
| | | RQ4.1.2 | Is there any relationship between students' motivation to access the Avatar Hall using the AbE | Pearson Correlation/Spearman Correlation |

| | | | | |
|---|---|---|---|---|
| | | | and their motivation to learn? | |
| | | RQ4.1.3 | Is there any relationship between students' motivation to access the Avatar Hall using the AbE and their motivation to view their human character avatar? | Pearson Correlation/Spearman Correlation |
| | RQ4.2 | Are students motivated to access the Avatar Hall using the Ranking-based Environment (RbE)? | | Percentage |
| | | RQ4.2.1 | Do students enjoy accessing the Avatar Hall using the RbE? | Percentage |
| | | RQ4.2.2 | Is there any relationship between students' motivation to access the Avatar Hall using the RbE and their motivation to learn? | Pearson Correlation/Spearman Correlation |
| | | RQ4.2.3 | Is there any relationship between students' motivation to access the Avatar Hall using the RbE and their motivation to view their text avatar? | Pearson Correlation/Spearman Correlation |
| | RQ4.3 | Is there any difference in students' motivation to access the Avatar Hall depending on whether they were using the AbE or the RbE? | | Independent-Samples T Test/Mann-Whitney Test |

Figure 3.4: Revisiting the Research Question

## 3.9 Analysis Framework

In this research, three steps are required in order to analyse the collected data. Step 1 identifies the normality of the data distribution. Step 2 selects the appropriate statistical test based on the outcome of Step 1. Step 3 analyses the data. These steps are described in the following subsections.

### 3.9.1 Step 1: Test of Normality

Before carrying out any statistical analysis, the normality of the data distribution needs to be considered. Only when this has been done can the appropriate type of statistical analysis be selected. The following subsections present a brief description of the procedure taken to ensure the selection of the correct statistical analysis.

Although the normality of data distribution may be seen through visual diagrams such as histograms, interpretation of the results may lead to inaccuracies. Therefore, in order to ensure the selection of the correct statistical test, the following procedures should be carried out.

#### 3.9.1.1 Procedure 1: Frequency Distribution (Histogram)

A frequency distribution shows how the results are distributed over various categories (Mann, 2007). According to Gravetter & Wallnau (2007), frequency distribution is "an organised tabulation of the number of individuals located in each category on the scale of measurement." Frequency distributions are normally presented as histograms. A histogram is a graph plotting values of observations on the horizontal axis, with a bar showing how many times each value occurred in the data set. Although the frequency distribution can have many different shapes, normal distribution is always characterised by a bell-shaped curve, which shows that the data are distributed symmetrically around the centre of all the scores and the majority of the scores lie around the centre of the distribution (Field, 2009). The bell-shaped curve of normal distribution is shown in Figure 3.5.

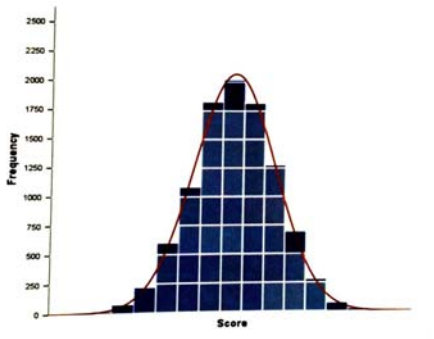


Figure 3.5: The Bell-Shaped Curve of Normal Distribution (Field, 2009)

### 3.9.1.2 Procedure 2: Skew & Kurtosis

There are two main ways in which a distribution can vary from normal: skew (lack of symmetry) and kurtosis (pointyness). Skewed distributions are not symmetrical and the most frequent scores are clustered at one end of the scale. A skewed distribution can be either positively or negatively skewed. Positive values of skewness indicate many low scores in the distribution and that the data are skewed to the right, whereas negative values indicate many high scores in the distribution and that the data are skewed to the left. Coolican (2004) suggested that abnormal distribution can easily be noted when the value of skewness and kurtosis is greater than twice the value of its standard error. Apart from that, if the difference between the mean and the median is large, e.g. half a standard deviation, then there is a lot of skew. Examples of skewed graphs can be seen in Figure 3.6.

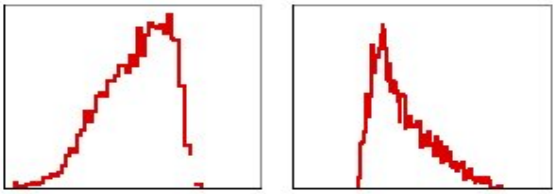

Figure 3.6: The Negative and The Positive Skew

Kurtosis, on the other hand, refers to the degree to which scores at the ends of the distribution (tails) not normal and how pointy a distribution is. Kurtosis also can be either positive or negative. Positive kurtosis indicates a peaked distribution which has many scores in the tails and characteristically is pointy at both ends. This is known as a leptokurtic distribution. Negative kurtosis, on the other hand, indicates a flat distribution and it has relatively thin tails. This is known as platykurtic distribution (Field, 2009). Examples of kurtosis graphs can be seen in Figure 3.7.

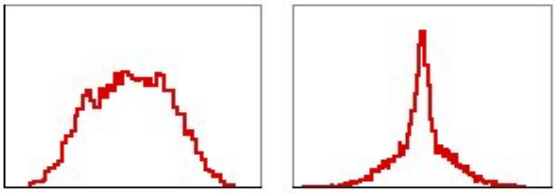

Figure 3.7: The Negative and The Positive Kurtosis

In summary, in the standard normal distribution, the value of skew should be zero and the value of kurtosis should be three. Therefore, if both of these values depart from the norm and the existence of skew and kurtosis is significant, then the data are not normally distributed.

#### 3.9.1.3 To Transform or Not to Transform

Field (2009) presented guidelines, as follows, on what to do if the distribution of the data is not normal. These guidelines are presented as follows.

I. Dealing with an Outlier

An outlier occurs in a data set where an individual value is substantially different (larger or smaller) from the values of the other items in the data set (Gravetter and Wallnau, 2007). This can be seen from a histogram.

There are several options to consider when an outlier is observed. These options are as follows.

Option 1: Remove the Case

This option allows the data responsible for the outlier to be removed. However, this option should be used only if the outlier data is not from the population that it is intended to sample.

Option 2: Transform the Data

Sometimes, this can reduce the impact of the outlier.

Option 3: Change the Score

If transformation does not have any impact on the outlier, the changing scores can be considered. However, this may seem like cheating the data.

II. Transforming Data

Although the transformation of data can sometimes reduce the impact of an outlier, some researchers claim that this is “seldom considered to be worth the effort” (Glass, Peckham & Sanders, 1972).

### 3.9.2 Step 2: Identifying the Right Statistics Test

If all the data are normally distributed, then the parametric test should be chosen. Otherwise, the non-parametric test is an alternative.

#### 3.9.2.1 Parametric Test

Parametric tests work on the principle of interval data, where the intervals between the scores are equal, and therefore numerical calculations are possible (Harris, 2008). The statistical analyses which are available as parametric tests for this particular research are the Independent T-Test and the Pearson Correlation Test.

#### 3.9.2.2 Non-Parametric Test

Non-parametric tests work on the principle of ordinal data, where the lowest score is given the rank of 1, the next highest score is given the rank of 2, and so on (Harris, 2008). The analysis is then carried out on the ranks rather than on the actual data. The statistical analyses which are available as non-parametric tests for this research are the Kruskal-Wallis Test, the Mann-Whitney Test, and the Spearman Correlation Test.

### 3.9.3 Step 3: Analysis of Data

The analysis of data is conducted once the outcome of Step 1 and Step 2 have been reported. Both the Parametric and Non-Parametric tests are described in the following subsections.

### 3.9.3.1 Statistical Analysis for Parametric Test

The parametric tests used in this research are the Independent T-Test, and the Pearson Correlation Test. These tests are described as follows.

#### 3.9.3.1.1 Independent T-Test

The Independent T-Test or T-Test (Unrelated) is designed to use the data from two separate samples to evaluate the difference between two treatments. It is identified by the symbol of ***t***.

The Independent T-Test result is represented by the symbols as shown in Table 3.11.

| Symbols | Meaning |
|---|---|
| M | • The value of mean. Mean is "the sum of the scores divided by the number of scores" (Gravetter & Wallnau, 2007). |
| SD | • The value of the standard deviation. This is "primarily a descriptive measure where it describes how variable, or how spread out, the scores are in a distribution" (Gravetter & Wallnau, 2007). |
| df | • The value of the degree of freedom. It is generally calculated as the total number of scores (*N*) minus one score. This can be simplified as *N*-1. |
| P < 0.05 | • This indicates that the alpha value is less than 0.05 and it means that the difference between the two groups is significant. |
| P > 0.05 | • This indicates that the alpha value is more than 0.05 and it means that the difference between the two groups is not significant. |

Table 3.11: Independent T-Test Symbols

Example: $t(22) = -1.68, p < .05$

The example shows that the value of *t* is -1.68, and df = 22. The test also shows that there is a significant difference between the two groups.

The value of df value of 22 also shows that there are 23 students participating in the experiment, where *N*-1 = 22. This means that the value of *N* is 23.

#### 3.9.3.1.2 Pearson's Product Moment Correlation

The Pearson Product Moment Correlation is commonly called Pearson's Correlation. It is a parametric measure to identify the linear relationship between two variables and it is identified by the symbol of ***r***.

According to Frey (2006), the strength of relationship between two variables ranges in value from -1.00 to +1.00. A positive sign in a correlation value indicates that the relationship is in the same direction. This means that, as one value increases, the other value increases. A negative sign in a correlation value, on the other hand, indicates that the relationship is in the opposite direction. This means that as one value increases, the other value decreases.

Pearson's Correlation results are represented by the symbols shown in Table 3.12.

| Symbols | Meaning |
|---|---|
| r | • The value of Pearson's Correlation. |
| p | • The significance value. |
| $p < 0.05$ | • This indicates that the alpha value is less than 0.05 and that the relationship between the variables is significant. |
| $p > 0.05$ | • This indicates that the alpha value is more than 0.05 and that the relationship between the variables is not significant. |

Table 3.12: Pearson's Correlation

Example: $r = 0.966$, $p < 0.05$

In this example, the value of Pearson's Correlation is 0.966 and there is a significant relationship between the variables.

### 3.9.3.2 Statistical Analysis for Non-Parametric Test

The non-parametric tests used in this research are the Kruskal-Wallis Test, the Mann-Whitney *U*-Test, and the Spearman Correlation Test. These tests are described as follows.

#### 3.9.3.2.1 Mann-Whitney *U*-Test (*U*)

The Mann-Whitney *U*-test is designed to use the data from two separate samples to evaluate the difference between two treatments. The calculations for this test require that the individual scores in the two samples are rank-ordered (Gravetter & Wallnau, 2007). As stated by Greene and D'Oliveira (2006), the Mann-Whitney test should be used for an unrelated design when different participants experience one of two conditions and the data are ordinal. The Mann-Whitney U-Test is identified by the symbol ***U***.

The Mann-Whitney U-Test results are represented by the symbols shown in Table 3.13.

| Symbols | Meaning |
|---|---|
| n1 | • Number of respondents in Group 1. |
| n2 | • Number of respondents in Group 2. |
| P < 0.05 | • This indicates that the alpha value is less than 0.05 and that the difference between the two groups is significant. |
| P > 0.05 | • This indicates that the alpha value is more than 0.05 and that the difference between the two groups is not significant. |

Table 3.13: Mann-Whitney *U*-Test Symbols

Example: $U = 166$, $n1 = 24$, $n2 = 24$, $p < 0.05$

In this example the value of *U* is 166, and both group 1 and group 2 have 24 respondents. It also shows that there is a significant difference between the two groups.

#### 3.9.3.2.2 Kruskal-Wallis Test (Unrelated)

The Kruskal-Wallis test is designed to use the data from three separate samples to evaluate the difference between three conditions. The calculations for this test require that the individual scores in the three samples are rank-ordered (Gravetter & Wallnau, 2007). As stated by Greene and D'Oliveira (2006), the Kruskal-Wallis test should be used for an unrelated design when different participants experience three or more conditions and the data are ordinal. The Kruskal-Wallis test is identified by the symbol ***H***.

The Kruskal-Wallis test results are represented by the symbols shown in Table 3.14.

| Symbols | Meaning |
|---|---|
| N | • Total number of respondents in the experiment. |
| n | • Total number of respondents in each condition. |
| df | • The number of conditions, *C*, minus 1. This can be simplified as *C*-1. |
| P < 0.05 | • This indicates that the alpha value is less than 0.05 and that the difference between the three groups is significant. |
| P > 0.05 | • This indicates that the alpha value is more than 0.05 and that the difference between the three groups is not significant. |

Table 3.14: Kruskal-Wallis test Symbols

Example: $H = 3.785$ (2, N = 15), $p > 0.05$

In this example, the value of $H = 3.785$, with three conditions and the total number of respondents involved in the experiment is 15. It also indicates that there are no significant differences among the conditions.

#### 3.9.3.2.3 Spearman's Rank Correlation

The Spearman's Rank Correlation is commonly called Spearman's Correlation. It is a non-parametric measure of the relationship between two variables. The Spearman's Correlation is identified by the symbol $\boldsymbol{r_s}$.

The Spearman's Correlation results are represented by the symbols shown in Table 3.15.

| Symbols | Meaning |
|---|---|
| $r_s$ | • The value of Spearman's Correlation. |
| p | • The significance value. |
| $p < 0.05$ | • This indicates that the alpha value is less than 0.05 and that the relationship between the variables is significant. |
| $p > 0.05$ | • This indicates that the alpha value is more than 0.05 and that the relationship between the variables is not significant. |

Table 3.15: Spearman's Correlation

Example: $r_s = 0.966$, $p < 0.05$.

In this example, the value of Spearman's Correlation is 0.966 and there is a significant relationship between the variables.

### 3.9.4 Section Summary

This research follows Coolican's (2004) advice that non-parametric test should be considered for data based on human judgement involving answers on a scale ranging from 1 for "Strongly Disagree" to 5 for "Strongly Agree". Wadsworth Cengage Learning (2005) also stressed that data on a nominal or ordinal scale of measurement requires a non-parametric test for hypothesis testing. Greene and D'Oliveira (2006) agree that ordinal data requires a non-parametric test.

The framework for analysing the data is summarised in Table 3.16.

| Steps | Description | |
|---|---|---|
| Step 1 | Test of Normality | |
| | Procedure 1: | Frequency of Distribution (Histogram) |
| | Procedure 2: | Skew & Kurtosis calculations |
| Step 2 | Identifying the Correct Statistical Test | |
| | Option 1: | Parametric Test |
| | Option 2: | Non-Parametric Test |
| Step 3 | Analysis of Data | |

Table 3.16: Analysis Framework

Table 3.16 shows the framework used for analysing data in this research. There are three steps provided by this framework, namely Step 1, Test of normality; Step 2, Identifying the correct statistical test; and Step 3, Analysis of data. In Step 1, two procedures were involved to test the normality of data: procedure 1 is about viewing the data distribution through histogram, and procedure 2 is about calculating the skew and the kurtosis of the data.

Secondly, in Step 2, identifying the correct statistical test is involved. Two options are given but only one need to be chosen. This can be resulted as either choosing a parametric test or a non-parametric test. Finally, in Step 3, the analysis of data is conducted, in accordance with the option selected from Step 2.

## 3.10 Chapter Summary

This chapter has described the issues relating to the research methodology adopted in this research. It explains and justifies its decisions about its research design, participants of the research, type of research instruments, procedures of implementing the research and approach to analysing the collected statistical data. The development of the Avatar Hall system will be presented in the following chapter.

# Chapter 4

# Avatar Hall System

## 4.1 Introduction

This chapter presents the process of developing the Avatar Hall System which includes the environment of the experiment, the user interface design, software and scripting language used for the development and the theory behind the development of the Avatar Hall environment.

## 4.2 The Environment of Experiment

The discussion of this section will be categorised into three subsections, as below.

### 4.2.1 Access to the Internet

The Avatar Hall system can be accessed anywhere and anytime via the Internet connection. Most of the students in the experiment were staying in the university student accommodation. Moreover, in term of internet facility, a wifi facility is provided to the students. Apart the availability of internet connection from student accommodation, students were also encouraged to use the computer (with internet connection) provided by the faculty and the university library.

### 4.2.2 Location of Avatar Hall Server

The Avatar Hall system was hosted by the server located in Durham University, England. Most of the students will access the system from their location in Sarawak, Malaysia.

### 4.2.3 Speed of Internet Connection

The speed of internet connection was unpredictable, especially when accessing the Avatar Hall system at Durham University. This situation may influence students' interest and effort towards the Avatar Hall system.

### 4.2.4 Integration of the Avatar Hall System on Morpheus

A link to the Avatar Hall website was provided on the respective courses on Morpheus. The integration of the Avatar Hall on Morpheus was based on the hyperlink provided, and not as an add-on component to the Morpheus system structure due to the restriction put by the university.

## 4.3 User Interface Design

The user interface design refers to the design process of any aspect which relates directly to the web page. Robbins (2007) has listed four types of task that are involved in designing a web page. These are:

I. **Graphic Design**. It is also known as visual design. It is what the visitors see on a web page, such as the graphics, colours, layout, and so on. Orr, Golas and Yao (1993) have suggested guidelines in relation to visual elements such as:

- not to present too much information at one time.
- organising information by:

- presenting it in one clear section such as at the centre of the screen.
- placing dynamic information at the centre of the screen.
- placing non-dynamic information in a static section such as at the corner of the screen.
- putting a navigation button in the corner of the screen.

- Colouring techniques, such as:
  - avoiding using too many colours on one screen.
  - the colour blue is a good colour for the background, but it should not used for text.

Figure 4.1 show the integration of these guidelines into the design of the Avatar Hall System.

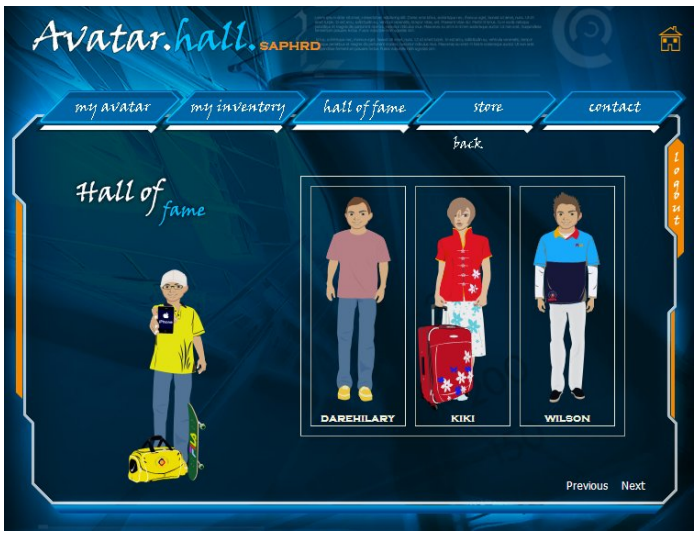


Figure 4.1: Visual Techniques in the Design of the Avatar Hall

II. **Information Design**. This is how the information on the web page is organised and how to get to that information. According to Robbins (2007), there are many types of method for organising information, such as alphabetical, chronological, by class (or type), hierarchical, spatial and by order of magnitude. Therefore, the organisation of information for the Avatar Hall System is organised based on the class (or type), where all the information is grouped based on similarities. For example, an avatar attribute, such as a t-shirt and trousers, will be grouped under

clothing, and a skateboard will be grouped under sport.

III. **Interface Design**. This is how the web page works. The concept of usability is applied to this task. This involves assessing how easily visitors can accomplish their goals on the site, as well as the general experience of using the site, such as the availability of buttons, links, and the functional organisation of the page. In this research, in order to achieve easy access to a navigation button, the button is presented at the top corner of the screen, as seen in Figure 4.1.

IV. **Site production**, such as HTML documents, Style Sheets and Javascript. This is also known as document production. The process of writing HTML and style sheets documents is commonly referred to as authoring. In Figure 4.1, the Cascading Style Sheets (CSS) language is used to organise the location of the avatars.

## 4.4 Software Selection for the Development of the Avatar Hall System

A modern website is dynamic, where a user has an opportunity to interact with the website such as by providing information through a form. Building a dynamic website requires a scripting language and a database. The most popular software for this purpose is PHP for scripting and MySQL for the database (Valade, 2008). As stated by Valade (2008), PHP and MySQL were specifically designed for web development and providing dynamic websites.

In addition to using these technologies, the websites also could be enhanced in order to increase the user's experiences while accessing them. This can be done by using Cascading Style Sheets (CSS) language and a graphic editor. A benefit of using CSS is to increase accessibility, such as by providing a clickable area of links, and allowing access by different media such as handheld devices or projectors – without changing the presentation structure of the content (Weakley, 2006).

A graphics editor, on the other hand, such as Adobe Photoshop, is a graphics editing program that enables the manipulation of visual images on a computer. It is claimed that Photoshop is the standard image creation software package for the web

environment (Robbins, 2007). This program is used to create, design and develop an avatar's attributes, such as the avatar's body and items, i.e. clothing, glasses, accessories, and so on.

## 4.5 Introduction to the Avatar Hall System

There are two types of Avatar Hall System – Attribute-based (AbE) and Ranking-based (RbE) environments.

- The AbE environment is divided into five main menus. These main menus are My Avatar, My Inventory, Hall of Fame, Store, and Contact.

- The RbE environment, on the other hand, also has five main menus and these are Attendance, Activities, Quizzes, Project and Examination.

The details of each environment will be described next.

### 4.5.1 Attribute-based Environment (AbE)

The main features of the Attribute-based Environment (AbE) are human character avatars and their accessories. The human character avatar can be personalised based on needs and points. The more points users have, the more choice of accessories they will have.

The AbE environment is divided into five main menus, such as My Avatar, My Inventory, Hall of Fame, The Store and Contact. See Figure 4.2 for the AbE Avatar Hall Main Menu page.


Figure 4.2: The Attribute-based Environment (AbE) of the Avatar Hall Main Menu

All of these menu structures will now be described in the following subsections.

#### 4.5.1.1 Menu: My Avatar

The first button on the left of the main menu screen is My Avatar (see Figure 4.2). In My Avatar, users will be presented with their avatar, along with their total and balance points. Moreover, users also can find the ‘change password’ button if they wish to do so. Additionally, users can explore other sections of Avatar Hall by selecting the name of the sections located at the top of the screen. The Log Out button is easily accessible on the right of the screen. See Figure 4.3 for the My Avatar screen.


Figure 4.3: Attribute-based Environment (AbE) - My Avatar

### 4.5.1.2 Menu: My Inventory

The next menu on the main menu screen is My Inventory (see Figure 4.2). My Inventory is a place where all the items will be kept once they have been bought by the user. Each item will be grouped based on an item's category, such as clothing, hairstyle, etc. Based on Figure 4.4, two inventories have been activated. The name of each inventory will be displayed once the cursor is hovering over the top of the inventory box (white box).


Figure 4.4: Attribute-based Environment (AbE) - My Inventory

### 4.5.1.3 Menu: Hall of Fame

The Hall of Fame is the next menu after My Inventory (see Figure 4.2). The main feature of the Hall of Fame is to let the user see other avatar characters. Here, a user could differentiate their avatar character from that of other avatars. The more accessories the avatars have, the more points the users gain. Based on Figure 4.5, the avatar on the far left represents the user, whereas the three avatars located inside the box represent other users. The default avatar can be seen by the avatar name 'Darehilary', whereas a customised avatar is shown by the avatar names 'Kiki' and 'Wilson'.


Figure 4.5: Attribute-based Environment (AbE) – Hall of Fame

#### 4.5.1.4 Menu: Store

The following menu is The Store (see Figure 4.2). The Store, as its name implies, is a place where a collection of items is displayed and sold. The selling transaction in the Store is based on points. Points will be exchanged for the items that users want. All items for avatars can be found in the Store. However, not all items will be available to the user. The availability of the item to the user is fully dependent on how many points they have in the Avatar Hall.

Based on Figure 4.6, the user is able to have more choices of items for their avatar. The user can browse through the items by clicking on the green unlock button. The availability of a number of green unlock buttons is designed to show to the user that s/he has successfully achieved a certain amount of points and therefore reflects their performance in completing the learning activities.


Figure 4.6: Attribute-based Environment (AbE) – Store, Main page

In addition to the Store, once the users have clicked on their selected green unlock button, they will be presented with the items of their choice. Based on Figure 4.7, the user has chosen to browse the clothing category of the Store. On this screen, the user may select any clothes that they want as long as they have enough points to buy them.

Subsequently, the user's avatar is also available next to the items. The user will have their new item once s/he has bought it. Due to the size of the screen, each screen can only present six items. The following items will be presented on the next screen by clicking the Next button which is located at the bottom right of the screen.

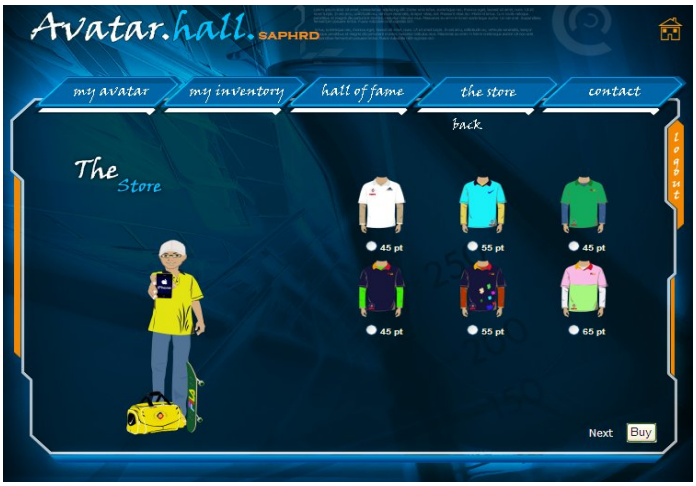


Figure 4.7: Attribute-based Environment (AbE) – Store, Items page

#### 4.5.1.5 Menu: Contact

The last section in the Avatar Hall is the Contact details (see Figure 4.2). This is a place where users can find the information on how to contact the researcher if they need to. See Figure 4.8 for Contact.


Figure 4.8: Attribute-based Environment (AbE) – Contact

### 4.5.2 Ranking-based Environment (RbE)

The main form of presentation for the Ranking-based Environment (RbE) is text based, for both the avatar and its ranking compared to other avatars. The more points a user has, the higher their avatar name will be placed on the ranking board.

The RbE environment is divided into five main menus, such as Attendance, Activities, Quizzes, Project and Examination. These menus are categorised based on the learning activities laid out in the users' course module, such as TMX2012 and KMC1093. The categorisation of the main menu for RbE Avatar Hall can be seen in Figure 4.9.


Figure 4.9: The Ranking-based Environment (RbE) of Avatar Hall Main Menu

In the Attendance submenu, there are three sub-categories of attendance. These are lecture, tutorial and lab. In the Activities submenu, students need to ask and answer the questions given by their instructor. In addition, the users also need to access the course's online learning portal as one of the activities.

The next menu is Quizzes. Those users with the highest marks will have their avatar's name on top of the ranking list, whereas those with the lowest marks will have their avatar's name at the bottom of the ranking list. This concept is also applied to the Project and Examination menu. Figure 4.10 shows an example of a ranking board based on Attendance.


Figure 4.10: Ranking-based Environment (RbE) – Attendance

Additionally, apart from viewing the users' performance separately based on each category of learning activity, such as attendance, activities, quizzes, projects and examinations, users can also view their avatar's names on the ranking board based on their overall performance in all learning activities. This concept is similar to normal practice in the classroom. Students' performance is not based on one subject but on their overall performance across all subjects. Although a student can perform well in one subject, however, their true performance could be identified by looking at their performance across all subjects.

Figure 4.11 gives an example of the ranking board based on the users' overall performance in all activities. The overall performance of a user is accessible by 'clicking' the user's avatar name, which is located in the Main Menu of the Avatar Hall.


Figure 4.11: Ranking-based Environment (RbE) – Overall Performance

## 4.6 Applying the Elements of Motivation into the Avatar Hall System

The design of an avatars' environment, the Avatar Hall, is based upon the elements presented by Malone (1981), which are curiosity, fantasy and challenge. Malone (1981) described how these factors are why computer games are motivating. These elements are now described as follows.

### 4.6.1 Curiosity

One of the elements for motivating the participants is to encourage curiosity. As stated by Malone (1981), curiosity can be achieved in a situation where it should be 'surprising'. In the development of the Avatar Hall System, specifically in the Attribute-based Environment (AbE), the curiosity element is applied through the Store menu. In the Store, the participants are presented with various categories of avatar attributes. These attributes are not accessible to the participants unless they have reached the required amount of points for every category. In addition, the participants do not know what they will get for the next category until the category is unlocked. This activity will encourage the curiosity of the participants by allowing them to discover what is going to be presented to them next. Figure 4.12 shows the curiosity aspect of the AbE environment.


Figure 4.12: Attribute-based Environment (AbE), Avatar Hall – Store, main section page

Based on Figure 4.12, two green unlock button have been enabled. This is to show that the user has reached the required amount of points for this category. Also noted was the fact that the category name appears once the cursor is hovering over the top of the selected button. Subsequently, the category name only appears when the button is unlocked. The category name will not appear when the button is locked even though the cursor is hovering on top of the selected lock button.

### 4.6.2 Fantasy

Fantasy is one of the elements which can motivate the participants. As stated by Pivec and Dziabenko (2004), fantasy could lead to greater interest in a person. Malone (1981) described fantasy as a mental image of an object or an environment which may or may not occur in a person's environment. The element of fantasy is applied when the participants start to personalise or customise their avatar. The personalisation of an avatar could be found in the Store menu where the participants may choose the attributes that are best for their avatar. Moreover, the personalisation of an avatar also happens in the Inventory menu where the participants may change their avatar's attributes when needed. In this research, the element of fantasy is based on having possession of something. Based on Figure 4.13, the element of fantasy is being applied by wearing clothing. Another aspect of fantasy that can be achieved is through having an expensive electronic device such as an iPhone.


Figure 4.13: A Collection of Avatar Clothing

### 4.6.3 Challenge

The final part of the elements that can engage motivation is challenge. As defined by the Oxford English Dictionary, challenge is defined as "a difficult or demanding task,

especially one seen as a test of one's abilities or character". Malone (1981) commented that providing a goal makes each situation challenging. Yee, Ellis and Ducheneaut (2008) have stated that, in order for the avatar to progress further in games or be enhanced, the players need to accumulate gold or some sort of money that can be exchanged for the items. This gold can only be obtained when the players have confronted successfully their challenges. Therefore, in the Avatar Hall, participants need to accumulate a certain amount of points in order to enhance their avatar or to have their avatar's name on the ranking board.

The element of challenge has been applied by implementing a points system into the AbE environment. In order for the participants to personalise their avatar, they need to have a certain amount of points. Every category of an avatar's attribute is allocated a certain amount of points. More points are needed to reveal more categories. The attributes categories in this study were adopted from the categorisation of an avatar on the Yahoo Avatar website. Table 4.1 shows the allocation of points for each category of attributes.

| **Number of Points** | **Attributes Categories** |
|---|---|
| < 50 | Clothing, Trousers |
| < 100 | Hairstyle |
| < 200 | Spectacles |
| < 300 | Hat |
| < 450 | University Clothing |
| < 600 | Luggage |
| < 700 | Pet |
| < 900 | Sport Appliance |
| < 1000 | Handheld Appliance |

Table 4.1: The Allocation of Points in the Avatar-based Environment (AbE)

In the Ranking-based Environment (RbE), points are needed for participants to move their avatar's name towards the top of the ranking board. Figure 4.14 shows the RbE environment ranking board.


Figure 4.14: Ranking-based Environment (RbE), Avatar Hall – Ranking Board

Success in completing each learning activity will grant the students a certain amount of points per week. Table 4.3 shows the amount of points allocated to every learning activity.

| **Learning Activity** | **Points per Week** | |
|---|---|---|
| | **Experiment 1** | **Experiment 2** |
| • Attendance (Lecture) | 34 | 50 |
| • Attendance (Tutorial) | 25 | N/A |
| • Attendance (Lab) | 22 | N/A |
| • Accessing Morpheus (eLearning Portal) | 12 | N/A |
| • Asking Question (via Morpheus) | 13 | N/A |
| • Answering Question (via Morpheus) | 13 | 70 |
| **Total** | **119** | **120** |

Table 4.3: The Allocation of Points for Every Learning Activity

Table 4.3 shows that there are two types of experiments involved in this research: experiment 1 and experiment 2. Learning activities involved in these experiments was

chosen in order to align with the requirement from the courses: attendance and online learning portal. Students must fulfil 80% of attendance as a requirement to sit for final examination. Additionally, the university encourage all instructors to integrate their learning activities into university online learning portal called morpheus in order to embrace technology in education.

There are two different courses involved in two different experiments. In experiment 1, an IT based course has been applied, whereas in experiment 2, a non-IT based course applied. Therefore, in relation to the IT-based course, the learning activities for experiment 1 were listed into six categories. These categories are as follows.

- Attendance – lecture
- Attendance – tutorial
- Attendance – lab
- Accessing morpheus
- Asking question via morpheus
- Answering question via morpheus

On the other hand, in relation to the non-IT based course, the learning activities for experiment 2 was listed as follows.

- Attendance – lecture
- Answering question via morpheus

Based on Table 4.3, Points per Week refers to the amount of points that students need to collect every week in order to have their points increase and consequently to unlock the next category of the avatar attribute or have their avatar name at the top of the ranking board. Students can view this information by selecting ‘Point System’ from the Store Menu, in the Avatar Hall (see figure 4.12).

## 4.7 Applying the Elements of Computer Games into the Avatar Hall System

Prensky (2007) has listed six elements of a computer game and these are: rules; goals and objectives; outcomes; challenge; interaction; and representation. These elements of a computer game have been applied to the design of the Avatar Hall System, specifically in the Attribute-based Environment (AbE). These are described as follows.

### 4.7.1 Rules

Rules are something that must be followed and accepted by the participants in the research. Rules are important in order to achieve the goal of each environment. The rules for each environment are:

- *Personalising the Avatar*: The rule for the participants to unlock the button and at the same time to have their avatar personalised is that they must have enough points for every allocated category of avatar attribute. Points are collected by performing all of the learning activities shown in Table 4.3. This rule is applied to the AbE environment.

- *Ranking Board*: The rule for the participants to move their avatar's name towards the top of the ranking board is to have more points compared to other avatars. The procedure for collecting point is the same for both types of avatar environment. Points are collected by performing all of the learning activities presented in Table 4.3. This rule is applied to the RbE environment.

### 4.7.2 Goals and Objectives

Goals and objectives are what the participants need to achieve in order to meet their personal requirements. In order to have more attributes categories available, they need to achieve a certain amount of points. For example, to make the next attribute

category available, the participants need to collect more than 500 points. In this case, the goal is to achieve 500 points.

### 4.7.3 Outcome

Outcomes and feedback are how the participants measure their performance. In the AbE environment, this element is applied when the participants start to personalise their avatar character. As an outcome of achieving a certain amount of points, one category of an avatar attribute is available to the participants. In the RbE environment, this element is applied when the participants have their avatar name on the ranking board.

### 4.7.4 Challenge

Challenge is the element that will provide a challenge to the participants. The element of challenge is applied by setting up the criteria for unlocking the attribute category of avatars, specifically for the AbE environment. These criteria are shown in Table 4.2 and Table 4.3. Based on Table 4.2, the participants need to gain more than 300 points to unlock the category which contains a collection of University Clothing. Therefore, the challenge occurs when the participants are trying to achieve more than 300 points by fulfilling all of the learning activities every week.

### 4.7.5 Interaction

The element of interaction is the element where the participants ‘communicate’ with the system. In the AbE environment, interaction happens when the participants are trying to buy an attribute for their avatar, such as clothing and other accessories. This type of interaction is described as the interaction between the user and the computer (Prensky, 2007), where something changes in response to what the user did.

### 4.7.6 Representation

According to Prensky (2007), representation means "that the game is about something". Prensky (2007) further commented that representation can be understood by referring to the examples shown in Table 4.4.

| Environment | Representation |
|---|---|
| Chess | • Is about conflict |
| Tetris | • Is about building and recognising patterns |
| The Age of Empires | • Is about the history of the art of war |

Table 4.4: Representation - Examples

Therefore, by holding the same definition of representation as Prensky (2007), this research of the Avatar Hall represents a place where all the participants can view their performance. Participants who are able to collect more points through learning activities will enable their avatar to have more accessories (AbE environment), as well as move their avatar towards the top of the ranking board (RbE environment). Table 4.5 shows the representation of the Avatar Hall in this research.

| Environment | Representation |
|---|---|
| Avatar Hall | • Is about the presentation of the students' performance, as indicated by:<br>o The quantity of items that an avatar is able to buy.<br>o The location of an avatar on a Ranking Board. |

Table 4.5: What does Avatar Hall Represent?

## 4.8 Chapter Summary

This chapter began by introducing the development aspect of the Avatar Hall system which includes the design of the system's user interface, as well as a description of the software used in this development. Further explanations of the Avatar Hall environment are also presented in this chapter. Subsequently, the elements of computer games presented by Prensky (2007) have been discussed to allow the concept of computer games to be applied to the Avatar Hall System. Nevertheless, the discussion of applying motivation to the system has resulted in discussing three elements of motivation, as presented by Malone (1981). The results of this research, based on the implemented experiment, will be presented in the following chapter.

# Chapter 5

# Results

## 5.1 Introduction

This chapter presents the results obtained from the research instrument used with Experiment 1 and Experiment 2 of this research study. All the data were analysed by the statistical software package called Statistical Package for Social Science (SPSS) version 17.

Based on the analysis framework described in Section 3.6.2, three steps are presented in order to determine the correct statistical test for the data analysis. Step 1 is the test of normality, Step 2 identifies the appropriate statistics tests to use, and Step 3 analyse the data.

This chapter reports the data derived from the demography questions in the questionnaire, reporting the results of the normality tests for frequency distribution, skewness and kurtosis. This is followed by the results of the experiments which sought to provide data to answer the research questions presented in Section 3.8. Next, responces from an open-ended question was also presented.

Finally, this chapter presents secondary data based on the students' usage activity in the Avatar Hall environment. These data were collected through the login system of the Avatar Hall.

## 5.2 Demography

This section reports the data from the demography section of the questionnaire. This includes the students' ages, gender, hours spent on the internet, prior experience with avatars, and knowledge of and attitude to avatars on the Internet. This research included two experiments, Experiment 1 with 71 participants and Experiment 2 with 45 different participants.

### 5.2.1 Age Group

31% of the participants in Experiment 1, and 82.2% of the participants in Experiment 2 were aged between 21-25 years old. 69% of the participants in Experiment 1 were aged 18-20 years, compared to 17.8% of the participants in Experiment 2. This indicates that the participants in Experiment 1 were, generally, younger than the participants in Experiment 2.

The age data are illustrated in Figure 5.1.

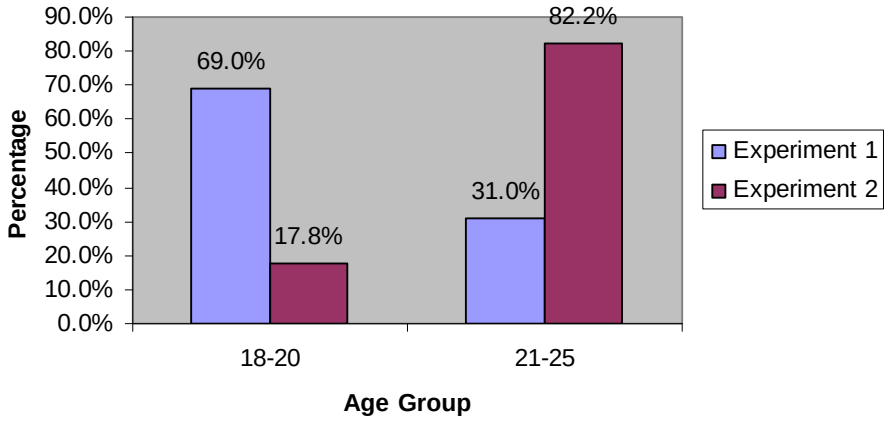


Figure 5.1: Bar Chart for Age Group

### 5.2.2 Gender

The participants in Experiment 1 were 78.9% female and 21.1% male. The participants in Experiment 2 were 73.3% female and 26.7% male. The data for gender are illustrated in Figure 5.2.

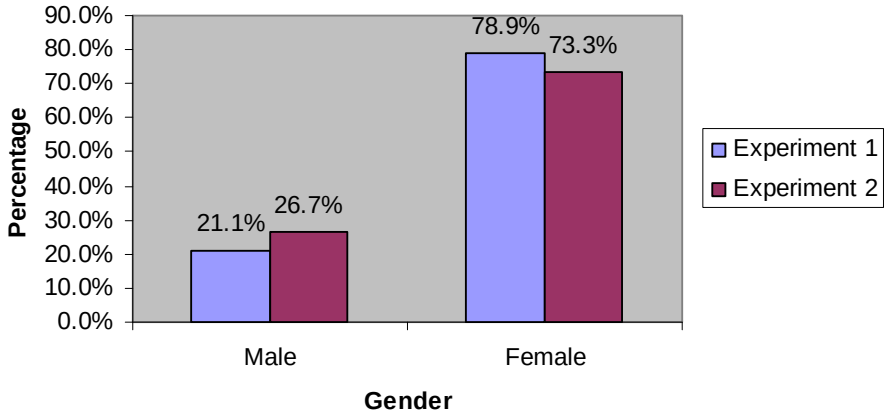


Figure 5.2: Bar Chart for Gender Group

### 5.2.3 Hours Spent on the Internet (Per Week)

Figure 5.3 shows the results for the question about the number of hours that this research's participants spent on the Internet. For participants in Experiment 1, the largest category (38%) spent 5-10 hours per week on the Internet, whereas for participants in Experiment 2 the largest category (42.2%) spent 0-4 hours per week on the Internet. This means that, in general, students in Experiment 1 used the Internet more than students in Experiment 2.

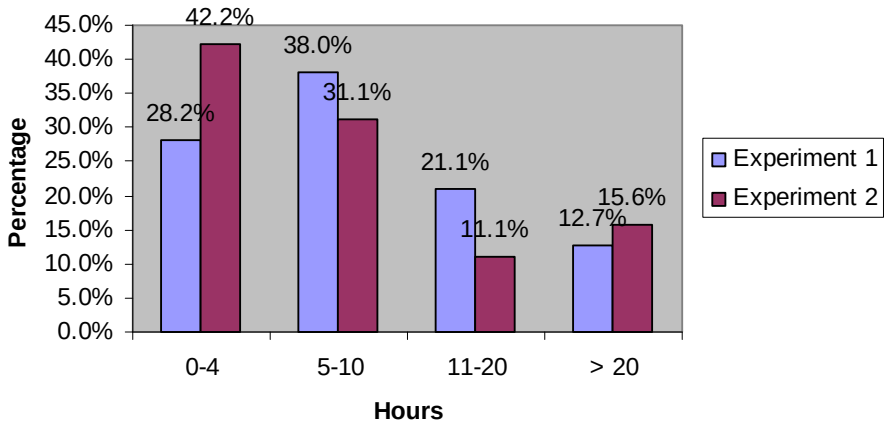


Figure 5.3: Bar Chart for Hours Spent on the Internet

### 5.2.4 Prior Experience with Avatars on the Internet (Games or Social Networking)

49.3% of participants in Experiment 1 had seen an avatar on the Internet compared to 53.3% of participants in Experiment 2. This means that roughly the same proportion of participants in both experiments had seen an avatar on the Internet. This data is illustrated in Figure 5.4.

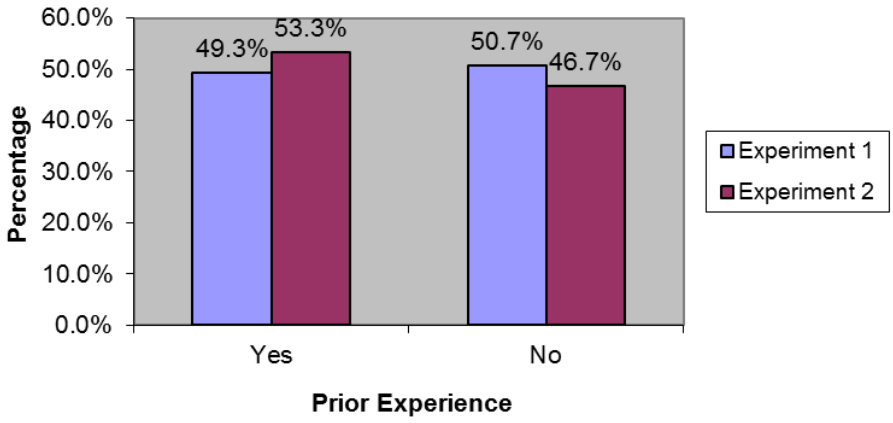


Figure 5.4: Bar Chart for Prior Experience with Avatars on the Internet

### 5.2.5 Knowledge of and Attitude to Avatars on the Internet (Games or Social Networking)

The majority of the students in Experiment 1 (57.7%) and Experiment 2 (62.2%) said that they did not know about the existence of avatars on the Internet. 36.6% of the students in Experiment 1 and 33.3% of the students in Experiment 2 reported that the existence of the avatar on the Internet was relevant to them. Only a very small number of students in both experiments said that they knew that avatars existed on the Internet but they were not relevant to them and therefore they were not bothered them. These data are illustrated in Figure 5.5.

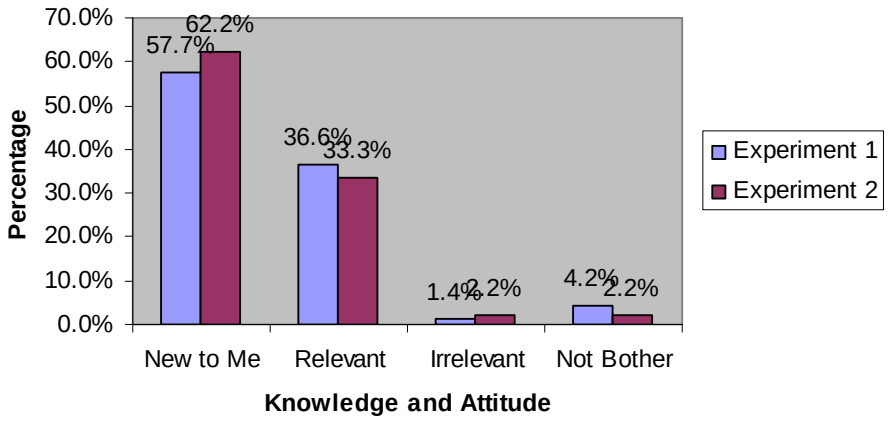


Figure 5.5: Bar Chart for Knowledge of and Attitude to Avatars on the Internet

### 5.2.6 Section Summary

The participants' demographic details as described in Section 5.2.1 to Section 5.2.5 are summarised in Table 5.0.

| | **Experiment 1 (N = 71)** | **Experiment 2 (N = 45)** |
|---|---|---|
| Age | | |
| • 18 – 20 years old | 69% | 17.8% |
| • 21 – 25 years old | 31% | 82.2% |

| | | |
|---|---|---|
| Gender<br>• Male<br>• Female | <br>21.1%<br>78.9% | <br>26.7%<br>73.3% |
| Hours Spent on the Internet<br>• 0 – 4 hours<br>• 5 – 10 hours<br>• 11 – 20 hours<br>• > 20 hours | <br>28.2%<br>38%<br>21.1%<br>12.7% | <br>42.2%<br>31.1%<br>11.1%<br>15.6% |
| Prior Experience with Avatars on the Internet<br>• Yes<br>• No | <br>49.3%<br>50.7% | <br>53.3%<br>46.7% |
| Knowledge of and Attitude to Avatars on the Internet<br>• New to Me<br>• Relevant<br>• Irrelevant<br>• Not Bothered | <br>57.7%<br>36.6%<br>1.4%<br>4.2% | <br>62.2%<br>33.3%<br>2.2%<br>2.2% |

Table 5.0: Demographic Summary

## 5.3 Investigations for the Analysis of Data

The data relevant to all the research questions presented in Figure 3.4 are analysed and reported in this section. The framework of analysis presented in Section 3.9 provided the necessary steps for this data analysis. Section 5.4 to 5.8, which follow, deal with Research Questions R1 to R4 respectively. In each section, the results from the data analysis are preceded by a table which gives an overview of:

- the research question to which the test is related to
- the procedures required to analyse the data
- the statistical test options available
- the statistical test used

## 5.4 Research Question 1: Are students motivated to learn when an avatar is applied in a conventional learning environment, in Experiment 1 and Experiment 2?

| Research Question | Analysis Framework | | |
|---|---|---|---|
| | **Step 1** | **Step 2** | **Step 3** |
| RQ1 | Procedure 1 & Procedure 2 | Option 2 | Kruskal-Wallis test, Mann-Whitney test |

Table 5.1: Analysis Framework for Research Question 1

### 5.4.1 Step 1: Test of Normality

The procedures for the Test of Normality were presented in Section 3.9. These are frequency distribution, skew and kurtosis.

#### 5.4.1.1 Procedure 1: Frequency Distribution (Histogram)

The distribution of the data from RQ1 in Experiment 1 and Experiment 2 are shown in Figure 5.6 and Figure 5.7 respectively. Both histograms indicate that the data was not normally distributed.

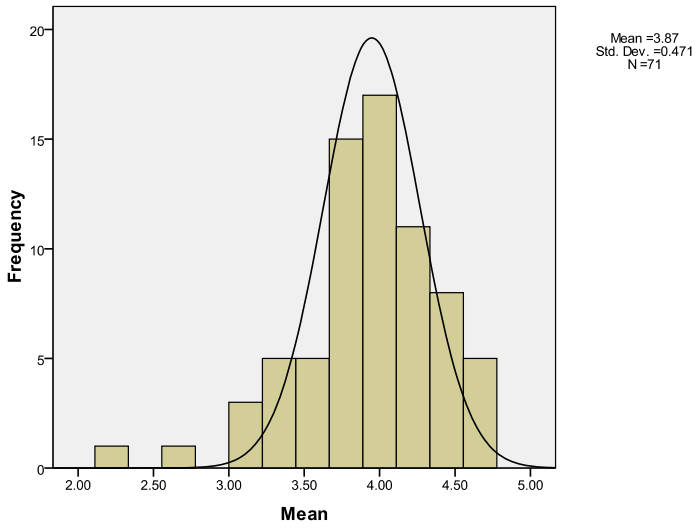


Figure 5.6: Histogram for Motivation to Learn – Experiment 1

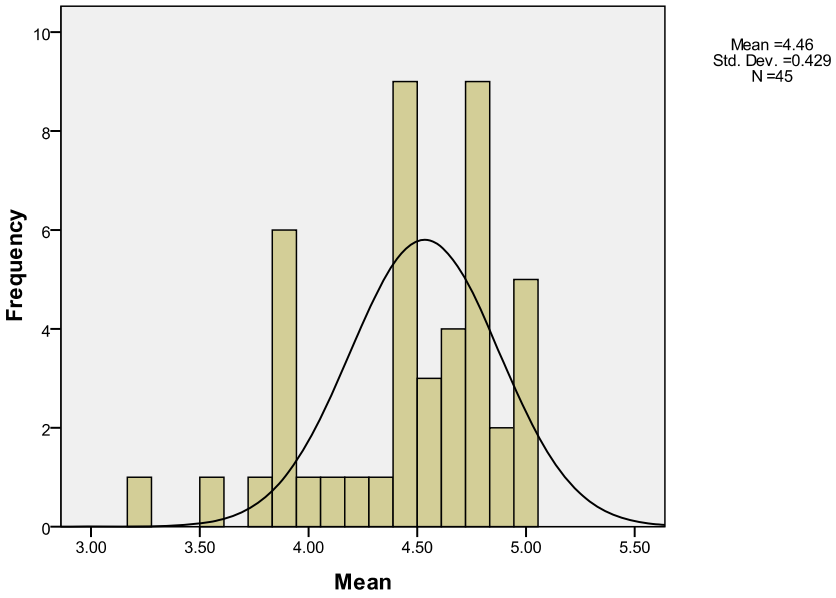


Figure 5.7: Histogram for Motivation to Learn – Experiment 2

#### 5.4.1.2 Procedure 2: Skew & Kurtosis

As stated in Section 3.6.2.1.2, a standard normal distribution is shown by a skew value of zero and a kurtosis value of three. The data relevant to RQ1 has a skew of -0.836 and a kurtosis of 1.667, meaning that neither reached the baseline values. Therefore, the distribution of data for motivation to learn when an avatar is applied in a conventional learning environment in Experiment 1 is not normal.

For the data collected from RQ1 in Experiment 2, the value of skew is -0.882 and the value of kurtosis is 0.245, which means that neither value reached the baseline value. Therefore, the data for motivation to learn when an avatar is applied in a conventional learning environment in Experiment 2 are also not normally distributed.

### 5.4.2 Step 2: Identifying the Correct Statistics Test

The results from Section 5.4.1 are summarised in Table 5.2.

| | **Frequency Distribution (Histogram)** | **Skew & Kurtosis** |
|---|---|---|
| Experiment 1 | Not Normal | Not Normal |
| Experiment 2 | Not Normal | Not Normal |

Table 5.2: Test of Normality Summary for Motivation to learn when an avatar is applied in a conventional learning environment

Based on the summary given in Table 5.2, it was decided to use a non-parametric statistics test for analysis. As explained in Section 3.6.2.2, a non-parametric test should be selected if the distribution of the data is not normal. Because the data from Experiment 1 involved three groups of respondents, the non-parametric statistics test used for analysing this data was the Kruskal-Wallis test. The non-parametric Mann-Whitney test is appropriate for analysing the data from Experiment 2, which involved two groups of respondents.

### 5.4.3 Step 3: Analysis of Data

This is a final step in the Analysis Framework depicted in Section 3.9. Section 5.4.2 explained why the Kruskal-Wallis and Mann-Whitney tests should be used and this section reports their results for the research questions presented in Figure 3.4.

#### 5.4.3.1 RQ1.1: Are students motivated to learn when a human character avatar is applied in a conventional learning environment?

In the Motivation Inventory (MI) depicted from Figure 3.2, there were 9 questions relating to students' perception of motivation to learn. The results for students' perception of motivation to learn when a human character avatar is applied in a conventional learning environment are shown in Table 5.3.

| | **Human Character Avatar** | |
|---|---|---|
| | **Experiment 1** | **Experiment 2** |
| **Disagree** | 0% | 0% |
| **Neutral** | 54.2% | 17.1% |
| **Agree** | 45.8% | 82.9% |
| **Total** | **24** | **35** |

Table 5.3: Results for Research Question 1.1

From Table 5.3, it can be seen that 45.8% of participants in Experiment 1 and 82.9% of participants in Experiment 2 agreed that they were motivated to learn when a human character avatar was applied to their learning environment.

Table 5.3 also shows that most (54.2%) of the participants in Experiment 1 but only 17.1% of participants in Experiment 2 were neutral, that is, neither positive nor negative, about their motivation to learn when a human character avatar was applied in their learning environment.

Surprisingly, no participant in either experiment gave a negative response on this issue.

#### 5.4.3.2 RQ1.2: Are students motivated to learn when a text avatar is applied in a conventional learning environment?

The MI contained 9 questions about students' perception of motivation to learn. The students' perception of their motivation to learn when a text avatar was applied in a learning environment is shown in Table 5.4.

| | **Text Avatar** | |
|---|---|---|
| | **Experiment 1** | **Experiment 2** |
| **Disagree** | 8.3% | 0% |
| **Neutral** | 45.8% | 30% |
| **Agree** | 45.8% | 70% |
| **Total** | **24** | **10** |

Table 5.4: Results for Research Question 1.2

Table 5.4 shows that 45.8% of participants in Experiment 1 who owned a text avatar and 70.0% of participants in Experiment 2 who owned a text avatar agreed that they were motivated to learn.

Table 5.4 also shows that 45.8% of the participants in Experiment 1 and 30.0% of participants in Experiment 2 could not say whether or not they were motivated.

8.3% of the participants with a text avatar in Experiment 1, and no participants with a text avatar in Experiment 2, said they were not motivated to learn.

#### 5.4.3.3 RQ1.3: Are students motivated to learn when there is no avatar in a conventional learning environment?

In the MI, there were 9 questions about students' perception of their motivation to learn. The results of the students' answers about their perception of motivation to learn when no avatar is given are shown in Table 5.5.

| | No Avatar | |
|---|---|---|
| | **Experiment 1** | **Experiment 2** |
| **Disagree** | 0% | Not Applicable |
| **Neutral** | 43.5% | |
| **Agree** | 56.5% | |
| **Total** | **23** | |

Table 5.5: Results for Research Question 1.3

Table 5.5 shows that, despite not being given an avatar, 56.5% of participants in the non-avatar group agreed that they were motivated to learn. However, 43.5% of the participants were not able to decide whether or not they were motivated to learn. None of the participants thought that they were not motivated to learn.

#### 5.4.3.4 RQ1.4: Is there any difference between the groups in their motivation to learn?

From the Kruskal-Wallis test, the results of $H = 2.279$ (2, $N = 71$), $p > 0.05$ ($p = 0.320$) indicated that there was no significant difference among the three groups. Therefore, no group in Experiment 1 had significantly different perceptions of their motivation to learn, regardless of possessing a human character avatar, a text avatar or no avatar.

Analysis of the data on students' perception of their motivation to learn in Experiment 2, produced the Mann-Whitney *U*-test scores of $U = 162.000$, $n1 = 35$, $n2 = 10$, $p = 0.720$. This result indicates that the human character avatar and the text avatar groups were not significantly different, ($p > 0.05$) in their perceptions of their motivation to learn.

### 5.4.4 Section Summary

This section has presented all the results to answer the research questions listed in Figure 3.4. These results related to the relevant research questions, are summarised in Table 5.6.

| Research Question | | Results | |
|---|---|---|---|
| | | Experiment 1 | Experiment 2 |
| RQ1.1 | Are students motivated to learn when a human character avatar is applied in a conventional learning environment? | 45.8% (Agree) | 82.9% (Agree) |
| RQ1.2 | Are students motivated to learn when a text avatar is applied in a conventional learning environment? | 45.8% (Agree) | 70.0% (Agree) |
| RQ1.3 | Are students motivated to learn when there was no avatar is applied in a conventional learning environment? | 56.5% (Agree) | Not Applicable |
| RQ1.4 | Is there any difference between the groups in their motivation to learn? | Not Significant | Not Significant |

Table 5.6: Research Question 1 Results Summary

## 5.5 Research Question 2: Are students motivated to view their avatar when an avatar is applied in a conventional learning environment, in Experiment 1 and Experiment 2?

| Research Question | Analysis Framework | | |
|---|---|---|---|
| | Step 1 | Step 2 | Step 3 |
| RQ2 | Procedure 1 & Procedure 2 | Option 2 | Mann-Whitney tests, Spearman's Correlation test |

Table 5.7: Analysis Framework for Research Question 2

### 5.5.1 Step 1: Test of Normality

#### 5.5.1.1 Procedure 1: Frequency Distribution (Histogram)

The distribution of the data from RQ2 in Experiment 1 and Experiment 2 is shown in Figure 5.8 and Figure 5.9 respectively. Both histograms indicate that the data is not normally distributed.

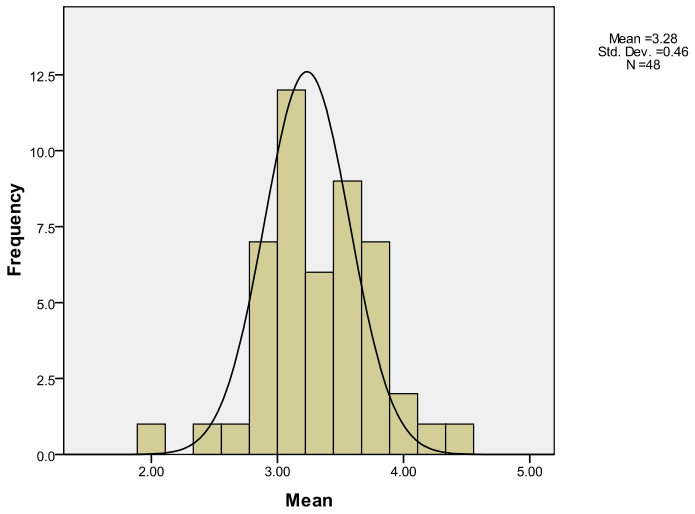


Figure 5.8: Histogram for Motivation to view an Avatar – Experiment 1

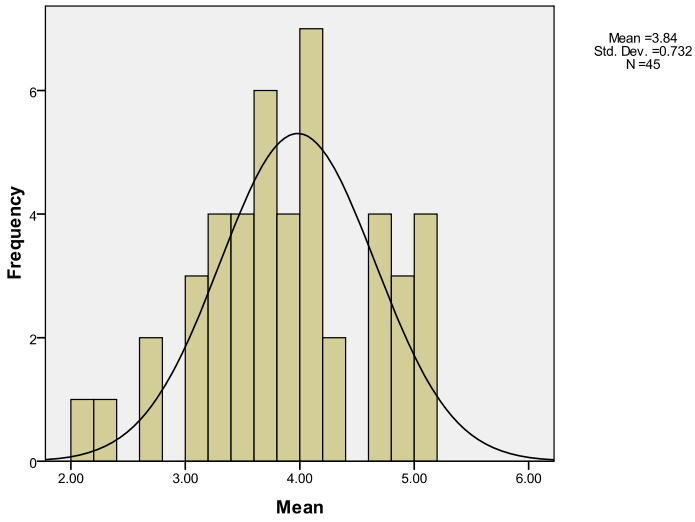


Figure 5.9: Histogram for Motivation to view an Avatar – Experiment 2

#### 5.5.1.2 Procedure 2: Skew & Kurtosis

As explained in Section 3.6.2.1.2, a standard normal distribution has a skew value of zero and a kurtosis value of three. Here, the skew value is 0.045 and the kurtosis value is 0.656 and neither reached the baseline value. Therefore, it can be concluded that the data for motivation to view an avatar when an avatar is applied in a conventional learning environment are not normally distributed.

In Experiment 2, the skew is -0.196 and the kurtosis is -0.360. These results mean that the baseline value for skew and kurtosis was not reached. Therefore, it can be concluded that the data for motivation to view an avatar when an avatar is applied in a conventional learning environment are not normally distributed.

### 5.5.2 Step 2: Identifying the Correct Statistics Test

The results from Section 5.5.1 are summarised in Table 5.8.

| | **Frequency Distribution (Histogram)** | **Skew & Kurtosis** |
|---|---|---|
| Experiment 1 | Not Normal | Not Normal |
| Experiment 2 | Not Normal | Not Normal |

Table 5.8: Test of Normality Summary – Motivation to view an Avatar

Table 5.8 indicates that a non-parametric statistics test should be used for analysis. This decision was based on the fact that all the Test of Normality results show that the data for motivation to view an avatar when an avatar is applied in a conventional learning environment are not-normally distributed. The Mann-Whitney test and the Spearman Correlation test were used to analyse the data on the two groups of respondents.

### 5.5.3 Step 3: Analysis of Data

This is a final step in the Analysis Framework, as explained in Section 3.9. As indicated in Section 5.5.2, the Mann-Whitney test was used for analysis. In this

section, the analysis results are reported and related to the appropriate research questions presented in Figure 3.4.

### 5.5.3.1 RQ2.1: Are students motivated to view their human character avatar when it is applied in a conventional learning environment?

The MI contained nine questions about students' perception of their motivation to view their avatar. The results for their motivation to view a human character avatar in Experiment 1 and Experiment 2 are shown in Figure 5.10.

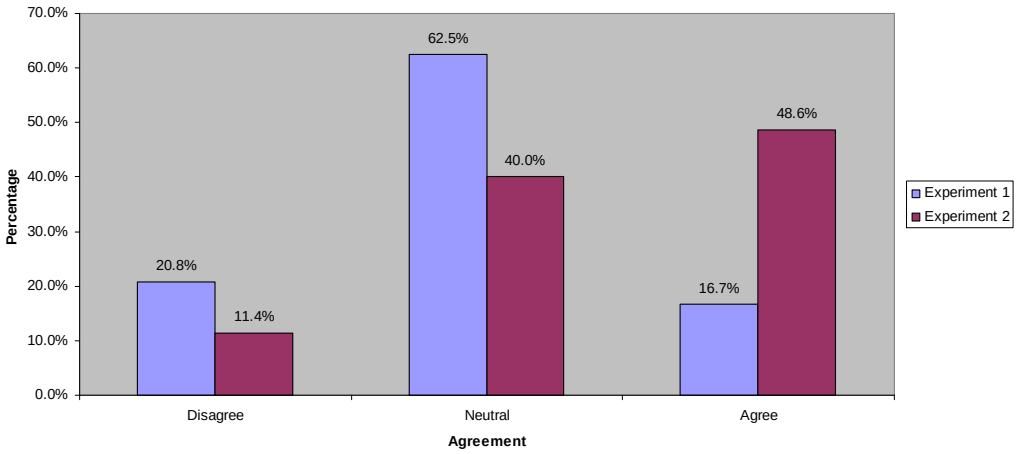


Figure 5.10: Distribution of Students' Motivation to view the Human Character Avatar

Figure 5.10, shows that 16.7% of the students in Experiment 1 and 48.6% of students in Experiment 2 agreed that they were motivated to view their human character avatar. The majority (62.5%) of the students in Experiment 1 and 40.0% of the students in Experiment 2 neither agreed nor disagreed with the statement that they were motivated to view the avatar. 20.8% of the students in Experiment 1 and 11.4% of the students in Experiment 2 reported that they were not motivated to view the human character avatar.

Therefore, from Figure 5.10, it can be inferred that students in Experiment 2 are more motivated to view their human character avatar than were students in Experiment 1.

### 5.5.3.2 RQ2.1.1: Do students enjoy viewing their human character avatar?

The MI contains three questions asking students if they enjoyed viewing their human character avatar. The results are shown in Figure 5.11.

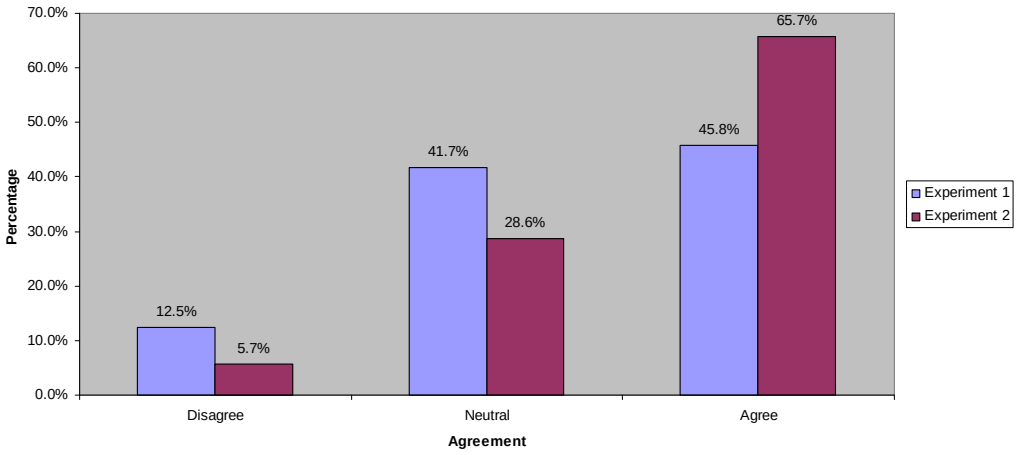


Figure 5.11: Distribution of Students' Enjoyment in viewing their Human Character Avatar

Figure 5.11 shows that 45.8% of the students in Experiment 1 and 65.7% of the students in Experiment 2 enjoyed viewing their human character avatar. Therefore, overall, the students in Experiment 2 enjoyed viewing their human character avatar more than did students in Experiment 1.

### 5.5.3.3 RQ2.1.2: Do students put some effort into viewing their human character avatar?

The MI contains three questions about the students' effort in viewing their human character avatar. The results of their answers are shown in Figure 5.12.

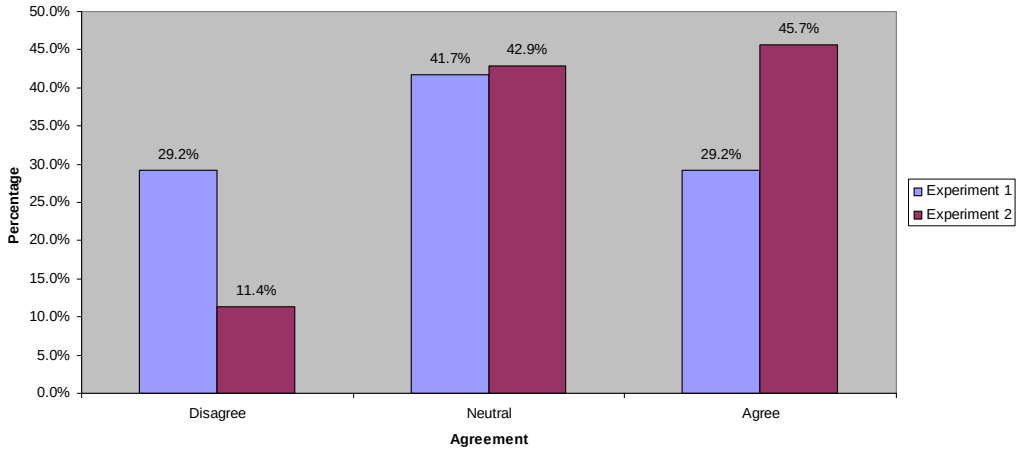


Figure 5.12: Distribution of Students' Effort to view their Human Character Avatar

Figure 5.12 shows that 29.2% of the students in Experiment 1 and 45.7% of the students in Experiment 2 believed they made an effort to view their human character avatar. Therefore, it can be inferred that more students in Experiment 2 than students in Experiment 1 put effort into viewing their human character avatar.

#### 5.5.3.4 RQ2.1.3: Do students value their human character avatar?

The MI contains three questions about the value that the students put on their human character avatar. The results of their answers are shown in Figure 5.13.

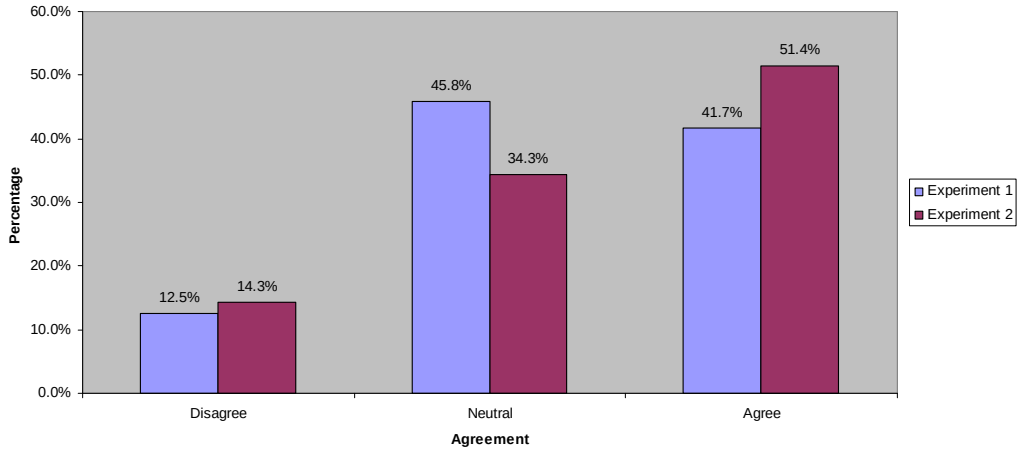


Figure 5.13: Distribution of The Value of Human Character Avatar to Students

Figure 5.13 shows that 41.7% of the students in Experiment 1 and 51.4% of the students in Experiment 2 valued their human character avatar. Thus, a large percentage of the students in both experiments valued their human character avatar in their learning environment.

### 5.5.3.5 RQ2.1.4: Is there any relationship between students' motivation to view their human character avatar and their motivation to learn?

The Spearman's Correlation test shows that there is a significant relationship in Experiment 2 between the motivation to view the human character avatar and motivation to learn, with $r_s = 0.428$, $p < 0.05$ ($p = 0.010$). However, the same results does not apply to Experiment 1, where no significant relationship found between the two variables, with $r_s = 0.168$, $p > 0.05$ ($p = 0.433$).

### 5.5.3.6 RQ2.1.5: Is there any relationship between students' motivation to view their human character avatar and their motivation to personalise it?

The Spearman's Correlation test shows that there is a significant relationship in both Experiment 1 and Experiment 2 between students' motivation to view a human character avatar and their motivation to personalise it, with $r_s = 0.774$, $p < 0.05$ ($p = 0.000$), and $r_s = 0.906$, $p < 0.05$ ($p = 0.000$) respectively.

#### 5.5.3.7 RQ2.2: Are students motivated to view their text avatar when it is applied in a conventional learning environment?

The MI contained nine questions about students' perception of their motivation to view their text avatar when it is applied in a conventional learning environment. The results for their answers for Experiment 1 and Experiment 2 are shown in Figure 5.14.

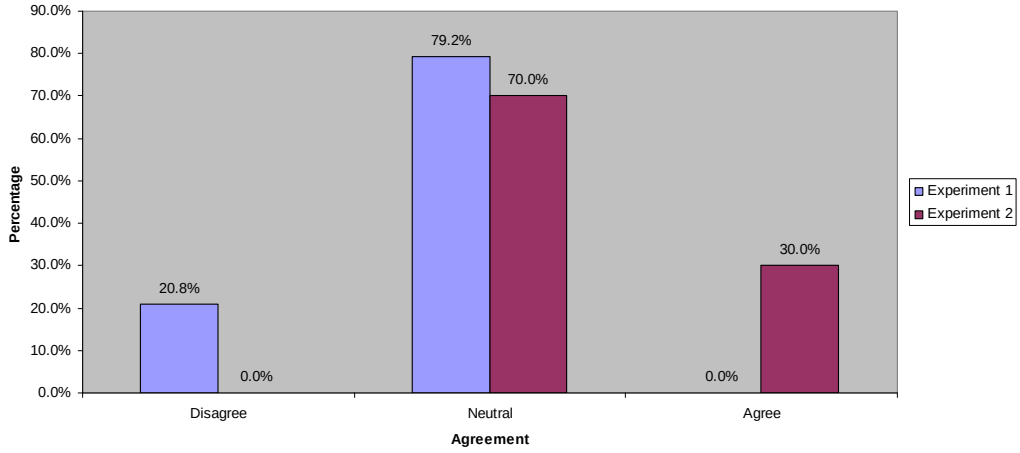


Figure 5.14: Distribution of Students' Motivation to view the Text Avatar

Figure 5.14 shows that none of the students in Experiment 1 and 30.0% of the students in Experiment 2 agreed that they were motivated to view their text avatar. The majority (79.2%) of the students in Experiment 1 and 70.0% of the students in Experiment 2, neither agreed nor disagreed that they were motivated to view their text avatar. 20.8% of the students in Experiment 1 but none of the students in Experiment 2 said that they were not motivated to view their text avatar in a learning environment.

Thus, the majority of the students in both Experiment 1 and Experiment 2 were neutral about their motivation to view their text avatar in a learning environment.

### 5.5.3.8 RQ2.2.1: Do students enjoy viewing their text avatar?

The MI contains three questions about the students' enjoyment of viewing their text avatar. The results of their answers are shown in Figure 5.15.

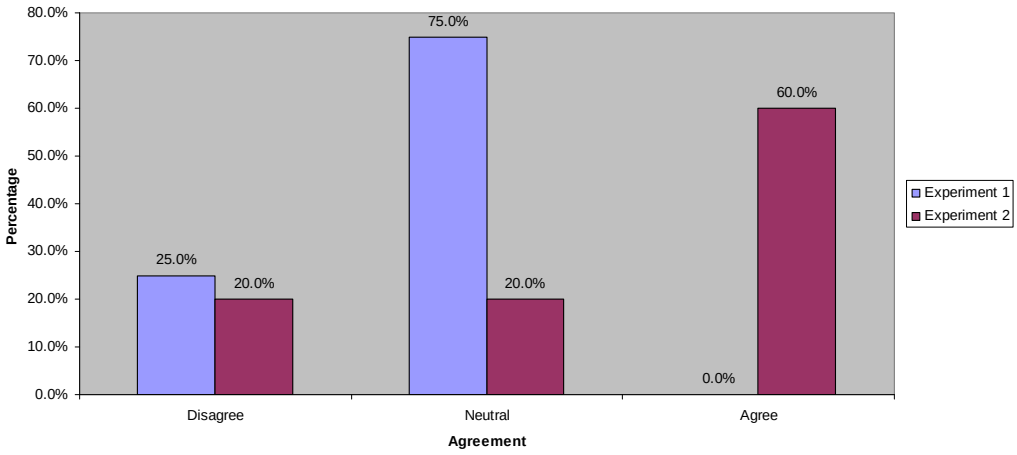


Figure 5.15: Distribution of Students' Enjoyment of viewing their Text Avatar

Figure 5.15 shows that no students in Experiment 1 and 60.0% of the students in Experiment 2 enjoyed viewing their text avatar. Thus, the majority of the students in Experiment 2 enjoyed viewing their text avatar but their feelings were not shared by those students in Experiment 1.

### 5.5.3.9 RQ2.2.2: Do students put some effort into viewing their text avatar?

The MI contains three questions about the effort that the students put into viewing their text avatar. The results of their answers are shown in Figure 5.16.

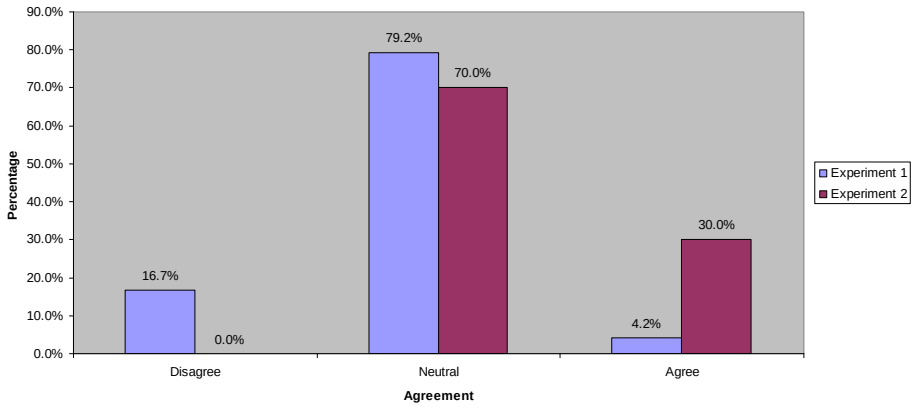


Figure 5.16: Distribution of Students Effort to view their Text Avatar

Figure 5.16 shows that 4.2% of the students in Experiment 1 and 30.0% of the students in Experiment 2 reported that they put effort into viewing their text avatar. Thus, overall, the students in Experiment 2 were more likely to put effort into viewing their text avatar than did the students in Experiment 1.

### 5.5.3.10 RQ2.2.3: Do students value their text avatar?

The MI contains three questions about the value that the students place on their text avatar. The results of their answers are shown in Figure 5.17.

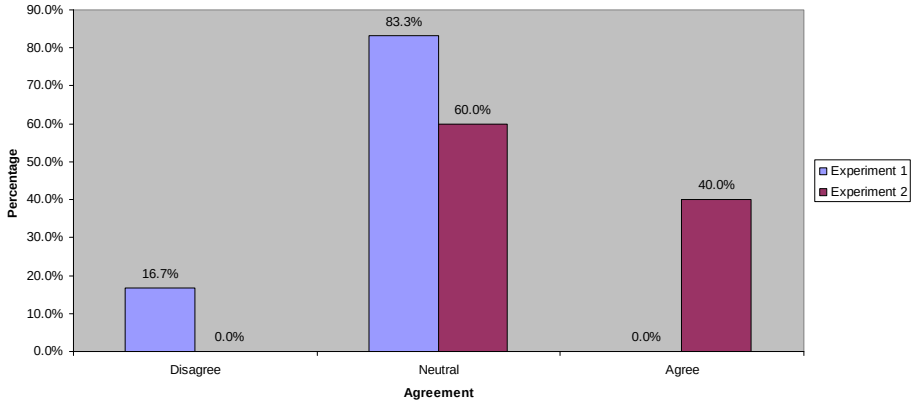


Figure 5.17: Percentage of the Value of Text Avatar to Students

Figure 5.17 shows that no student in Experiment 1 placed any value on his or her text avatar whereas 40.0% of the students in Experiment 2 did so. Thus, overall, the

students in Experiment 2 saw more value in their text avatar than did the students in Experiment 1.

#### 5.5.3.11 RQ2.2.4: Is there any relationship between students' motivation to view their text avatar and their motivation to learn?

The Spearman's Correlation test indicated that there is no significant relationship in either Experiment 1 ($r_s$ = -0.064, p > 0.05) or Experiment 2 ($r_s$ = 0.378, p > 0.05) between the motivation to view a text avatar and motivation to learn.

#### 5.5.3.12 RQ2.3: Is there any difference in students' motivation to view their avatar depending on whether it is a human character avatar or a text avatar?

The Mann-Whitney test results for Experiment 1 showed that there is significant difference between the students' motivation to view a human character avatar and their motivation to use a text avatar, with $U$ = 167.5, n1 = 24, n2 = 24, p = 0.013. Since p < 0.05, the two groups were significantly different.

However, no significant difference was found in Experiment 2 between these two kinds of avatar, with $U$ = 158.500, n1 = 35, n2 = 10, p = 0.652.

### 5.5.4 Section Summary

This section has presented all the results to answer the questions listed in Figure 3.4. The results and the research questions to which they relate are summarised in Table 5.9.

| Research Question | | Results | |
|---|---|---|---|
| | | **Experiment 1** | **Experiment 2** |
| **RQ2.1** | Are students motivated to view their human character avatar when it is applied in a conventional learning environment? | 16.7% (Agree) | 48.6% (Agree) |
| RQ2.1.1 | Do students enjoy viewing their human character avatar? | 45.8% (Agree) | 65.7% (Agree) |
| RQ2.1.2 | Do students put some effort into viewing their human character avatar? | 29.2% (Agree) | 45.7% (Agree) |
| RQ2.1.3 | Do students value their human character avatar? | 41.7% (Agree) | 51.4% (Agree) |
| RQ2.1.4 | Is there any relationship between students' motivation to view their human character avatar and their motivation to learn? | Not Significant | Significant |
| RQ2.1.5 | Is there any relationship between students' motivation to view their human character avatar and their motivation to personalise it? | Significant | Significant |
| **RQ2.2** | Are students motivated to view their text avatar when it is applied in a conventional learning environment? | 0.0% (Agree) | 30.0% (Agree) |
| RQ2.2.1 | Do students enjoy viewing their text avatar? | 0.0% (Agree) | 60.0% (Agree) |
| RQ2.2.2 | Do students put some effort into viewing their text avatar? | 4.2% (Agree) | 30.0% (Agree) |
| RQ2.2.3 | Do students value their text avatar? | 0.0% (Agree) | 40.0% (Agree) |
| RQ2.2.4 | Is there any relationship between students' motivation to view their text avatar and their motivation to learn? | Not Significant | Not Significant |
| **RQ2.3** | Is there any difference in students' motivation to view their avatar | Significant | Not SIgnificant |

| | | | |
|---|---|---|---|
| | depending on whether it is a human character avatar or a text avatar? | | |

Table 5.9: Research Question 2 Results Summary

## 5.6 Research Question 3: Are students motivated to personalise their avatar, in Experiment 1 and Experiment 2?

| Research Question | Analysis Framework | | |
|---|---|---|---|
| | **Step 1** | **Step 2** | **Step 3** |
| RQ3 | Procedure 1 & Procedure 2 | Option 2 | Mann-Whitney tests, Spearman's Correlation test |

Table 5.10: Analysis Framework for Research Question 3

### 5.6.1 Step 1: Test of Normality

Chapter 3 explained two procedures for the Test of Normality, namely, frequency distribution, and skew and kurtosis. The following sub-sections report the results of these procedures in relation to Research Question 3.

#### 5.6.1.1 Procedure 1: Frequency Distribution

From 5.18 and Figure 5.19 show the distribution of the data on students' motivation to personalise their avatar in Experiment 1 and Experiment 2 respectively. Both histograms indicate that the data were not normally distributed.

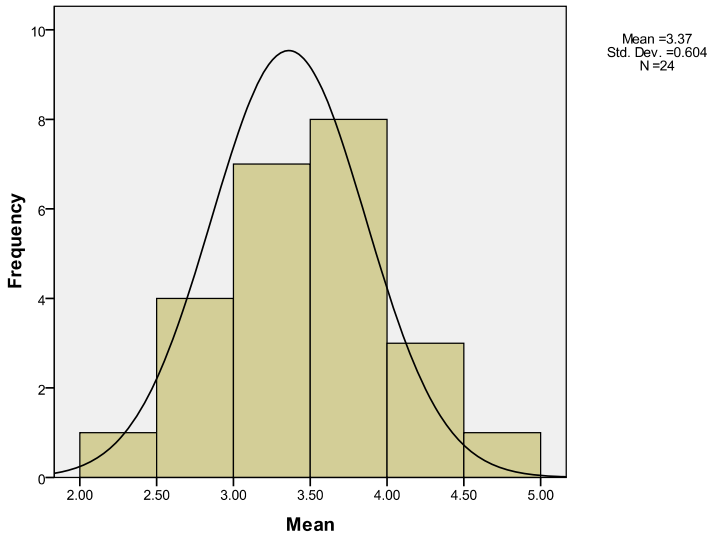


Figure 5.18: Histogram for Motivation to Personalise an Avatar – Experiment 1

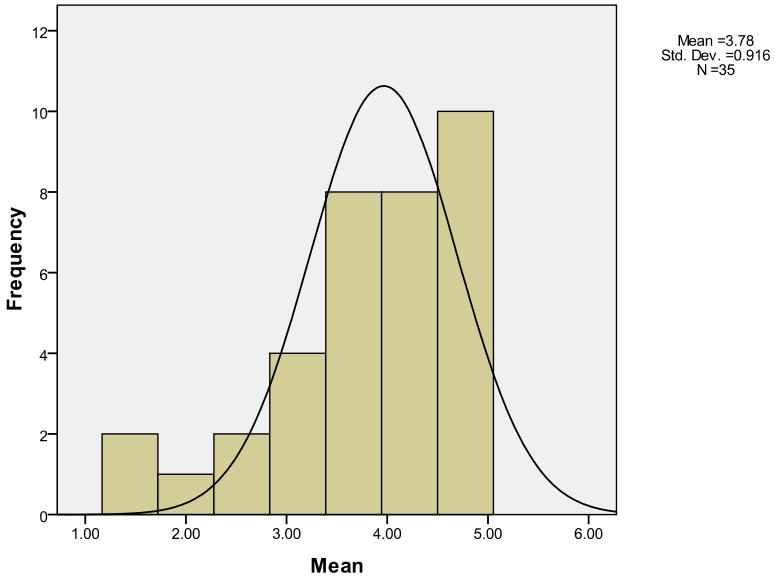


Figure 5.19: Histogram for Motivation to Personalise an Avatar – Experiment 2

#### 5.6.1.2 Procedure 2: Skew & Kurtosis

As explained in Section 3.6.2.1.2, a standard normal distribution has a skew value of zero and a kurtosis value of three. For Experiment 1, skew is -0.027 and kurtosis is -0.288. These results show that the data is not normally distributed and that neither reached the baseline value. Thus, the data for motivation to personalise an avatar in Experiment 1 are not normally distributed.

In Experiment 2, the data has a skew of -0.855 and a kurtosis of 0.471. Neither reaches the baseline value. Thus, the data for motivation to personalise an avatar in Experiment 2 are not normally distributed.

### 5.6.2 Step 2: Identifying the Correct Statistics Test

The results from Section 5.6.1 is summarised in Table 5.11.

| | **Frequency Distribution (Histogram)** | **Skew & Kurtosis** |
|---|---|---|
| Experiment 1 | Not Normal | Not Normal |
| Experiment 2 | Not Normal | Not Normal |

Table 5.11: Test of Normality Summary – Motivation to Personalise an Avatar

Based on the summary given in Table 5.11, a non-parametric test for analysis is indicated. But, because only one group of participants answered this part of the questionnaire, a test such as the Mann-Whitney could not be used. However, the Spearman's Correlation test is used to test the relationship between motivation to personalise an avatar and motivation to learn.

### 5.6.3 Step 3: Analysis of Data

This is a final step in the Analysis Framework, as explained in Section 3.9. Section 5.6.2 explained that the statistics test available for analysis is the Spearman' Correlation test. This section reports the results of that analysis in relation to the research questions presented in Figure 3.4.

### 5.6.3.1 RQ3.1: Are students motivated to personalise their human character avatar?

The MI contained nine questions about students' perception of their motivation to personalise their human character avatar. The results from their answers for Experiment 1 and Experiment 2 are shown in Figure 20.

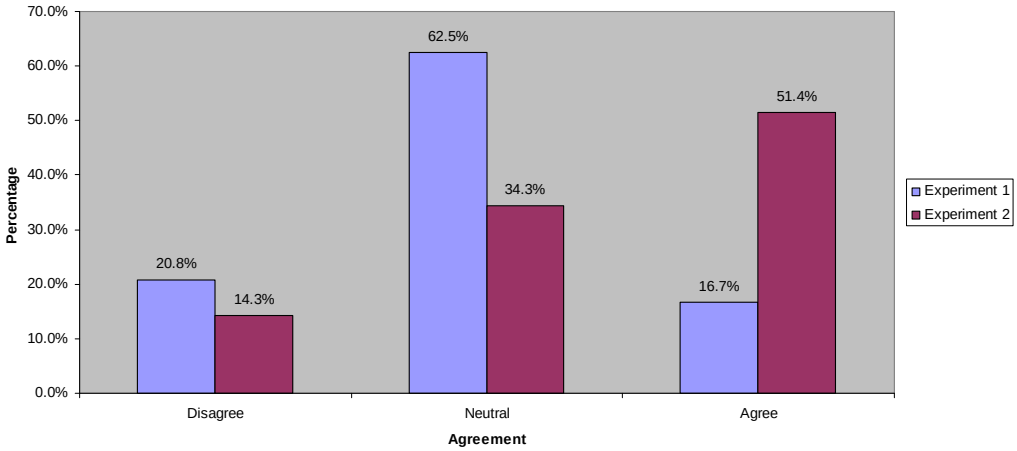


Figure 5.20: Distribution of Students' Motivation to Personalise an Avatar

Figure 5.20 shows that 16.7% of the students in Experiment 1 and 51.4% of the students in Experiment 2 agreed that they were motivated to personalise their human character avatar. However, most of the students (62.5%) in Experiment 1 and 34.3% of the students in Experiment 2 were neither positive nor negative about their motivation to personalise their human character avatar. 20.8% of the students in Experiment 1 and 14.3% of the students in Experiment 2 reported that they were not motivated to personalise their human character avatar.

### 5.6.3.2 RQ3.2: Do students enjoy personalising their human character avatar?

The MI contains three questions asking if the students enjoyed personalising their human character avatar. The results of their answers are shown in Figure 5.21.

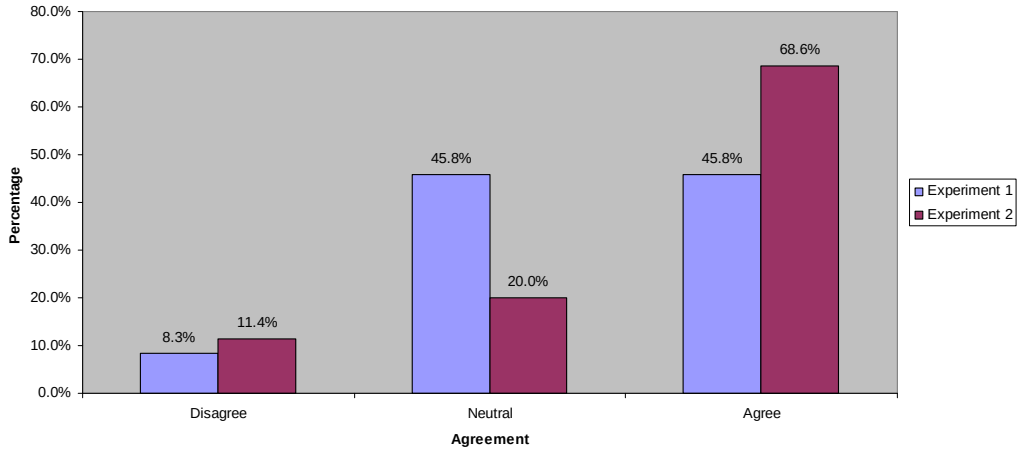


Figure 5.21: Distribution of Students Enjoyment to Personalise their Avatar

Figure 5.21 shows that 45.8% of the students in Experiment 1 and 68.6% of the students in Experiment 2 enjoyed personalising their human character avatar. Thus, more students in Experiment 2 than in Experiment 1 enjoyed their avatar personalisation.

#### 5.6.3.3 RQ3.3: Is there any relationship between students' motivation to personalise their human character avatar and students' motivation to access the Avatar Hall using the AbE environment?

The Spearman's Correlation test shows that there is a significant relationship in both Experiment 1 and Experiment 2 between students' motivation to personalise their human character avatar and their motivation to access the Avatar Hall using the AbE environment, with $r_s = 0.675$, $p < 0.05$ ($p = 0.000$), and $r_s = 0.881$, $p < 0.05$ ($p = 0.000$), respectively.

### 5.6.4 Section Summary

These sections have presented all the results about the students' personalisation of their avatar that are relevant to the questions listed in Figure 3.4. These results are related to those research questions in Table 5.12.

| Research Question | | Results | |
|---|---|---|---|
| | | Experiment 1 | Experiment 2 |
| RQ3.1 | Are students motivated to personalise their avatar? | 16.7% (Agree) | 51.4% (Agree) |
| RQ3.2 | Do students enjoy personalising their human character avatar? | 45.8% (Agree) | 68.6% (Agree) |
| RQ3.3 | Is there any relationship between students' motivation to personalise their human character avatar and their motivation to access the Avatar Hall using the AbE environment? | Significant | Significant |

Table 5.12: Research Question 3 Results Summary

## 5.7 Research Question 4: Are students motivated to access the Avatar Hall using the Attribute-based Environment (AbE) and the Ranking-based Environment (RbE), in Experiment 1 and Experiment 2?

| Research Question | Analysis Framework | | |
|---|---|---|---|
| | Step 1 | Step 2 | Step 3 |
| RQ4 | Procedure 1 & Procedure 2 | Option 2 | Mann-Whitney tests, Spearman's Correlation test |

Table 5.13: Analysis Framework for Research Question 4

### 5.7.1 Step 1: Test of Normality

#### 5.7.1.1 Procedure 1: Frequency Distribution (Histogram)

The distribution of data for students' motivation to access Avatar Hall using AbE or RbE in Experiment 1 and Experiment 2 is shown in Figure 5.22 and Figure 5.23 respectively. Both histograms indicate that the data are not normally distributed.

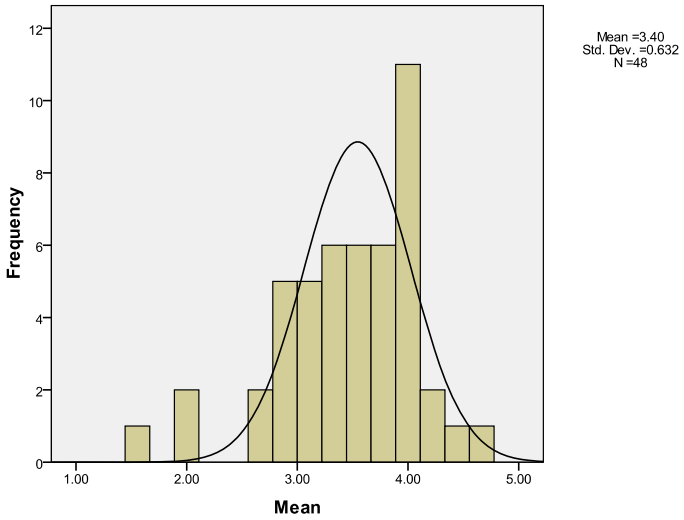


Figure 5.22: Histogram for Motivation to Access an Avatar Environment – Experiment 1

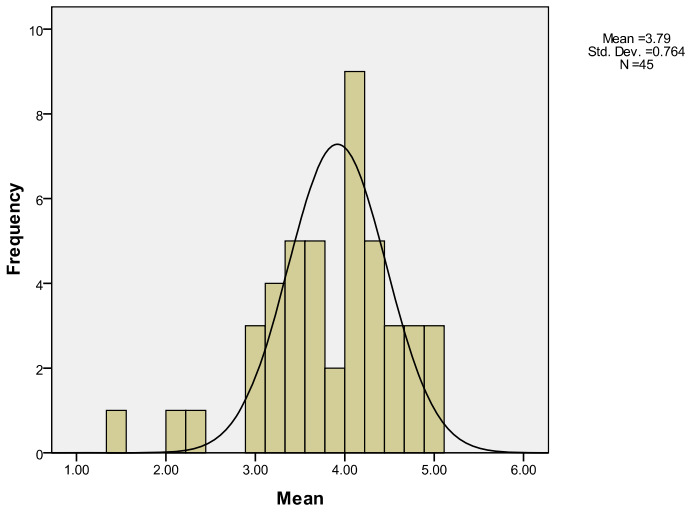


Figure 5.23: Histogram for Motivation to Access an Avatar Environment – Experiment 2

### 5.7.1.2 Procedure 2: Skew & Kurtosis

As stated in Section 3.6.2.1.2, a standard normal distribution has a skew value of zero and a kurtosis value of three. For Experiment 1, the value of skew is -0.823 and the value of kurtosis is 0.826. These results mean that neither skew nor kurtosis reached

the baseline values. Therefore, the data for motivation to access the Avatar Environment are not normally distributed.

For Experiment 2, the value of skew is -0.839 and the value of kurtosis is 1.249. These results do not reach the baseline value for skew and kurtosis. Therefore, the data for motivation to access the Avatar Environment data are not normally distributed.

### 5.7.2 Step 2: Identifying the Correct Statistics Test

The results from Section 5.7.1 are summarised in Table 5.14.

| | **Frequency Distribution (Histogram)** | **Skew & Kurtosis** |
|---|---|---|
| Experiment 1 | Not Normal | Not Normal |
| Experiment 2 | Not Normal | Not Normal |

Table 5.14: Test of Normality Summary – Motivation to Access an Avatar Environment

Based on the summary given in Table 5.14, a non-parametric test should be used for analysis. The Mann-Whitney test, along with the Spearman's Correlation test was chosen.

### 5.7.3 Step 3: Analysis of Data

This is a final step in the Analysis Framework, as explained in Section 3.9. Section 5.5.2 explained that the non-parametric statistics test appropriate for this analysis is the Mann-Whitney test and Spearman's Correlation test. In this section, the results from the analysis are reported according to the research questions presented in Figure 3.4.

### 5.7.3.1 RQ4.1: Are students' motivated to access the Avatar Hall using the Attribute-based Environment (AbE)?

The MI contained nine questions about students' perception of their motivation to access the Avatar Hall using the AbE environment. The results of their answers in Experiment 1 and Experiment 2 are shown in Figure 5.24.

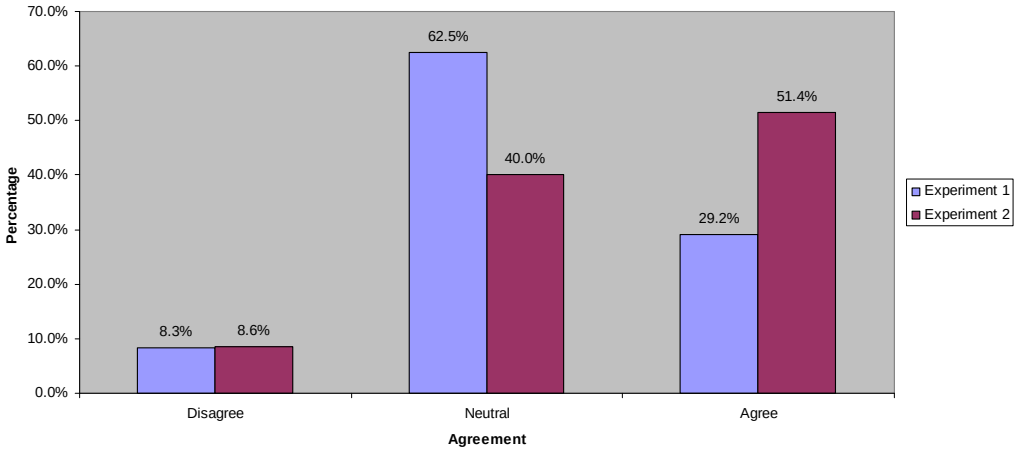


Figure 5.24: Distribution of Students' Motivation to Access the Avatar Hall using the AbE Environment

Figure 5.24 shows that 29.2% of the students in Experiment 1 and 51.4% of the students in Experiment 2 agreed that they were motivated to access the Avatar Hall using the AbE environment. The majority (62.5%) of the students in Experiment 1 and 40.0% of the students in Experiment 2 felt that they were neither motivated nor unmotivated to access the Avatar Hall using the AbE environment. A few students reported that they were not so motivated, and these accounted for 8.3% of the students in Experiment 1 and 8.6% of the students in Experiment 2.

### 5.7.3.2 RQ4.1.1: Do students enjoy accessing the Avatar Hall using the AbE?

The MI contains three questions about students' enjoyment of accessing the Avatar Hall using the AbE environment. The results of their answers are shown in Figure 5.25.

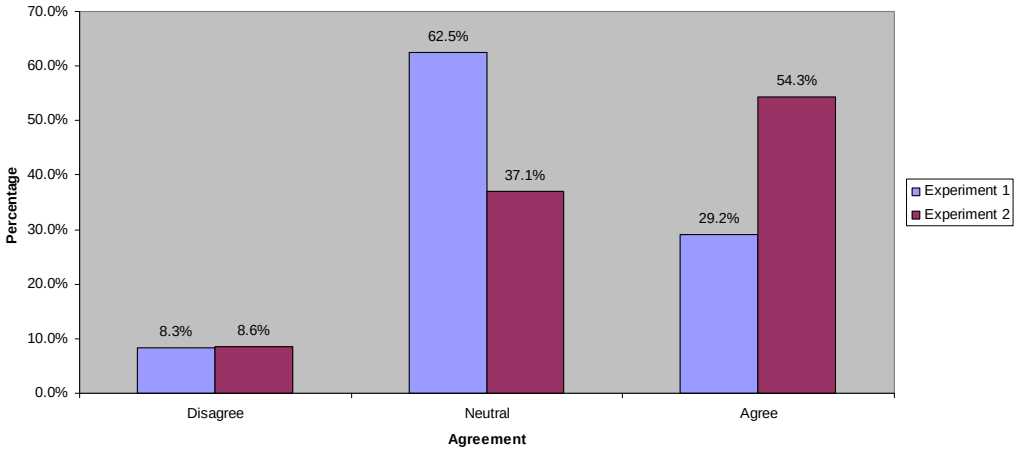


Figure 5.25: Distribution of Students' Enjoyment of Accessing the Avatar Hall using the AbE Environment

Figure 5.25 shows that 8.0% of the students in Experiment 1 and 54.3% of the students in Experiment 2 enjoyed accessing the Avatar Hall using the AbE environment. Thus, more students in Experiment 2 than in Experiment 1 enjoyed accessing the Avatar Hall using the AbE environment.

### 5.7.3.3 RQ4.1.2: Is there any relationship between students' motivation to access the Avatar Hall using the AbE and their motivation to learn?

The Spearman's Correlation test shows that there is a significant relationship in Experiment 2 between students' motivation to access the Avatar Hall using the AbE environment and their motivation to learn, with $r_s = 0.478$, $p < 0.05$ ($p = 0.004$). However, the same result was not found in the correlation test conducted in

Experiment 1. Here, no significant relationship was found, with $r_s = 0.155$, $p > 0.05$ ($p = 0.469$).

#### 5.7.3.4 RQ4.1.3: Is there any relationship between students' motivation to access the Avatar Hall using the AbE and their motivation to view their human character avatar?

The Spearman's Correlation test shows that there is a significant relationship in both Experiment 1 and Experiment 2 between students' motivation to access the Avatar Hall using the AbE environment and their motivation to view their human character avatar, with $r_s = 0.635$, $p < 0.05$ ($p = 0.001$), and $r_s = 0.882$, $p < 0.05$ ($p = 0.000$), respectively.

#### 5.7.3.5 RQ4.2: Are students' motivated to access the Avatar Hall using the Ranking-based Environment (RbE)?

Figure 5.26 shows that 16.7% of the students in Experiment 1 and 50.0% of the students in Experiment 2 were motivated to access the Avatar Hall using the RbE environment. However, most of the students in both experiments were undecided on this issue; this accounted for 50.0% of the students in Experiment 1 and 40.0% of the students in Experiment 2. 33% of the students in Experiment 1 and 10.0% of the students in Experiment 2 said that they were not motivated to access the Avatar Hall using the RbE environment.

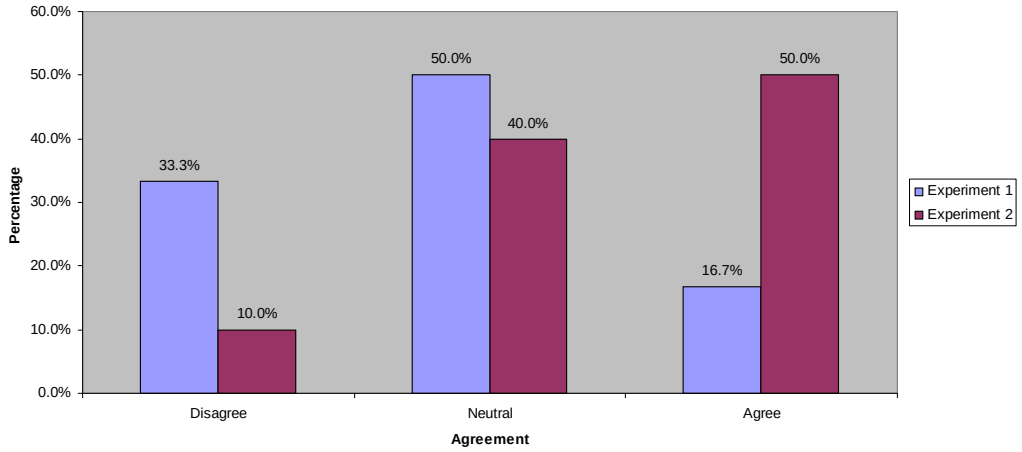


Figure 5.26: Distribution of Students' Motivation to Access the Avatar Hall using the RbE Environment

### 5.7.3.6 RQ4.2.1: Do students enjoy accessing the Avatar Hall using the RbE?

The MI contains three questions about students' enjoyment of accessing the Avatar Hall using the RbE environment. The results of their answers are shown in Figure 5.27.

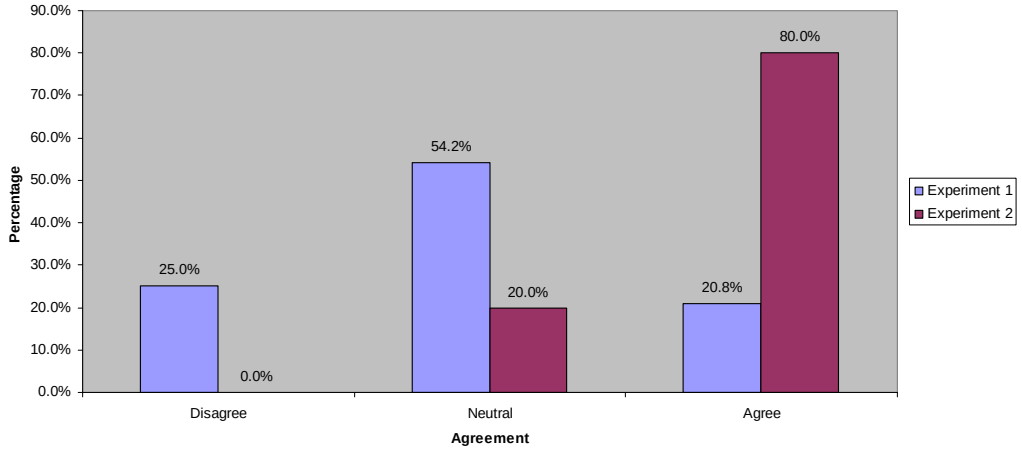


Figure 5.27: Distribution of Students Enjoyment to Access the Avatar Hall using the RbE Environment

Figure 5.27 shows that 20.8% of the students in Experiment 1 and 80.0% of the students in Experiment 2 enjoyed accessing the Avatar Hall using the RbE environment. Thus, many more students in Experiment 2 than in Experiment 1 enjoyed accessing the Avatar Hall using the RbE environment.

#### 5.7.3.7 RQ4.2.2: Is there any relationship between students' motivation to access the Avatar Hall using the RbE and their motivation to learn?

The Spearman's Correlation test shows that there is a significant relationship in both Experiment 1 and Experiment 2 between students' motivation to access the Avatar Hall using the RbE environment and their motivation to learn, with $r_s = 0.486$, $p < 0.05$ ($p = 0.016$), and $r_s = 0.782$, $p < 0.05$ ($p = 0.008$), respectively.

#### 5.7.3.8 RQ4.2.3: Is there any relationship between students' motivation to access the Avatar Hall using the RbE and their motivation to view their text avatar?

The Spearman's Correlation test shows that there is a significant relationship in Experiment 2 between students' motivation to access the Avatar Hall using the RbE environment and their motivation to view their text avatar, with $r_s = 0.681$, $p < 0.05$ ($p = 0.030$). However, the same result was not found in this correlation test for Experiment 1. No significant relationship was found between these two variables in Experiment 1, with $r_s = 0.024$, $p > 0.05$ ($p = 0.913$).

#### 5.7.3.9 RQ4.3: Is there any difference in students' motivation to access the Avatar Hall depending on whether they were using the AbE or the RbE?

The Mann-Whitney test showed that, in Experiment 1, there was no significant difference between students using the AbE and those using the RbE environment in their motivation to access the Avatar Hall, with $U = 241.500$, n1 = 24, n2 = 24, p =

0.336. Thus, the two groups were not significantly different in this respect, with $p > 0.05$.

Similarly, no significant difference was found in Experiment 2 between these two groups on this issue, with $U = 158.000$, n1 = 35, n2 = 10, $p = 0.657$ ($p > 0.05$).

### 5.7.4 Section Summary

The above sections have presented all the results that are relevant to answering the questions listed in Figure 3.4. A summary of these results together with the respective research questions are presented in Table 5.15.

| **Research Question** | | **Results** | |
|---|---|---|---|
| | | **Experiment 1** | **Experiment 2** |
| **RQ4.1** | Are students motivated to access the Avatar Hall using the Attribute-based Environment (AbE)? | 29.2% (Agree) | 51.4% (Agree) |
| RQ4.1.1 | Do students enjoy accessing the Avatar Hall using the AbE? | 8.0% (Agree) | 54.3% (Agree) |
| RQ4.1.2 | Is there any relationship between students' motivation to access the Avatar Hall using the AbE and their motivation to learn? | Not Significant | Significant |
| RQ4.1.3 | Is there any relationship between students' motivation to access the Avatar Hall using the AbE and their motivation to view their human character avatar? | Significant | Significant |
| **RQ4.2** | Are students motivated to access the Avatar Hall using the Ranking-based Environment (RbE)? | 16.7% (Agree) | 50.0% (Agree) |
| RQ4.2.1 | Do students enjoy accessing the Avatar Hall using the RbE? | 20.8% (Agree) | 80.0% (Agree) |

| | | | |
|---|---|---|---|
| RQ4.2.2 | Is there any relationship between students' motivation to access the Avatar Hall using the RbE and their motivation to learn? | Significant | SIgnificant |
| RQ4.2.3 | Is there any relationship between students' motivation to access the Avatar Hall using the RbE and their motivation to view their text avatar? | Not Significant | Significant |
| **RQ4.3** | Is there any difference between students' motivation to access the Avatar Hall depending on whether they are using the AbE or the RbE? | Not Significant | Not Significant |

Table 5.15: Research Question 4 Results Summary

## 5.8 Research Questions Summary

The 'Section Summary' from previous sections has presented all the results that are relevant to answering the questions listed in Figure 3.4. A summary of these results together with the respective research questions are presented in Table 5.16.

| **Research Question** | | **Results** | |
|---|---|---|---|
| | | **Experiment 1** | **Experiment 2** |
| RQ1.1 | Are students motivated to learn when a human character avatar is applied in a conventional learning environment? | 45.8% (Agree) | 82.9% (Agree) |
| RQ1.2 | Are students motivated to learn when a text avatar is applied in a conventional learning environment? | 45.8% (Agree) | 70.0% (Agree) |
| RQ1.3 | Are students motivated to learn when there was no avatar is applied in a conventional learning environment? | 56.5% (Agree) | Not Applicable |
| RQ1.4 | Is there any difference between the groups in their motivation to learn? | Not Significant | Not Significant |

| | | | |
|---|---|---|---|
| **RQ2.1** | Are students motivated to view their human character avatar when it is applied in a conventional learning environment? | 16.7% (Agree) | 48.6% (Agree) |
| RQ2.1.1 | Do students enjoy viewing their human character avatar? | 45.8% (Agree) | 65.7% (Agree) |
| RQ2.1.2 | Do students put some effort into viewing their human character avatar? | 29.2% (Agree) | 45.7% (Agree) |
| RQ2.1.3 | Do students value their human character avatar? | 41.7% (Agree) | 51.4% (Agree) |
| RQ2.1.4 | Is there any relationship between students' motivation to view their human character avatar and their motivation to learn? | Not Significant | Significant |
| RQ2.1.5 | Is there any relationship between students' motivation to view their human character avatar and their motivation to personalise it? | Significant | Significant |
| **RQ2.2** | Are students motivated to view their text avatar when it is applied in a conventional learning environment? | 0.0% (Agree) | 30.0% (Agree) |
| RQ2.2.1 | Do students enjoy viewing their text avatar? | 0.0% (Agree) | 60.0% (Agree) |
| RQ2.2.2 | Do students put some effort into viewing their text avatar? | 4.2% (Agree) | 30.0% (Agree) |
| RQ2.2.3 | Do students value their text avatar? | 0.0% (Agree) | 40.0% (Agree) |
| RQ2.2.4 | Is there any relationship between students' motivation to view their text avatar and their motivation to learn? | Not Significant | Not Significant |
| **RQ2.3** | Is there any difference in students' motivation to view their avatar depending on whether it is a human character avatar or a text avatar? | Significant | Not Significant |

| | | | |
|---|---|---|---|
| RQ3.1 | Are students motivated to personalise their avatar? | 16.7% (Agree) | 51.4% (Agree) |
| RQ3.2 | Do students enjoy personalising their human character avatar? | 45.8% (Agree) | 68.6% (Agree) |
| RQ3.3 | Is there any relationship between students' motivation to personalise their human character avatar and their motivation to access the Avatar Hall using the AbE environment? | Significant | Significant |
| **RQ4.1** | Are students motivated to access the Avatar Hall using the Attribute-based Environment (AbE)? | 29.2% (Agree) | 51.4% (Agree) |
| RQ4.1.1 | Do students enjoy accessing the Avatar Hall using the AbE? | 8.0% (Agree) | 54.3% (Agree) |
| RQ4.1.2 | Is there any relationship between students' motivation to access the Avatar Hall using the AbE and their motivation to learn? | Not Significant | Significant |
| RQ4.1.3 | Is there any relationship between students' motivation to access the Avatar Hall using the AbE and their motivation to view their human character avatar? | Significant | Significant |
| **RQ4.2** | Are students motivated to access the Avatar Hall using the Ranking-based Environment (RbE)? | 16.7% (Agree) | 50.0% (Agree) |
| RQ4.2.1 | Do students enjoy accessing the Avatar Hall using the RbE? | 20.8% (Agree) | 80.0% (Agree) |
| RQ4.2.2 | Is there any relationship between students' motivation to access the Avatar Hall using the RbE and their motivation to learn? | Significant | Significant |

| | | | |
|---|---|---|---|
| RQ4.2.3 | Is there any relationship between students' motivation to access the Avatar Hall using the RbE and their motivation to view their text avatar? | Not Significant | Significant |
| **RQ4.3** | Is there any difference between students' motivation to access the Avatar Hall depending on whether they are using the AbE or the RbE? | Not Significant | Not Significant |

Table 5.16: Research Question Results Summary

Table 5.16 indicates that this research was conducted in two experiments: experiment 1 and experiment 2. In general, this research has answered all the objectives stated in Section 1.3.1 – 1.3.4. For example, in Section 1.3.1, the objective is 'To investigate students' motivation to learn when the use of an avatar is applied in the CLE environment.' Four research questions were presented to answer this objective. These research questions can be found as RQ1.1 – RQ1.4 in Table 5.16.

## 5.9 Responses from an Open-Ended Question

In this section the students' responses from an open-ended question were presented. There were a small number of students willing to answer this question. Students' responses for both experiment 1 and experiment 2 can be found in Table 5.17 and Table 5.18.

| Participant | Feedback |
|---|---|
| Student 1 | In my opinion, an avatar not able to undermine students motivation to learning because learning offers credit hours whereas an avatar was more to system that providing motivation. |
| Student 2 | Students need to give more attention to learning in order to perform well on assessment. |
| Student 3 | An avatar is still new as one of a factor of motivation. However, I believe the avatar can be improved in term of its exposure and facility provided such as the internet connection. Some of my |

| | |
|---|---|
| | friends commented that they still believe of their conventional ways of learning (without having an avatar alongside learning activities). They also worried that having an avatar would took their time and therefore a burden to them. |
| Student 4 | I think that the education system has driven us, students, into the way we are now. We are more interested in what we can gain on the spot than to spend time on something we don't know. The avatar in my opinion doesn't benefit us in term of academic achievement. We can't see the result of applying the use of avatar in our daily life; therefore neglect the use of it. |
| Student 5 | Having an avatar has given me positive effect to my learning besides learning itself. Avatar motivates me to become more committed to attend lecture and tutorial. However, due to time constraint and inability to access the internet has made me and my friends not to use and explore the avatar. |

Table 5.17 Students' Responses on an Avatar and Learning - Experiment 1

| **Participant** | **Feedback** |
|---|---|
| Student 1 | This system is very interesting. We can enjoy our avatar and at the same time improve our knowledge by answering all the questions in Morpheus. |
| Student 2 | The idea of having an avatar in the learning activity is a good concept. It allows me to answer the questions in Morpheus and get a point for my avatar. |
| Student 3 | Thank you for choosing us to participate in this study. I like to play this game. |
| Student 4 | I like to play this game. I will collect as many points as possible for personalising my avatar, such as to buy my avatar a new cloth and other accessories. |
| Student 5 | Thank you for providing such a fun game. I don't like to play a computer game but surprisingly this one particular game is exceptional. |

| | |
|---|---|
| Student 6 | I like to use the Avatar Hall. It makes everyone of us to login to Morpheus and do the forum and quiz. |

Table 5.18: Students' Responses on an Avatar and Learning – Experiment 2

## 5.10 Results based on the Usage of the Avatar Hall System

In this section the students' activity within the Avatar Hall system using the Attribute-based Environment (AbE) and the Ranking-based Environment (RbE) for Experiment 1 and Experiment 2 are presented. This activity was collected automatically by the system. The ability to trace students' usage of the Avatar Hall system is important in order to support the findings from statistical analysis. In this research, this data is known as a secondary data, besides the primary data which is generated from the questionnaire.

The results based on the usage of the Avatar Hall are divided into two subsections as follows.

### 5.10.1 The Trend of Log-ins to the Avatar Hall using the Attribute-based Environment

24 students in Experiment 1 and 35 students in Experiment 2 were registered to use the system. The trend for log-ins to the Avatar Hall using the AbE environment for both experiment 1 and experiment 2 is depicted by the scatter graph shown in Figure 5.28 and Figure 5.29. In both figures, students are designated according to their login's frequency from the highest to the lowest.

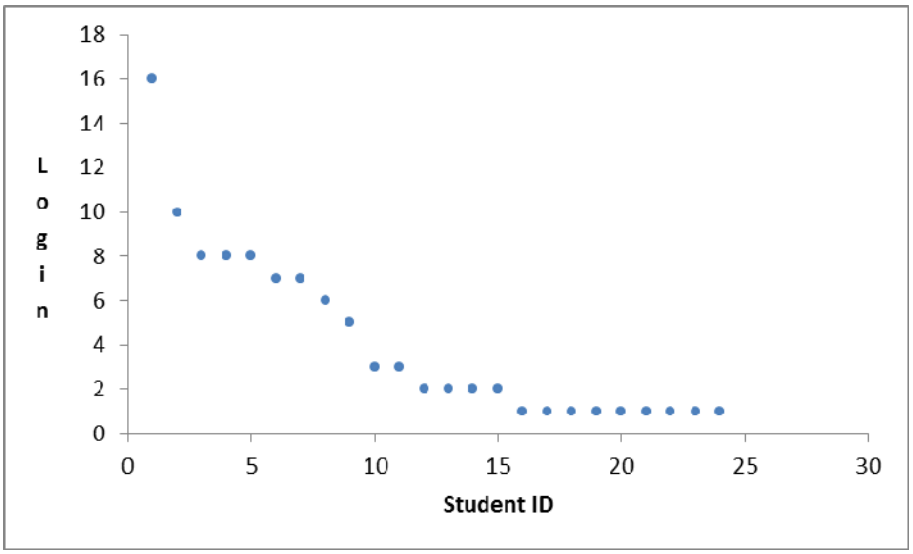


Figure 5.28: Usage of the Avatar Hall System using AbE Environment for Experiment 1

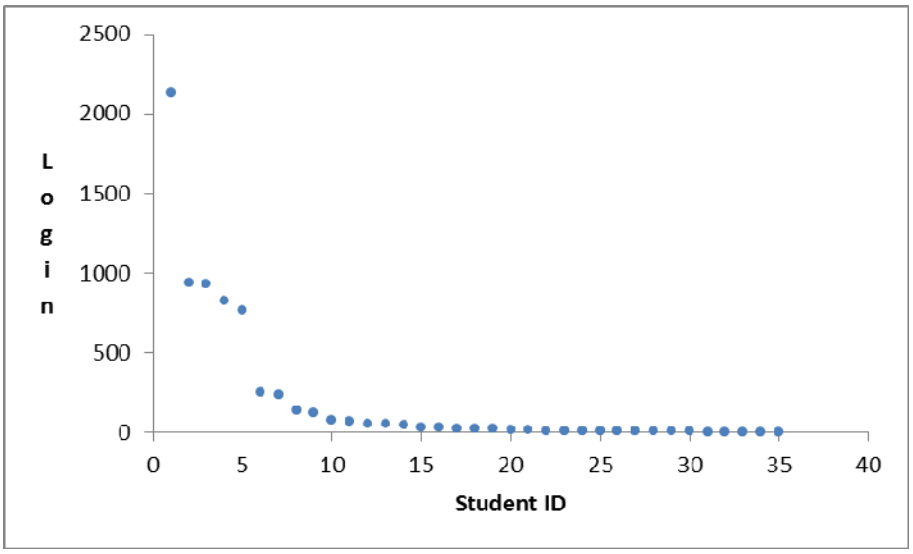


Figure 5.29: Usage of the Avatar Hall System using AbE Environment for Experiment 2

In Figure 5.28 and Figure 5.29 shows that every student with a human character avatar in Experiment 1 and Experiment 2 logged-in at least once. The largest number of log-ins by any students was 16 in Experiment 1 and 2,132 in Experiment 2.

### 5.10.2 The Trend of Log-ins to the Avatar Hall using the Ranking-based Environment

24 students in Experiment 1 and 10 students in Experiment 2 who were registered to use the system with the RbE environment. The trend of log-ins to the Avatar Hall using the RbE environment for both experiment 1 and experiment 2 is depicted by the scatter graph shown in Figure 5.30 and Figure 5.31. In both figures, students are designated according to their login's frequency from the highest to the lowest.

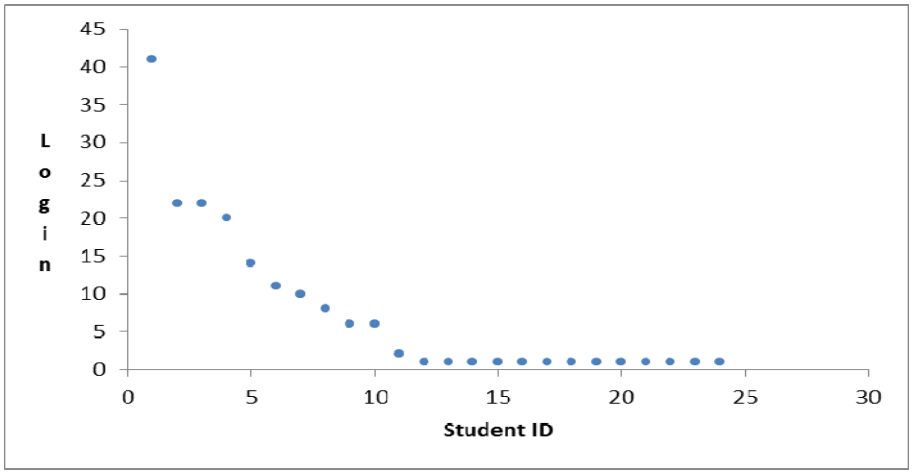


Figure 5.30: Usage of the Avatar Hall System using RbE Environment for Experiment 1

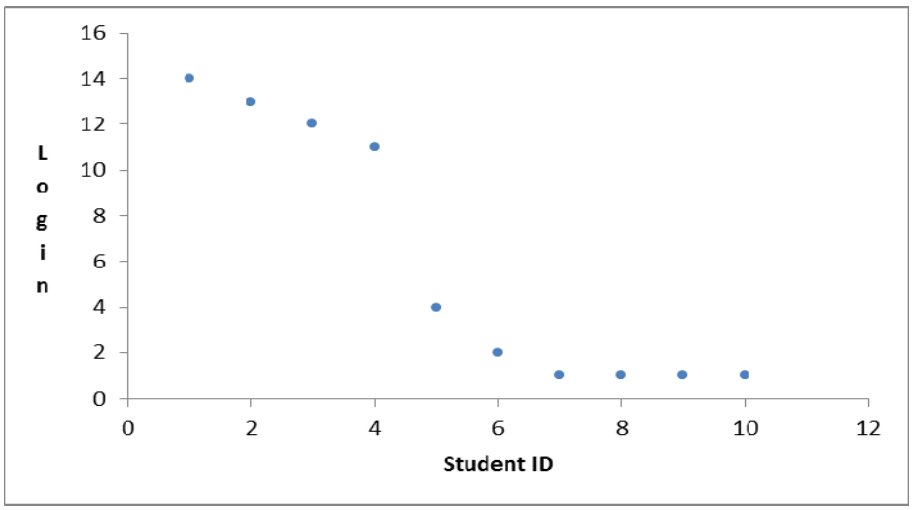


Figure 5.31: Usage of the Avatar Hall System using RbE Environment for Experiment 2

Figure 5.30 and Figure 5.31 shows that every student with access to a text avatar in Experiment 1 and Experiment 2 logged-in at least once. The largest number of log-ins by text avatar students was 41 in Experiment 1 and 14 in Experiment 2.

## 5.11 Chapter Summary

This chapter has presented the analysis of the collected research data for Experiment 1 and Experiment 2. These findings have resulted in the selection of statistic tests such as the Kruskal-Wallis test, the Mann-Whitney test, and the Spearman's Correlation test. The results of the research questions for motivation to learn, motivation to use an avatar, motivation to personalise an avatar, and motivation to access an avatar environment, have been reported in this chapter. This chapter also reported that the non-avatar group had a greater motivation to learn than did the avatar group. Moreover, participants in Experiment 2 accessed the Avatar Hall more frequent than did participants in Experiment 1. The following two chapters will discuss these findings and make suggestion about future study.

# Chapter 6

# Discussion

## 6.1 Introduction

The discussion in this chapter takes place in two sections: first, the findings based on the results presented in Chapter 5, and then the implementation of the Avatar Hall and its relationship to learning activity.

## 6.2 Findings

This section discusses the findings of this research, and considers all the research questions presented in Figure 3.4.

This research has conducted two experiments with two different groups of students. The first experiment, named Experiment 1 has three type of groups; the human character avatar (24 students), the text avatar (24 students) and the non-avatar (23 students). This can be depicted in Table 6.1. The details of participants (students) in Experiment 1 have been discussed in Section 3.4.2.

| Group | Number of Students | Type of Avatar |
|---|---|---|
| Treatment 1 | 24 | Human Character |
| Treatment 2 | 24 | Text |
| Control | 23 | None |
| **Total Students** | **71** | |

Table 6.1: Summary of Students in Experiment 1

In addition, 69.0% of the students were aged between 18-20 years old, and 31.0% were aged 21-25 years. This indicates that the students were generally young adults. The majority (78.9%) of these students were female compared to only 21.1% were male. Moreover, it was reported that 28.2% of these students have spent 0-4 hours per week on the Internet, followed by 38.0% spent 5-10 hours per week on the Internet. There were 21.1% who spent between 11-20 hours per week, followed by 12.7% spent more than 20 hours per week.

It is also reported that 49.3% of the students had seen an avatar on the Internet and the rest had not. In addition, 57.7% of the students said that they were new to the idea of having an avatar to represent them. However, 36.6% said that having an avatar on the Internet was relevant to them. Only a small number of students (1.4%) said that this idea were not relevant, and 4.2% of the students were not bothered trying to understand this idea.

The second experiment, named Experiment 2 has two types of groups; the human character avatar (35 students) and the text avatar (10 students). This can be depicted in Table 6.2. The details of participants (students) in Experiment 2 have been discussed in Section 3.4.3.

| Group | Number of Students | Type of Avatar |
|---|---|---|
| Treatment 1 | 35 | Human Character |
| Treatment 2 | 10 | Text |
| **Total Students** | **45** | |

Table 6.2: Summary of Students in Experiment 2

In addition, 17.8% of the students were aged between 18-20 years old, and majority (82.2%) were aged 21-25 years. This indicates that the students were generally older than students in Experiment 1. The majority (73.3%) of these students were female compared to only 26.7% were male. This can be inferred that there were more female than male students in both Experiment 1 and Experiment 2. Moreover, it was reported that 42.2% of these students have spent 0-4 hours per week on the Internet, followed by 31.1% spent 5-10 hours per week on the Internet. There were 11.1% who spent between 11-20 hours per week, and 15.6% spent more than 20 hours per week.

It is also reported that 53.3% of the students had seen an avatar on the Internet and 46.7% had not. In addition, 62.2% of the students said that they were new to the ideas of having an avatar as to represent them on the Internet. However, 33.3% said that having an avatar on the Internet was relevant. There were only a small number of students (2.2%) who said that this idea was not relevant, and 2.2% of the students were not bothered trying to understand this idea.

It is believed that the demographic data affect students' perception of motivation to learn, motivation to view their avatar, motivation to personalise their avatar and motivation to access the Avatar Hall system. This was discussed in Section 6.2.1.5, 6.2.2.4, 6.2.3.3, and 6.2.4.4.

Gender Imbalance

Based on the results reported in Section 5.2.2, it was found that female students dominated the number of participant in both experiment, Experiment 1 (Male: 21.1%; Female: 78.9%) and Experiment 2 (Male: 26.7%; Female: 73.3%). This was due to the large number of female students in the population of study. Moreover, this situation was not only in the study population, but also to other universities in Malaysia. Therefore, the Malaysian government has taken steps to try to find ways to encourage more male students to further their study to the university level. Ishii (2011), in his news report wrote that the Malaysia Deputy Education Minister has described the gender imbalance as a world phenomenon, and is looking into the solution to solve this phenomenon.

Gender Differences towards Adoption of Technology

Research shows that males are more interested to use technology as compared to their female counterpart. A study done by Park and Lee (2011) has found that more males than females like to play computer games. Apart from having playing games, it was also found that males like to access social network world than female (Mäntymäki and Salo, 2011). In relation to this study, the results of students' motivation towards an avatar and the Avatar Hall can be affected if the gender of participants of the study is equal or having more males than females.

Age Differences towards Adoption of Technology

Based on the results reported in Section 5.2.1, it was found that students in Experiment 1 (18-20 years old: 69%) were generally younger than students in Experiment 2 (21-25 years old: 82.2%). The differences in the age group among students in the experiments can affect students' motivation towards an avatar and the Avatar Hall. A study has reported that students who are aged between 18-19 years old were accessing the Internet more often than students who are aged 22 years. Moreover, it was also reported that this age group (18-19 years old) of students were mostly using the computer for recreational purpose such as downloading music, and playing computer games. However, the use of technology to the individual will become less frequent when they are older (Kravik and Caruso, 2005).

Academic Programme Differences towards Adoption of Technology

According to Section 3.4.2 and 3.4.3, there were two groups of students who participated in this study. In Experiment 1, students were registered under the academic programme of Cognitive Science where their subjects are related to computing. On the other hand, in Experiment 2, students were registered under the academic programme of Human Resource Development where their subjects are related to social sciences. Therefore, it is believed that the differences between students' academic programme can affect students' motivation towards an avatar and the Avatar Hall. A study done by EDUCAUSE Center for Applied Research (ECAR) in 2005 on student use and skill with information technology reported that the use of

technology was closely related to student's academic programme. They further reported that the technology related academic programme such as engineering, and computing, has a higher level of use of technology than the social science related academic programme (Kravik and Caruso, 2005).

### 6.2.1 RQ1: Are students motivated to learn when an avatar is applied in a Conventional Learning Environment (CLE), in Experiment 1 and Experiment 2?

As shown in Table 6.1 and Table 6.2, students in Experiment 1 were divided into three groups: human character avatar, text avatar and non-avatar, whereas, in Experiment 2, students were divided into two groups: human character avatar and text avatar. As shown in Figure 3.4, RQ1 was divided into four sub-research questions. Therefore, the following sections will answer these four questions in order to approach an answer for RQ1.

#### 6.2.1.1 RQ1.1: Are students motivated to learn when a human character avatar is applied in a Conventional Learning Environment (CLE)?

RQ1.1 is answered by referring to Table 5.3, which shows that 45.8% of the students in Experiment 1 reported a positive response when they perceived that they were motivated to learn when a human character avatar was applied in a CLE, whereas 54.2% reported a non-negative response. This means that 54.2% of the students in Experiment 1 were unable to say whether or not they were motivated when a human character avatar was applied in a CLE. However, none of the students in this experiment perceived that they were not motivated to learn when a human character avatar was applied in a CLE. Table 5.3 also showed that 82.9% of the students in Experiment 2 reported a positive response when they perceived that they were motivated to learn when a human character avatar was applied in a CLE, and 17.1% reported a non-negative response to this question.

Thus, it can be inferred that, in general, students experienced a positive response when a human character avatar was applied in a CLE. Moreover, none of the students reported a negative response when a human character avatar was applied in a CLE. Therefore, the finding of this research for RQ1.1 is that, in general, the students in both Experiment 1 and Experiment 2 reported a positive response towards motivation

to learn when a human character avatar was applied in a CLE. This finding agrees with Samsonov and McCartney's (2011) suggestion that the use of avatars in the classroom has a good potential to become a motivator for students to learn. Moreover, Samsonov and McCartney's (2011) participants expressed their willingness to use the avatars in their teaching materials in the future.

In this research, avatar attributes were offered to students as a reward for fulfilling various required learning activities on the assumption that rewards can motivate students to learn. Chen, Kuo, Chang and Heh (2009) mentioned that rewards can be the easiest approach to motivating students to learn. The application of rewards in learning originated from the behavioural theory of learning and as explained in Section 2.10.1, the important principle of this theory is stimulus and response. In this research, rewards can be seen as the stimulus and motivation to learn as the response. In other words, students were rewarded with avatar attributes in order to increase their motivation to learn.

#### 6.2.1.2 RQ1.2: Are students motivated to learn when a text avatar is applied in a Conventional Learning Environment (CLE)?

RQ1.2 is answered by referring to Table 5.4 which shows that 45.8% of the students in Experiment 1 reported a positive response when they perceived that they were motivated to learn when a text avatar was applied in a CLE, whereas 45.8% reported a non-negative response to it and 8.3% reported a negative response when they perceived that they were not motivated to learn by a text avatar. Table 5.4 also shows that 70% of the students in Experiment 2 reported a positive response when they perceived that they were motivated to learn when a text avatar was applied in a CLE, and 30% reported a non-negative response to it. No student perceived that he or she was not motivated by the application of a text avatar in a CLE.

Thus, although 8.3% of the students reported a negative response on motivation to learn when a text avatar was applied in a CLE, 45.8% of the students in Experiment 1 and 70.0% in Experiment 2 reported a positive response on their motivation to learn by the application of a text avatar. The finding of this research for RQ1.2 is that, in general, students in both Experiment 1 and Experiment 2 were positively motivated to learn by the application of a text avatar in a CLE.

#### 6.2.1.3 RQ1.3: Are students motivated to learn when there is no avatar in a Conventional Learning Environment (CLE)?

RQ1.3 is answered by referring to Table 5.5 which shows that 56.5% of the students in Experiment 1 reported a positive response when they perceived that they were motivated to learn when there was no avatar in a CLE, whereas 43.5% gave a non-negative response and no student gave a negative response when asked about this.

Thus, half (56.5%) of the students in Experiment 1 perceived that they were motivated to learn when there was no avatar in a CLE. This finding is not consistent with the findings from both research questions RQ1.1 and RQ1.2. It was not the expected results, but it was consistent, if for instance, motivation to learn is coming from something other than the avatar. Moreover, this finding contradicts the research findings of Samsonov and McCartney (2011) that the use of avatars in the classroom has a good potential to motivate students to learn. However, looking at another perspective of educational achievement, this finding was consistent with that of Wolters (1999) whose paper on motivation and classroom performance observed that students are inclined to be more motivated to learn when grade and achievement are involved rather than when by the sole motivation is their own interest in learning. Wolters (1999) explained that this occurs because students are more familiar with this type of encouragement. This supported Harter's (1992) argument that students are more motivated to engage in academic activities by a desire for a good grade rather than by the pleasure of learning.

#### 6.2.1.4 RQ1.4: Is there any difference between the groups in their motivation to learn in a Conventional Learning Environment (CLE)?

RQ1.4 is answered by referring to Section 5.4.3.4 which reported that no significant difference was found between the three groups in Experiment 1 or between the two groups in Experiment 2. In other words, all the students in Experiment 1 and Experiment 2 were motivated to learn, with or without an avatar.

Although differences between the groups were found descriptively, further analysis using the Kruskal-Wallis test on the results of Experiment 1 and the Mann-Whitney test on the results of Experiment 2 showed no significant differences. These

findings are due to the small percentage values found between each group of participants affecting the results of these tests.

#### 6.2.1.5 Outcomes for RQ1

Having answered the research sub-questions RQ1.1 to RQ1.4, this section can conclude by answering the research question RQ1, stated in Section 1.3.1. The conclusion that can be drawn from the discussion in this section is that, while some students do report a motivational impact on their learning of having an avatar, this view is not shared by many students. Indeed, students who were not given an avatar were found, in general, to have the most motivation to learn. To try to understand this result, the students were asked to answer an open-ended question. It seems that, in general, students gave greater priority to their academic performance.

Some of the students' feedback on having an avatar in their learning environment is shown in Table 5.17. This suggests that some students chose to prioritise learning over using an avatar. Also, they saw learning as directly related to their educational performance. Student 4 suggested that the education system in Malaysia has promoted the idea that academic achievement should be the top priority for every student. The scenario in which students are mainly motivated by attempting to achieve a high academic performance is not new. It occurs in almost every educational institution around the world. Many educational institutions are proud to see their students succeed academically and they promote the importance of achieving good grades. Wolters (1999) observed that students are inclined to be more motivated to learn when grades and achievements are involved, than when the sole motivator is their own interest in learning. Pursuant to this, he explained that this occurs because students are more familiar with this type of encouragement. This supported Harter's (1992) argument that students are motivated to engage in academic activities more for performance than for pleasure.

The results of this research relating to RQ1 can also be explained by a study done by Deci (1971), by Lepper, Greene and Nisbelt (1973), and by Deci and Ryan (2000). These studies found that students who received no reward for their learning spent more time on the task than the students who were rewarded for learning and they concluded that reward sometimes undermines interest in the given task.

Therefore, following these important findings and the findings of the current study, the answer to RQ1 is that, some students do feel motivated to learn by using an avatar and by earning rewards in the form of avatar attributes for successful completion of learning activities. Nevertheless, most of the students in both experiments, Experiment 1 (49.3%) and Experiment 2 (53.3%) were claiming that they had seen an avatar on the Internet, such as while playing computer games or accessing social networking website.

### 6.2.2 RQ2: Are students motivated to view their avatar when it is applied in a Conventional Learning Environment (CLE), in Experiment 1 and Experiment 2?

As shown in Figure 3.4, RQ2 was divided into 12 sub-research questions. Therefore, the following sections will answer these 12 questions in order to approach an answer for RQ2.

#### 6.2.2.1 RQ2.1: Are students motivated to view their human character avatar when it is applied in a Conventional Learning Environment (CLE)?

RQ2.1 is answered by referring to Figure 5.10, which shows that 16.7% of the students in Experiment 1 reported a positive response when they perceived that they were motivated to view their avatar in a CLE, whereas 62.5% gave a non-negative response and 20.8% gave a negative response to this question. Thus, 16.7% of the students in Experiment 1 were motivated to view their avatar in a CLE.

Figure 5.10 also shows that 48.6% of the students in Experiment 2 reported a positive response when they perceived that they were motivated to view their avatar, but that 40.0% gave a non-negative response and 11.4% gave a negative response to this question. Thus, almost half (48.6%) of the students in Experiment 2 were positive about viewing their avatar when it was applied in a conventional learning environment. These results neither support nor contradict those of previous studies about avatar use. Frery, Kelner, Moreira and Teichrieb (2002) found that having an avatar made students' learning experiences more realistic in CGBL. Inal and Cagiltay (2006) claimed that educators prefer to use an avatar as a catalyst to increase learners' motivation in online environments. In games, Shelton and Scoresby (2011) found that

the availability of an avatar enhanced the experience of the game player and created motivation.

In addition to the results reported in Figure 5.10, students' motivation to view their human character avatar can be further investigated by looking at the enjoyment, effort and value they experienced while viewing their avatar. The relationship between motivation to view and personalising an avatar, and motivation to learn, are also important features of this study. These investigations were covered by five sub-research questions, as stated in Figure 3.4 and they are discussed below in Sections 6.2.2.1.1 to 6.2.2.1.5.

#### 6.2.2.1.1 RQ2.1.1: Do students enjoy viewing their human character avatar?

RQ2.1.1 is answered by referring to Figure 5.11, which shows that 45.8% of the students in Experiment 1 reported a positive response when they enjoyed viewing their human character avatar, whereas 41.7% had a non-negative response, and 12.5% reported a negative response when they did not enjoy viewing their avatar. Thus, 45.8% of these students positively enjoyed viewing their avatar.

Figure 5.11 also shows that 65.7% of the students in Experiment 2 reported a positive response when they enjoyed viewing their human character avatar, whereas 28.6% were non-negative response about viewing it, and 5.7% reported a negative response when they did not enjoy viewing it. Thus, the majority (65.7%) of these students positively enjoyed viewing their avatar. It can be inferred that the enjoyment students gained in viewing their human character avatar affects their motivation to view it.

#### 6.2.2.1.2 RQ2.1.2: Do students put some effort into viewing their human character avatar?

RQ2.1.2 is answered by referring to Figure 5.12, which shows that 29.2% of the students in Experiment 1 reported a positive response to some effort into viewing their human character avatar, whereas 41.7% gave a non-negative response, and 29.2% gave a negative response when asked about this. Thus, relatively 29.2% of the students put some effort into viewing their human character avatar. This result supports the findings for RQ2.1 that 16.7% of the students in Experiment 1 were

motivated to view their human character avatar in a CLE. The inference is that students' reluctance to view their avatar affects their motivation to put some effort into viewing it, or vice-versa.

Figure 5.12 also shows that 45.7% of the students in Experiment 2 reported a positive response to some effort into viewing their human character avatar, whereas 42.9% chose to give a non-negative response, and 11.4% reported a negative response on this issue. Thus, more students in Experiment 2 than in Experiment 1 reported a positive response to some effort into viewing their avatar. This result provides some weak support for the findings in RQ2.1 that 48.6% of the students in Experiment 2 were motivated to view their human character avatar in a CLE.

#### 6.2.2.1.3 RQ2.1.3: Do students value their human character avatar?

In this research, value is defined as "the relative status of a thing, or the estimate in which it is held, according to its real or supposed worth, usefulness, or importance" (Oxford English Dictionary). If motivation is related to the perceived value of a goal, then people tend to be motivated by a goal they see as valuable and not motivated by goal they perceive as not valuable.

RQ2.1.3 is answered by referring to Figure 5.13, which shows that 41.7% of the students in Experiment 1 reported a positive response about the value of their human character avatar, whereas 45.8% were non-negative, and 12.5% reported a negative response about the value of their avatar. Thus, somewhat less than half (41.7%) of the students in Experiment 1 positively valued their avatar. This result is in line with the findings in RQ2.1 that few (16.7%) students in Experiment 1 were motivated to view their human character avatar in a CLE. The implication is that because relatively few students valued their avatar were not motivated to view it, although it is also be that a reluctance to view it affected the value they placed upon it.

Figure 5.13 also shows that 51.4% of the students in Experiment 2 reported a positive response about the value of their human character avatar, whereas 34.3% were non-negative, and 14.3% reported a negative response about its value to them. Thus, 51.4% of the students in Experiment 2 positively valued their avatar. This result support the findings for RQ2.1 that about half (48.6%) of the students in Experiment 2 were motivated to view their human character avatar in a CLE. This suggests that the value students give to their avatar and motivation to view it is closely related.

6.2.2.1.4 RQ2.1.4: Is there any relationship between students' motivation to view their human character avatar and their motivation to learn?

RQ2.1.4 is answered by referring to Section 5.5.3.5, which reported that no significant relationship was found between students' motivation to view their human character avatar and their motivation to learn in Experiment 1. This means that students' motivation to view their avatar had no significant effect on their motivation to learn. This result supports the findings for RQ2.1 that 16.7% of the students in Experiment 1 were motivated to view their human character avatar.

In Experiment 2, however, it was found that the two variables were significantly related. This means that students' motivation to view their avatar did affect students' motivation to learn. This result supports the findings for RQ2.1 that almost half (48.6%) of the students in Experiment 2 were motivated to view their human character avatar.

6.2.2.1.5 RQ2.1.5: Is there any relationship between students' motivation to view their human character avatar and their motivation to personalise the avatar?

RQ2.1.5 is answered by referring to Section 5.5.3.6, which reported that a significant relationship was found between students' motivation to view their human character avatar and their motivation to personalise the avatar in Experiment 1. The same result was reported for Experiment 2. This means that students' motivation to view their avatar positively affected their motivation to personalise the avatar.

### 6.2.2.2 **RQ2.2: Are students motivated to view their text avatar when it is applied in a Conventional Learning Environment (CLE)?**

RQ2.2 is answered by referring to Figure 5.14, which shows that 79.2% of the students in Experiment 1 gave a non-negative answer and 20.8% of the students gave a negative response to this question. No students said they were motivated to view the text avatar. Thus, in Experiment 1, there was no motivation to view the text avatar in a CLE. This result is not consistent to the result found for viewing a human character avatar. This means that the textual nature of the text avatar took away any interest that the students have to view their avatar.

Figure 5.14 also shows that 30.0% of the students in Experiment 2 reported a positive response that they were motivated to view their text avatar, whereas 70.0% gave a non-negative response to this question. There were no negative responses. Thus, some (30.0%) of the students in Experiment 2 were positive about viewing their text avatar when it was applied in a conventional learning environment.

In addition to the results reported in Figure 5.14, students' motivation to view their text avatar can be further investigated by looking at the enjoyment, effort and value they experienced while viewing their text avatar. Then, the relationship between motivation to view their text avatar and motivation to learn can be analysed. These investigations were designed through four sub-research questions, as stated in Figure 3.4. These questions are discussed in Section 6.2.2.2.1 to 6.2.2.2.4, as follows.

#### 6.2.2.2.1 RQ2.2.1: Do students enjoy viewing their text avatar?

RQ2.2.1 is answered by referring to Figure 5.15, which shows that 75.0% of the students in Experiment 1 reported a non-negative response while 25% reported a negative response about their enjoyment of viewing their text avatar. No students gave a positive response. This can be inferred that the textual nature of the text avatar has taken away any interest that the students had to view their avatar. This has led the students not enjoyed viewing their text avatar.

Figure 5.15 also shows that 60.0% of the students in Experiment 2 enjoyed viewing their text avatar, 20.0% reported a non-negative response about it, and 20.0% did not enjoy viewing their text avatar. Thus, most (60.0%) of these students enjoyed viewing their text avatar and this have positively affected their motivation to view the avatar.

#### 6.2.2.2.2 RQ2.2.2: Do students put some effort into viewing their text avatar?

RQ2.2.2 is answered by referring to Figure 5.16, which shows that 4.2% of the students in Experiment 1 reported a positive response to some effort into viewing their text avatar, whereas 79.2% reported a non-negative response, and 16.7% gave a negative response to this question. Thus, hardly any students put effort into viewing their text avatar. This result is in line with the findings for RQ2.2 that none of the students in Experiment 1 were motivated to view their text avatar in a CLE. This

could mean that students' reluctance to put some effort into viewing their text avatar have negatively affected their motivation to view their text avatar.

Figure 5.16 also shows that 30.0% of the students in Experiment 2 reported a positive response to some effort into viewing their text avatar, whereas 70.0% reported a non-negative response on this question. No students said that they did not put any effort into viewing their text avatar. This result is consistent with the findings for RQ2.2 that 30.0% of the students in Experiment 2 were motivated to view their text avatar in a CLE.

#### 6.2.2.2.3 RQ2.2.3: Do students value their text avatar?

RQ2.2.3 is answered by referring to Figure 5.17, which shows that no students in Experiment 1 valued their text avatar, 83.3% reported a non-negative response about its value, and 16.7% reported a negative response when they perceived that their text avatar had no value for them. Thus, in Experiment 1, none of the students valued their text avatar.

Figure 5.17 also shows that 40.0% of the students in Experiment 2 reported a positive response about the value of their text avatar, whereas 60.0% reported a non-negative response about its value. No students said that the text avatar was of no value to them. Thus, nearly half (40.0%) of the students in Experiment 2 positively valued their text avatar.

These results can be inferred that students in Experiment 2 have shown more positive feedback than students in Experiment 1. These differences will be discussed in Section 6.2.2.4.

#### 6.2.2.2.4 RQ2.2.4: Is there any relationship between students' motivation to view their text avatar and their motivation to learn?

RQ2.2.4 is answered by referring to Section 5.5.3.11, which reported that no significant relationship was found between students' motivation to view their text avatar and their motivation to learn in either Experiment 1 or Experiment 2. This means that students' motivation to view their text avatar did not affect their motivation to learn. This result supports the findings for RQ2.1 that none of the students in Experiment 1 were motivated to view their text avatar. Nevertheless, there was only

30.0% of the students in Experiment 2 were found motivated to view their text avatar. The textual nature of the text avatar affect the non-significant relationship found between students' motivation to view their text avatar and their motivation to learn.

#### 6.2.2.3 RQ2.3: Is there any difference in students' motivation to view their avatar depending on whether it is a human character avatar or a text avatar?

RQ2.3 is answered by referring to Section 5.5.3.12, which reported that, in Experiment 1, students given a human character avatar were significantly more likely to be motivated to view their avatar than were students who were given a text avatar.

Section 5.5.3.12 also reported that no significant difference was found, in Experiment 2, between students' motivation to view their human character avatar and students' motivation to view their text avatar. Arguably, taken together, these two findings enable RQ2.3 to be answered in the affirmative and in favour of the human character avatar since a significant preference for a human character avatar were found in Experiment 1 and a greater, but not significantly greater similar preference was found in Experiment 2.

#### 6.2.2.4 Outcomes for RQ2

This section has tried to answer the research question RQ2, stated in Section 1.3.2, namely, are students motivated to view their avatar when it is applied in a conventional learning environment in Experiment 1 and Experiment 2? These results show that while some students are motivated to view it, most students are not motivated to view it. However, students in Experiment 2 were more motivated than students in Experiment 1. The different findings for the two experiments could be explained by three factors:

- Differences in the course content
- Differences in points allocation
- Differences in prior experience with avatars on the Internet

and these are discussed below.

Factor 1: Differences in Course Content

This research involved students on two different courses. The Information Technology (IT) for Knowledge Workers (coded TMX2012) course was selected for Experiment 1 because it provides students with an understanding of IT, including how to use the computer and the Internet, and this enabled them to participate in this research. This course also offers hands-on teaching and learning during lab sessions. Easy access to computers and the Internet was essential to students' participation in the research. The course on Personality Development (code KMC1093) was selected for Experiment 2 because it provides students with an understanding of personality, identity, and personal development.

The difference in these two courses could help to explain the different findings on motivation to view the avatar between the human character avatar group in Experiment 1 and the human character avatar group in Experiment 2. Although the TMX2012 course helped students to participate in the experiment easily, it may not have given them any interest in using the avatar and accessing the Avatar Hall. On the other hand, the KMC1093 course is about the development of personality and identity and this can include preferences about appearance and clothing. This have encouraged an interest in the human character avatar and their ability to personalise it which was absent in course TMX2012.

Factor 2: Differences in Points Allocation

Experiment 1 and Experiment 2 had different points allocation system. As was shown in Table 4.3, the allocation of points was based on the course learning activities and these were different for each course. These learning activities and the points available are presented again in Table 6.3.

| **Learning Activity** | **Points per Week** | |
|---|---|---|
| | **Experiment 1** | **Experiment 2** |
| • Attendance (Lecture) | 34 | 50 |
| • Attendance (Tutorial) | 25 | N/A |

| | | | |
|---|---|---|---|
| | • Attendance (Lab) | 22 | N/A |
| | • Accessing Morpheus (eLearning Portal) | 12 | N/A |
| | • Asking Question (via Morpheus) | 13 | N/A |
| | • Answering Question (via Morpheus) | 13 | 70 |
| | • Accessing the Avatar Hall | N/A | 1 (per login) |

Table 6.3: The Allocation of Points for Every Learning Activity

Table 6.3 shows that students in Experiment 2 could collect 120 points per week, whereas, students in Experiment 1 could collect 119 points. In addition, students in Experiment 2 could collect an extra point for every Avatar Hall system log-in. This means that, with 30 log-ins, these students could earn 150 points a week. This greater opportunity to collect more points and the greater connection in Experiment 2 between accessing the Avatar Hall system and the learning activities is the reason why these students had a greater motivation to view the avatar.

Factor 3: Differences in Prior Experience with Avatars on the Internet

Section 5.2.4 reported that 49.3% of the students in Experiment 1 and 53.3% of the students in Experiment 2 had a prior experience with avatars on the Internet, such as playing games and accessing social networking websites. These experiences affect students' interest towards their avatar on the Avatar Hall.

### 6.2.3 RQ3: Are students motivated to personalise their human character avatar, in Experiment 1 and Experiment 2?

RQ3 is answered by referring to Figure 5.20, which shows that 16.7% of the students in Experiment 1 reported a positive response when they were motivated to personalise their human character avatar, while 62.5% of the students gave a non-negative response, and 20.8% of the students gave a negative response to this question. Thus, 16.7% of the students in Experiment 1 were motivated to personalise their human character avatar.

Figure 5.20 also shows that 51.4% of the students in Experiment 2 reported a positive response when they were motivated to personalise their human character avatar, whereas 34.3% gave a non-negative response, and 14.3% gave a negative response to this question. Thus, half (51.4%) of the students in Experiment 2 were positive about personalising their human character avatar.

In addition to the results shown in Figure 5.20, students' motivation to personalise their human character avatar can be further investigated by looking at their enjoyment of this activity. This investigation is discussed in Section 6.2.3.1.

#### 6.2.3.1 RQ3.2: Do students enjoy personalising their human character avatar?

RQ3.2 is answered by referring to Figure 5.21, which shows that 45.8% of the students in Experiment 1 reported a positive response when they enjoyed personalising their human character avatar, whereas 45.8% were non-negative and 8.3% of the students gave a negative response on this issue. Thus, nearly half (45.8%) of the students enjoyed personalising their human character avatar.

Figure 5.21 also shows that 68.6% of the students in Experiment 2 reported a positive response when they enjoyed personalising their human character avatar, whereas 20.0% were non-negative, and 11.4% reported a negative response when they did not enjoy personalising their human character avatar. This indicates that most (68.6%) of the students in Experiment 2 positively enjoyed personalising their human character avatar. Taking the two experiments together, most students enjoyed personalising their human character avatar and it can be inferred that this experience influenced students' motivation to personalise their human character avatar.

#### 6.2.3.2 RQ3.3: Is there any relationship between students' motivation to personalise their human character avatar and students' motivation to access the Avatar Hall using the Attribute-based Environment (AbE)?

RQ3.3 is answered by referring to Section 5.6.3.3, which reported that a significant relationship was found between students' motivation to personalise their human character avatar and their motivation to access the Avatar Hall using the AbE environment in both Experiment 1 and Experiment 2. This suggests that their

motivation to personalise their human character avatar positively influenced their motivation to access the Avatar Hall using the AbE environment.

#### 6.2.3.3 Outcomes for RQ3

This section has attempted to answer the research question RQ3, stated in Section 1.3.2 which asked if students are motivated to personalise their human character avatar in Experiment 1 and Experiment 2. The finding is that more students in Experiment 2 than in Experiment 1 were motivated to personalise their human character avatar, though even in Experiment 2 they were not in the majority. This finding is somewhat surprising given the finding for RQ3.2 that the majority of all the students enjoyed personalising their avatar; it has been thought that the enjoyment would lead to more motivation. The enjoyment factor helps to explain the finding for RQ3.3 of a positive relationship between students' motivation to personalise their human character avatar and their motivation to access the Avatar Hall. Differences between the two groups of students, again, can be explained by the two factors mentioned previously in Section 6.2.2.3.

- Differences in the course content
- Differences in points allocation

The differences in the motivation of students in Experiment 1 and Experiment 2 to personalise their human character avatar also relates to their Avatar Hall login trends, depicted in Figure 5.28 and Figure 5.29. These showed that every student logged-in at least once and that the maximum number of log-ins by the students in Experiment 1 was 16 and in Experiment 2 it was 2,132. This higher usage by the students in Experiment 2 compared to students in Experiment 1 was because it was easier for them to earn points, as explained above, and more points increased their ability to personalise their avatar frequently. In turn, this also have had an effect on their interest in accessing the Avatar Hall. Castronova (2003) observed that having an opportunity to personalise an avatar made a user spend more time in the online environment.

### 6.2.4 RQ4: Are students motivated to access the Avatar Hall using the Attribute-based Environment (AbE) and the Ranking-based Environment (RbE), in Experiment 1 and Experiment 2?

To answer this research question, the AbE environment and the RbE environment will first be discussed separately in order to address the sub-research questions that applied to each of them. This is done in Section 6.2.4.1 and 6.2.4.2, as follows.

#### 6.2.4.1 RQ4.1: Are students' motivated to access the Avatar Hall using the Attribute-based Environment (AbE)?

RQ4.1 is answered by referring to Figure 5.24, which shows that 29.2% of the students in Experiment 1 reported a positive response when they were motivated to access the Avatar Hall using the AbE environment, while 62.5% of the students gave a non-negative response and 8.3% of the students gave a negative response to this question. Thus, only 29.2% of the students in Experiment 1 were positively motivated to access the Avatar Hall using the AbE environment.

Figure 5.24, also shows that 51.4% of the students in Experiment 2 reported a positive response when they were motivated to access the Avatar Hall using the AbE environment, whereas 40.0% gave a non-negative response and 8.6% gave a negative response to this question. Thus, half (51.4%) of the students in Experiment 2 were positively motivated to access the Avatar Hall using the AbE environment.

In addition to these findings, students' motivation towards using the AbE environment can be further investigated by looking at their enjoyment of this activity. Also relevant are the relationship between students' motivation to access the AbE environment and both their motivation to learn, and their motivation to view their human character avatar. These three investigations relate to the three sub-research questions, stated in Figure 3.4, and they are discussed in Section 6.2.4.1.1 to 6.2.4.1.3, as follows.

##### 6.2.4.1.1 RQ4.1.1: Do students enjoy accessing the Avatar Hall using the AbE?

RQ4.1.1 is answered by referring to Figure 5.25, which shows that 29.2% of the students in Experiment 1 reported a positive response when they enjoyed using the

AbE environment, whereas 62.5% gave a non-negative response and 8.3% of the students gave a negative response on this issue. Thus, 29.2% of the students in Experiment 1 enjoyed accessing the Avatar Hall using the AbE environment.

Figure 5.25 also shows that 54.3% of the students in Experiment 2 reported a positive response when they enjoyed using the AbE environment to access the Avatar Hall, whereas 37.1% gave a non-negative response and 8.6% gave a negative response on this issue. Thus, half (54.3%) of these students positively enjoyed using the AbE environment. It can be inferred that this enjoyment positively affects students' motivation to access the Avatar Hall.

6.2.4.1.2 RQ4.1.2: Is there any relationship between students' motivation to access the Avatar Hall using the AbE and their motivation to learn?

RQ4.1.2 is answered by referring to Section 5.7.3.3 which reported that no significant relationship was found between students' motivation to use the AbE environment and their motivation to learn in Experiment 1. This means that accessing the Avatar Hall using the AbE environment did not influence students' motivation to learn.

Section 5.7.3.3 also reported that a significant relationship was found between students' motivation to use the AbE environment and their motivation to learn in Experiment 2. This finding suggests that these students' motivation to access the Avatar Hall using the AbE environment positively influenced their motivation to learn because they can get marks for doing so.

6.2.4.1.3 RQ4.1.3: Is there any relationship between students' motivation to access the Avatar Hall using the AbE and their motivation to view their human character avatar?

RQ4.1.3 is answered by referring to Section 5.7.3.4 which reported that a significant relationship was found between students' motivation to use the AbE environment and their motivation to view their human character avatar in both Experiment 1 and Experiment 2. These results suggest that students' motivation to view their human character avatar increased their motivation to access the Avatar Hall using the AbE environment.

#### 6.2.4.2 RQ4.2: Are students' motivated to access the Avatar Hall using the Ranking-based Environment (RbE)?

RQ4.2 is answered by referring to Figure 5.26, which shows that 16.7% of the students in Experiment 1 reported a positive response when they were motivated to access the Avatar Hall using the RbE environment, while 50.0% gave a non-negative response and 33.3% gave a negative response to this question. Thus, 16.7% of the students in Experiment 1 were motivated to access the Avatar Hall using the RbE environment.

Figure 5.26 also shows that 50.0% of the students in Experiment 2 reported a positive response when they were motivated to access the Avatar Hall using the RbE environment, whereas 40.0% reported a non-negative response on this issue and 10.0% gave a negative response. Thus, half (50.0%) of the students in Experiment 2 were positive about accessing the Avatar Hall using the RbE environment.

In addition to these findings, students' motivation towards using the RbE environment can be further investigated by looking at their enjoyment towards this activity. An analysis of the relationship between students' motivation towards using the RbE environment and both their motivation to learn, and their motivation to view their text avatar, was relevant. These investigations relate to three sub-research questions stated in Figure 3.4 and they are discussed in Section 6.2.4.2.1 to 6.2.4.2.3, as follows.

##### 6.2.4.2.1 RQ4.2.1: Do students enjoy accessing the Avatar Hall using the RbE?

RQ4.2.1 is answered by referring to Figure 5.27, which shows that 20.8% of the students in Experiment 1 reported a positive response when they enjoyed using the AbE environment, whereas 54.2% reported a non-negative response on this issue and 25.0% of the students did not enjoy accessing the Avatar Hall. Thus, 20.8% of these students enjoyed accessing the Avatar Hall.

Figure 5.27 also shows that 80.0% of the students in Experiment 2 reported a positive response when they enjoyed using the RbE environment to access the Avatar Hall, whereas 20.0% reported a non-negative response on this issue. No negative response was found from the students in this experiment. Thus, these students positively enjoyed using the RbE environment and this finding suggests that the

enjoyment that students experienced in accessing the Avatar Hall have increased their motivation to access the Avatar Hall.

6.2.4.2.2 RQ4.2.2: Is there any relationship between students' motivation to access the Avatar Hall using the RbE and their motivation to learn?

RQ4.2.2 is answered by referring to Section 5.7.3.7 which reported that a significant relationship was found between students' motivation to use the RbE environment and their motivation to learn in both Experiment 1 and Experiment 2. These results indicate that students' motivation to access the Avatar Hall using the RbE environment increased their motivation to learn because they get marks for doing so.

6.2.4.2.3 RQ4.2.3: Is there any relationship between students' motivation to access the Avatar Hall using the RbE and their motivation to view their text avatar?

RQ4.3.3 is answered by referring to Section 5.7.3.8 which reported that no significant relationship was found between students' motivation to use the RbE environment and their motivation to view their text avatar in Experiment 1. Thus, the motivation of these students to access the Avatar Hall using the RbE environment did not affects their motivation to view their text avatar.

Section 5.7.3.8 also reported that a significant relationship was found between students' motivation to use the RbE environment and their motivation to view their text avatar in Experiment 2. This indicates that students' motivation to access the Avatar Hall using the RbE environment affects their motivation to view their text avatar.

6.2.4.3 RQ4.3: Is there any difference in students' motivation to access the Avatar Hall depending on whether they were using the AbE or the RbE?

RQ4.3 is answered by referring to Section 5.7.3.9 which reported that there was no significant difference between students' motivation to access the Avatar Hall using either the AbE or the RbE environment in either Experiment 1 and Experiment 2. This indicates that students' motivation to access the Avatar Hall was the same regardless of whether they were using the AbE or the RbE environment.

#### 6.2.4.4 Outcomes for RQ4

This section has attempted to answer the research question RQ4 stated in Section 1.3.3 which asked if students are motivated to access the Avatar Hall using the Attribute-based environment or the Ranking-based environment in Experiment 1 and Experiment 2.

For the AbE environment, the findings is that while some students are motivated to access the Avatar Hall, the majority are not. This finding is based on the fact that 29.2% of the students in Experiment 1 and 51.4% of the students in Experiment 2 were so motivated. The different results for Experiment 1 and Experiment 2 is explained by referring to Figure 5.28 and Figure 5.29, which showed students' log-ins using the AbE environment for Experiment 1 and Experiment 2 respectively. Every student logged-in at least once and the maximum number of log-ins by the students was 16 in Experiment 1 and 2,132 in Experiment 2. Higher usage by the students in Experiment 2 is because, unlike the students in Experiment 1, they were offered an extra point for every login and this stimulates their interest in continuing to access the Avatar Hall.

For the RbE environment, the finding is similar to that for the AbE environment, based on 16.7% of the students in Experiment 1 and 50.0% of the students in Experiment 2 being motivated to access the Avatar Hall. The difference between the results for the two experiments is explained by Figure 5.30 and Figure 5.31, which show students' log-ins using the RbE environment for Experiment 1 and Experiment 2 respectively. Every student in both experiments logged-in at least once but the maximum number of log-ins by any student was 41 in Experiment 1 and 14 in Experiment 2. In the RbE environment, it seems that the comparative ease with which Experiment 2 students could gain points did not affect their interest in logging-in to the Avatar Hall. This is because, unlike their friends in the human character avatar group, they could not personalise their avatar.

This view is supported by the fact that only 30.0% of the students in Experiment 2 were motivated to view their text avatar and 70.0% were undecided about their motivation, as shown in Figure 5.14. Thus, it could be inferred that the uncertainty of the majority of the students given a text avatar in Experiment 2 about their motivation to use their avatar has influenced their usage of the Avatar Hall.

## 6.3 The Implementation of the Avatar Hall and its relationship to Learning Activity

This research has implemented an experiment which allowed its' participants to access and use an online environment called the Avatar Hall. In the Avatar Hall environment, each student was given an avatar that represented him or her.

The experiment was conducted concurrently with course modules TMX2012 and KMC1093. This enabled the experiment to be related to the learning activities in the modules.

The Avatar Hall exhibited the achievements of the students in performing the course learning activities. These achievements were shown by one of two methods: either an avatar adorned with accessories or an avatar that simply showed the student's position on a ranking board.

The students' achievements were measured by the extent to which they performed all the learning activities listed by the course module. These activities comprised attendance, accessing an online course module called Morpheus and involvement in a forum discussion within Morpheus. Thus, the experiment was closely related to the learning environment of the students.

The Avatar Hall was designed to encourage the students to perform all the learning activities needed for the course module by portraying their achievements. In addition, it was intended to investigate whether or not seeing their avatar in the AbE environment with a variety of accessories earned by their personal learning activities, or wanting to get their avatar to the top position on the ranking board in the RbE environment, would promote students' motivation to learn.

Section 6.2.2 concluded that some of the students, especially those using a human character avatar, were motivated to learn. In addition, Section 6.2.4 concluded that some students were motivated to access the Avatar Hall. These findings give a positive indication of a potential link between having an avatar in the Avatar Hall and performing learning activities.

# Chapter 7

# Conclusions

## 7.1 Introduction

The discussion in this chapter takes place in three sections: the limitations of the research, future work, and the contributions that this study makes to knowledge in this field.

## 7.2 Contributions of Thesis

The contribution of this thesis is categorised into three; theory, knowledge, and policy.

### 7.2.1 Theory

This research offers an added value to the theory of intrinsic motivation. This is because the elements of intrinsic motivation have been applied into the design and the experiment of this research. Although past studies have used similar elements of intrinsic motivation within their study such as in computer-related studies (Deci, Eghrari, Patrick, & Leone, 1994; Wan Ali, Eow, Mahmud, & Baki, 2011), however, their research design and experiment are not the same. For example, their research was about the use of Information Communication Technology (ICT) and how it affects users' motivation. Although their theory was about motivation, however, the

motivation factor applied into their research was not similar to the current research where the use of an avatar is used as a motivation factor. Moreover, the current research has involved the existence of an avatar in the CLE (please refer to Section 1.2).

### 7.2.2 Knowledge towards an Avatar

The results reported and discussed in Chapter 5 showed that students were motivated to use the avatar and to access the Avatar Hall. These findings are consistent with many studies on the avatar and its environment, such as those involving computer games, and social networking environments like Second Life. Although the avatar features and the avatar environment (the Avatar Hall) implemented in this research do not exactly match the highly-developed avatars of other studies, such as the 3D avatar in the very sophisticated environment like Second Life, the findings of this research support those of the other studies that find that the use of an avatar is motivating. Therefore, based on these results, the integration of the avatar and the Avatar Hall into the learning environment should be seriously considered.

This research also found that students were more interested in using a human character avatar than a text avatar. Moreover, students who used a human character avatar were found to be more motivated to learn than were students who used a text avatar. Therefore, this research has contributed to knowledge in this field by proving, at least for these students, that a human character avatar, rather than a text avatar, should be used in a learning environment.

### 7.2.3 Policy towards Rewards System

This research has found a positive indicator that the use of an avatar can become an alternative method to the grading system. In the current practice of reviewing performance, students were graded for their performance and these grades will be posted on the wall. This study, however, identified an alternative way to present students' grades, and this lead to the introduction of an avatar and avatar environment, the Avatar Hall. In the Avatar Hall, students' performance is shown by an avatar and avatar's attribute. An avatar who able to collect more attributes like sunglasses, an expensive gadget such as iPhone, is consider to be a surrogate for good performance

in learning activities. Although it is still bear the concept of presenting students' grades, however, this alternative method will try to translate it into pleasure rather than pressure.

This study showed that students agreed that the Avatar Hall was able to provide an alternative way of presenting students' academic performance and achievement within the course modules TMX2012 and KMC1093. Therefore, this finding could be useful to instructors. Student's performance and achievement can be presented not only on a printed ranking list, but also on an attribute-based environment such as Avatar Hall, which also provides enjoyment and entertainment. As stated by Kohn (1999), the integration of technology into learning may play a role in enhancing the motivation to learn.

## 7.3 Limitations

The approach taken in implementing this research was not without its limitations. It is important to note that all findings reported in this research were based on one population; two undergraduate degree programmes; and in one public university only. Therefore, the findings cannot be generalised to other populations. However, the findings do provide a foundation for further research work and, as such, provide opportunities for further research, which will be discussed in Section 7.3.

Some of the limitations identified while implementing the research are as follows.

i. The sample of this research was first year students from the Department of Cognitive Science and the Department of Human Resource Development, at Faculty of Cognitive Science and Human Development, in one public university in Malaysia. Therefore, the results may not be generalised to all students.

ii. Participants in the experiments were divided into groups according to the model presented in Figure 3.1. However, the method by which participants were registered could reflect their interest in participating. For example, students who registered last may have less interest in participating in the

experiment. This, in turn, may impact their interest in the avatar and in accessing the Avatar Hall.

iii. This research focused on only three subscales of motivation, namely, Interest/Enjoyment, Effort/Important and Value/Usefulness. Therefore, the findings contribute to knowledge about these subscales alone.

iv. Because of unreliable internet connections in the student accommodation, participants may have found it difficult to access the Avatar Hall. However, reasonable access to computers with an internet connection was provided by the faculty and the university library. Criteria such as level of interest may have been adversely impacted by this factor.

v. The speed of the internet connection was unpredictable, especially when trying to access the overseas website at Durham University, where the Avatar Hall was hosted. This may have reduced participants' interest in accessing the Avatar Hall.

vi. This research captured only students' login activity to the system. Fuller, and possibly more reliable, results may have been obtained if all the activities on the system by students could have been captured.

vii. This research has not thoroughly reported the demography data to the research questions, and therefore was less details towards the demography perspective. For example, in Section 6.2.4.1, in Experiment 1, 62.5% of the students gave a non-negative response towards motivation to access the Avatar Hall using the AbE environment. In regards to the demography data, it may include the percentage of male and female students within the 62.5%.

viii. Students were reminded to access the Avatar Hall system during their classes. This approach may affect their perception towards the system. They will see that accessing the systems were compulsory rather than voluntary.

ix. The integration between the Avatar Hall system and Morpheus was based on the hyperlink provided on Morpheus instead of having the Avatar Hall system as an add-on component on Morpheus. By having the Avatar Hall system as an add-on component on Morpheus may change their perception from being compulsory to voluntary access to the Avatar Hall system.

x. Students were asked to answer and later to return the questionnaire during class. Although this approach has been applied to many experiments, however, it may influence students' concentration and their understanding towards the questions. This scenario tends to allow the students to simply answer the questionnaire so they can proceed with the class.

## 7.4 Future Work

Some aspects of the research that could be further investigated are described in this section.

Based on the results reported in Chapter 5, it was concluded that the implementation of avatars and the Avatar Hall alongside the learning activities in the conventional learning environment was successful.

The implementation of these experiments however, involved a small number of students, that is, 71 students of those attending the course module TMX2012 for Experiment 1 and 45 students of those attending the course module KMC1093 for Experiment 2. More reliable results would be obtained if the experiments could involve a wider range and a greater number of participants, such as to the whole population of the students in the university. As claimed by Gravetter and Wallnau (2007), "a large sample will result in more power than a small sample." However, to achieve such research would require significant funding due to the number of participants that would need to be involved. Ideally, such a re-run would involve the recruitment of a graphic designer, greater database storage capacity, and a high-end desktop computer for accommodating large number of participants and supplying a huge number of avatar attributes, such as clothing, body, etc.

Additionally, this research investigated students' perception of their motivation to view the avatar and to access the Avatar Hall. Motivation was measured by three elements taken from the Ryan and Deci (2008) Intrinsic Motivation Inventory (IMI).

These selected categories were interest/enjoyment, effort/important, and value/usefulness. However, the original IMI included three other elements, namely, perceived competence, felt pressure and tension, and perceived choice. Further work on avatars and motivation should use more than the three categories used in this research; ideally, all six elements of the Ryan and Deci (2008) IMI should be used.

The use of more IMI categories would require additional features for the avatar and the Avatar Hall. For example, in order to evaluate 'Perceived Choice', research would have to allow the participant to make a choice of avatar, such as a human character, an alien character, or a text avatar. This choice would entail redesign of the avatar as well as the Avatar Hall itself.

Future studies should aim to provide easier access to the avatar and the Avatar Hall; this might be accomplished by better cooperation between the researcher and the university management. Such cooperation would allow the avatar and the Avatar Hall to be integrated into the university online learning portal called the Morpheus and, thus, provides easy access to it by all the students in the university.

It is also suggested that a further study might aim to understand the longevity of motivation among students. A longitudinal study could provide a framework for investigating how students' motivation due to the avatar and the Avatar Hall changes over time or throughout a degree course.

Finally, the framework of this research could be used to investigate personality and identity. Every student has his or her own personality and identity. Past research has claimed that an avatar's identity can have a positive effect on its user if he or she feels that their avatar is a representative of their identity (Jang, Kim and Ryu, 2010). Although this research was based on motivation, further research could investigate the development of personality and identity from a psychology point of view. Such a study would need to use a personality inventory to identify the development of personality and identity among students and their avatar. With the advantage of implementing the longitudinal study, therefore, through the avatar, the research could investigate the relationship between avatar use and the development of students' personality and identity throughout their life at the university.

Proposals for further research are summarised as follows.

1. To include more participants in the research. Participation should be open to all the university's students so that everyone will talk about their avatars; this would encourage students to give more attention to their avatars. And also, this will make the analysis of results more robust.

2. To add more features to the avatar character, such as type of avatar, ability to animate, and ability to have the student's own face.

3. To embed the avatar concept into the university's online learning portal. This would show that the university gives its full support to this concept. Also, this approach will ensure better alignment between students associating the outcome of their learning and the representation of their avatar.

4. A longitudinal research of avatar use should be conducted over the whole length of the degree course. The longitudinal research will allow researchers to study changes over time and to allow students to acquire the achievement through their study not just for a single module.

5. Variables of personality and identity could be introduced, especially in a longitudinal research. How does a student who is introvert/extrovert personalise his or her avatar character? What are the features that could differentiate an introvert avatar from an extrovert avatar?

6. The concept of an avatar also could be integrated into mobile phone. Students will have an option to access their avatar and Avatar Hall environment through a mobile phone environment. Such increased accessibility may help students access their avatar more easily as well as facilitate students to compare their with others.

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Appendix 3.0

Matrics Number:

This questionnaire is designed to determine the usability of an Avatar as motivation factor in the learning activities. There are **Thirty Six (36)** questions that need to be answered.

**The Confidentiality:**

This survey will be completely **Confidential** and all the information will be strictly used for the purpose of this study ONLY.

In advanced, I would like to thank you for your cooperation and participation.

Thank you very much.

Mohammad Nur Azhar Mazlan
PhD Student
Durham University, England, UK

Appendix 3.0

**Demography Section**

| | | | |
|---|---|---|---|
| 1. | Age | : | ☐ 18 - 20<br>☐ 21 - 25<br>☐ 26 – 30<br>☐ 31 – 35<br>☐ Other |
| 2. | Gender | : | ☐ Male<br>☐ Female |
| 3. | How many hours do you spent on the Internet each week? | : | ☐ 0 – 4 hours<br>☐ 5 – 10 hours<br>☐ 11 – 14 hours<br>☐ 15 – 20 hours<br>☐ More than 20 hours |
| 4. | Do you ever encounter an Avatar in any game or social networking? | : | ☐ Yes<br>☐ No |
| 5. | How do you describe the roles of an Avatar in a game or social networking? | : | ☐ New to me<br>☐ Relevant<br>☐ Irrelevant<br>☐ Not Bother |

# Students' Perception of Motivation to Learn

| Please select an answer that best represent how much you agree or disagree with the following statements. | | | | |
|---|---|---|---|---|
| 1 - Strongly Disagree | 2 - Disagree | 3 - Undecided | 4 - Agree | 5 - Strongly Agree |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **1.** | **I enjoyed studying this course.** | | | | | | |
| | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | Strongly Agree |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **2.** | **This course was fun.** | | | | | | |
| | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | Strongly Agree |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **3.** | **I would describe this course as very interesting.** | | | | | | |
| | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | Strongly Agree |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **4.** | **I put a lot of effort into this course.** | | | | | | |
| | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | Strongly Agree |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **5.** | **I tried harder on this course.** | | | | | | |
| | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | Strongly Agree |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **6.** | **It was important to me to do well on this course.** | | | | | | |
| | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | Strongly Agree |

| 7. | I believe this course could be of some value to me. | | | | | |
|---|---|---|---|---|---|---|
| Strongly Disagree | 1 | 2 | 3 | 4 | 5 | Strongly Agree |

| 8. | I think this is an important course to me. | | | | | |
|---|---|---|---|---|---|---|
| Strongly Disagree | 1 | 2 | 3 | 4 | 5 | Strongly Agree |

| 9. | I believe attending this course could be beneficial to me. | | | | | |
|---|---|---|---|---|---|---|
| Strongly Disagree | 1 | 2 | 3 | 4 | 5 | Strongly Agree |

# Students' Perception of Motivation to view an Avatar

| Please select an answer that best represent how much you agree or disagree with the following statements. | | | | |
|---|---|---|---|---|
| 1 - Strongly Disagree | 2 - Disagree | 3 - Undecided | 4 - Agree | 5 - Strongly Agree |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **10.** | **I like my avatar.** | | | | | | |
| | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | Strongly Agree |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **11.** | **Having an avatar was fun.** | | | | | | |
| | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | Strongly Agree |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **12.** | **I would describe an avatar as very interesting.** | | | | | | |
| | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | Strongly Agree |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **13.** | **I put a lot of effort into my avatar.** | | | | | | |
| | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | Strongly Agree |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **14.** | **I tried very hard to have a good avatar.** | | | | | | |
| | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | Strongly Agree |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **15.** | **It was important to me to have an avatar.** | | | | | | |
| | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | Strongly Agree |

| 16. | I believe an avatar could be of some value to me. | | | | | | |
|---|---|---|---|---|---|---|---|
| | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | Strongly Agree |

| 17. | I think an avatar could help me to describe myself. | | | | | | |
|---|---|---|---|---|---|---|---|
| | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | Strongly Agree |

| 18. | I believe having an avatar could be beneficial to me. | | | | | | |
|---|---|---|---|---|---|---|---|
| | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | Strongly Agree |

Appendix 3.0

# Students' Perception of Motivation to Personalise an Avatar

| Please select an answer that best represent how much you agree or disagree with the following statements. | | | | |
|---|---|---|---|---|
| 1 - Strongly Disagree | 2 - Disagree | 3 - Undecided | 4 - Agree | 5 - Strongly Agree |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **19.** | **I enjoyed personalising my avatar.** | | | | | | |
| | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | Strongly Agree |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **20.** | **Personalising my avatar was fun.** | | | | | | |
| | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | Strongly Agree |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **21.** | **I would describe personalising my avatar as very interesting.** | | | | | | |
| | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | Strongly Agree |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **22.** | **I put a lot of effort into personalising my avatar.** | | | | | | |
| | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | Strongly Agree |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **23.** | **I tried very hard to personalising my avatar.** | | | | | | |
| | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | Strongly Agree |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **24.** | **It was important to me to personalise my avatar.** | | | | | | |
| | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | Strongly Agree |

| 25. | I believe personalising an avatar could be useful to me. | | | | | | |
|---|---|---|---|---|---|---|---|
| | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | Strongly Agree |

| 26. | I think personalising an avatar is an important activity to me. | | | | | | |
|---|---|---|---|---|---|---|---|
| | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | Strongly Agree |

| 27. | I think personalising my avatar is useful to compare my avatar with other avatars. | | | | | | |
|---|---|---|---|---|---|---|---|
| | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | Strongly Agree |

# Students' Perception of Motivation to access Avatar Hall

| Please select an answer that best represent how much you agree or disagree with the following statements. | | | | |
|---|---|---|---|---|
| 1 - Strongly Disagree | 2 - Disagree | 3 - Undecided | 4 - Agree | 5 - Strongly Agree |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **28.** | **I enjoyed browsing the Avatar Hall.** | | | | | | |
| | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | Strongly Agree |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **29.** | **Browsing the Avatar Hall was fun.** | | | | | | |
| | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | Strongly Agree |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **30.** | **I would describe the Avatar Hall as very interesting.** | | | | | | |
| | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | Strongly Agree |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **31.** | **The implementation of the Avatar Hall is practicable.** | | | | | | |
| | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | Strongly Agree |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **32.** | **The Avatar Hall is fit for purpose.** | | | | | | |
| | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | Strongly Agree |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **33.** | **It was important to me to have the Avatar Hall.** | | | | | | |
| | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | Strongly Agree |

| 34. | I believe the Avatar Hall could be of some value to me. | | | | | | |
|---|---|---|---|---|---|---|---|
| | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | Strongly Agree |

| 35. | I believe the 'Hall of Fame' concept is very useful for its purposes. | | | | | | |
|---|---|---|---|---|---|---|---|
| | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | Strongly Agree |

| 36. | I believe extending the concept of the Avatar Hall to other courses would be useful. | | | | | | |
|---|---|---|---|---|---|---|---|
| | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | Strongly Agree |

***Thank you***

**DURHAM UNIVERSITY**

**DEPARTMENT OF COMPUTER SCIENCE**

**APPLICATION FOR RESEARCH STAFF AND POSTGRADUATE RESEARCH STUDENTS FOR ETHICAL REVIEW AND APPROVAL**

**INTRODUCTION**:

All undergraduate, postgraduate student or staff proposals for University work which involves human participants and/or gives rise to ethical issues (reference may be made to the ACM Code of Ethics – http://www.acm.org/about/code-of-ethics) must be assessed for ethics approval, whether it is for teaching, learning-related or research purposes. (The term "participant" is used to cover any volunteers involved in the project, with the exclusion of the applicant and his/her supervisor).

- Applications should normally be submitted one month before the intended project start date.
- Please complete all sections of the form, as a word-processed document, marking as not applicable [N/A] those questions which do not apply to your study. Applications may well have a significant number of [N/A] answers.
- The text boxes are for guidance only. Where necessary, you may attach additional pages to your application.

**Submission of the Form:**

The final version of the form is to be signed but initial versions should be submitted electronically.

Please note that submission of this form indicates acceptance of the ACM Code of Ethics as above.

Project Title

| |
|---|
| Technology Enhanced Learning: Avatar as Motivator |

**Contact Person (normally the person undertaking the study)**

| |
|---|
| Mohammad Nur Azhar Mazlan |

- **Does your project involve human participants or, for another reason, require ethical approval?**

  **If "YES", the rest of this form must be completed electronically and** submitted electronically to the Chairman of the Departmental Ethics Committee (currently Brendan Hodgson, B.M.Hodgson@durham.ac.uk) as an e-mail attachment.

- **Does your project require ethical approval for another reason?**
  **If "YES", please consult the** Chairman of the Departmental Ethics Committee (currently Brendan Hodgson, B.M.Hodgson@durham.ac.uk) for advice.

**If your answers to both of the above questions are "NO", please sign below and submit this page only.**

**"I confirm that this project does NOT need any ethical approval." ……..**

**Date ……..**

Appendix 3.1
**DEPARTMENT OF COMPUTER SCIENCE**
**DURHAM UNIVERSITY**

# APPLICATION FORM FOR RESEARCH ETHICS APPROVAL OF WORK WITH HUMAN PARTICIPANTS

**SECTION A** **INVESTIGATOR**:

1. NAME, QUALIFICATIONS, POST HELD, STUDENT/ACADEMIC STAFF/OTHER:

Name: Mohammad Nur Azhar Mazlan

2. E-MAIL ADDRESS, DEPARTMENT, CONTACT ADDRESS and CONTACT TELEPHONE NUMBER

m.n.a.mazlan@durham.ac.uk, Department of Computer Science, Durham University, Durham DH1 3LE

3. PRINCIPAL INVESTIGATOR

Mohammad Nur Azhar Mazlan

4, PRINCIPAL INVESTIGATOR'S E-MAIL ADDRESS, DEPARTMENT, CONTACT ADDRESS and CONTACT TELEPHONE NUMBER

m.n.a.mazlan@durham.ac.uk, Department of Computer Science, Durham University, Durham DH1 3LE

5. RESEARCH SUPERVISOR OR ACADEMIC-IN-CHARGE :

Professor Dr Liz Burd

6. RESEARCH SUPERVISOR/ACADEMIC-IN-CHARGE'S E-MAIL ADDRESS, UNIVERSITY DEPARTMENT, CONTACT ADDRESS AND TELEPHONE NUMBER

Email address: liz.burd@durham.ac.uk, Department: Computer Science, Contact address: Department of Computer Science, Durham University, South Road, Durham, DH1 3LE. Contact telephone number: +44 191 33 41719

7. LIST ALL CO-WORKERS, THEIR: STATUS, EMPLOYER (AND DEPARTMENT), AND RESEARCH EXPERIENCE:

N/A

8. INTENDED LOCATION/S FOR THE STUDY

Faculty of Cognitive Science and Human Development (FCSHD), Universiti Malaysia Sarawak, Sarawak, Malaysia

9. CONSENT: Please give details of any other consent applied for and/or obtained from: NHS Local Research Committees in this country, or their equivalent overseas, for medical/clinical projects etc., and attach copies of any relevant application forms submitted and decision letter/s received.

N/A

**SECTION B DESCRIPTION OF WORK**

10. TITLE OF PROJECT (as on cover sheet):

Technology Enhanced Learning: Avatar as Motivator

11. PROPOSED ROUTES OF PUBLICATION (for students, this may be by dissertation; for staff: an indication of the type of publication envisaged)

Dissertation

12. ABSTRACT:

The study is trying to investigate the motivation effect of an avatar on students' learning. The study will focus on building an online environment of avatar called Avatar Hall and to identify the possibility of motivation among students.

13. AIMS and OBJECTIVES: Please state the Research Question, including, where appropriate, the hypothesis to be tested.

The study is aiming to investigate if students' motivation to learning can be enhanced by recognising assessment outcomes via an avatar. The study will considering if enabling students' avatar to

i. Have possesions
ii. Be personalised
iii. Exist in an Avatar Hall

will have a position impact on student motivation.

14. EXPERT INDEPENDENT REVIEW: Please state who has conducted an expert independent review of your proposed project, and his/her verdict. (For a student, this will be your research supervisor; for staff, the review may be by another member of your department.)

Professor Dr Liz Burd

15. DESIGN OF STUDY and METHODOLOGY, in brief:

The study is trying to identify the motivational effect on students' possession of an avatar. The study will, for instance, examines motivational difference between those students who do and who do not has possessions of an avatar.

Research Design: This is a quantitative method of study and is based on a quasi-experiment design, where a non-probability and non-random sampling method such as purposive sampling will be used to select students to participate in the study.

Procedure: Participants will be grouped into two, control and treatment group.

16. IS THIS PROJECT TO BE A DECEPTION STUDY? NO
(**If the response is YES, then please contact REDSS for advice and guidelines on how to proceed.)**

17. PARTICIPANTS:

(a) Who are they (e.g. students, colleagues,…)? Students from FCSHD

(b) If students: course, year, size of groups, % of students involved

Course/Module: TMX2012 IT for Knowledge Worker, First year students, 180 students, 5.55% or 10 (pilot testing) and 47.22% or 85 (treatment group)

(Names of students may be required subsequently)

(c) How many participants are to be recruited? Approximately 85

(d) Selection (e.g. age, sex, ...)? No preference

(e) How are the participants to be recruited?

Voluntarily

(f) Is there any link with the investigator (supervisor, tutor, etc.)? NO

(g) Are any participants likely to be pregnant, or would pregnant women be excluded?

The question is not relevant to the study

(h) How are the participants to be involved in the study?

They are required to use an online environment of avatar called an Avatar Hall, and they are free to personalise their avatar using points derived from assessments.

18. TESTS – QUESTIONNAIRES/OTHER

Questionnaire

19. ARE SUBSTANCES TO BE GIVEN TO PARTICIPANTS? NO
**If YES - complete Appendix A**

20. ARE SAMPLES TO BE TAKEN FROM PARTICIPANTS? NO
**If YES - complete Appendix A**

21. ARE OTHER PROCEDURES TO BE APPLIED i.e. A QUESTIONNAIRE OR OTHER TOOL? YES
**If YES - complete Appendix A, including a copy of your questionnaire.**

22. DETAILS OF DRUGS AND MATERIALS TO BE USED *(name of compound and dosage where appropriate - full details to be given in **Appendix (A**)* with details of NHS LREC/equivalent consent sought and obtained*)*

N/A

23. CONTROLS (needed?). If so, how many, who are they, how recruited/selected?

Yes, 47.22% or 85, purposive sampling methods

24. RISKS AND HAZARDS

Has a full risk assessment been carried out? N/A
Further details: Health and Safety Office at http://www.dur.ac.uk/healthandsafety/NewManualIndex.htm

| What risks to participants are present? | PROBABILITY | SERIOUSNESS |
|---|---|---|
| N/A | N/A | N/A |

State precautions to minimise each risk

N/A

25. DEGREE OF STRESS EXPECTED

Equal to what a normal student will experience in a typical classroom study.

26. DISCOMFORT, INCONVENIENCE OR DANGER
What discomfort, danger or interference with normal activities will be suffered by the participant?

There will be no danger. Meanwhile, there will be some inconvenience if the participant has no access to internet as he or she only can access to his or her Avatar online.

State precautions to minimise them:

Participants will be explained about the inconvenience that could occur. Again, participant will be giving full right to discontinue the study by informing the investigator (by email).

27. STATE SPECIAL ARRANGEMENTS FOR INDEMNIFICATION IN THE EVENT OF INJURY AND NON-NEGLIGENT HARM TO THE PARTICIPANTS

N/A

28. BENEFIT
Please state what benefit to society or individuals should arise from the work:

i. It is hope that this study will provide a better way to motivate students to learn within the world of technology enhanced learning. For example, having a stand alone online avatar environment linked to learning delivery, could engage student motivation for learning.
ii. It is hope that the study of an avatar could bring a positive contribution to the theory of motivation, particularly in the discipline of education.

29. STATISTICS

Has statistical advice been sought on study design?

YES/NO

If YES, from whom? If NO, give reasons

| |
|---|
| Unneeded |

30. SAMPLE SIZE

Please describe the statistical/other rationale for the sample size/number of participants to be used in this study and how the study size will yield meaningful research results.

| |
|---|
| This is a quantitative method of study and is based on quasi-experiment design, where a non-probability and non-random sampling method such as purposive sampling will be used to select students to participate in the study. |

31. CONSENT

(a) Who will explain the investigation to the participant?

| |
|---|
| Mohammad Nur Azhar Mazlan |

(b) Will written explanation be given to the participant as a summary of the project written in layman's language? Please attach a copy to your form, or advise on why one is not to be used. Where schoolchildren/minors are involved, there should also be an information sheet directed at the teachers, parents/guardians.

| |
|---|
| Yes – attached. Explanations will be given by email. |

(c) Will written consent be obtained? This is the normal expectation. Therefore, if your response is that you do not intend to obtain written consent, please explain in detail.

| |
|---|
| Yes |

(d) How and where will consent be recorded? Where schoolchildren/minors/persons with a mental incapacity are involved, there should be full details of your procedures for ensuring informed written consent would be given before participation commences.

| |
|---|
| Upon consent forms |

Please attach copies of any participant explanation leaflets and written consent forms (*it is advised that the University's consent form is used).*

32. CONFIDENTIALITY

(a) Please indicate what steps will be taken to safeguard the anonymity and confidentiality of the participants' records, and confirm that the requirements of the Data Protection Acts will be complied with.

| |
|---|
| Participants' name will be recorded only on the consent forms, but will not be used during the experiment. Participants will have an opportunity to create their avatar name (not their own name) when they log in to the Avatar Hall system for the first time. |

(b) If you are intending to make tape recordings or video recordings of participants please answer the following questions:

(i) Will tape or video recordings and any written transcriptions from these be destroyed at the end of the project? N/A

(ii) If NO, what further use do you intend to make of the recordings and what arrangements will be made for their secure storage?

N/A

(iii) Will consent be requested for this future use? YES/NO
If your response is "no", please give reasons:

N/A

33. PROJECT DURATION

(i) When do you hope to commence the project?

4 January 2010

(ii) When will the project finish and how long will it take to complete?

18 April 2010, 105 days from the start date to the end date, end date included (3 months, 15 days)

34. FOLLOW-UP ACTION

(i) Please confirm that at the project's conclusion, all participants who have contributed to the project will receive a summary written in layman's language of the project and its results

Yes – via email.

(ii) If your response to the above is "no", please provide an explanation.

N/A

35. FUNDING

Please state the source of funding for the work

The Government of Malaysia (Ministry of Higher Learning and Universiti Malaysia Sarawak)

36. OTHER

Are you, or a collaborator, proposing to undertake any other related work which might involve any species of animal?

No

37. OTHER PROCEDURES

Describe the exact procedures, which will be applied to/used with each participant. If questionnaires are to be used, please attach copies.

Questionnaire

SIGNATURE OF INVESTIGATOR: DATE:

..... .....

DECLARATION BY HEAD OF DEPARTMENT
I confirm that:

1. I have read and approved this application for consideration by the Ethics Advisory Committee and

2. the principal investigator and other key researchers have the necessary expertise and experience and have access to the resources needed to conduct the proposed research successfully and

3. the research proposal is worthwhile, of high scientific value and represents good value for money.

SIGNATURE OF HEAD OF DEPARTMENT DATE:

..... .....
NAME IN BLOCK CAPITALS

**Approved / Not Approved by the Ethics Committee**

..... Date: .....

**PLEASE NOTE THAT THIS APPROVAL EXPIRES:**

1. **WHERE THE PROJECT CONTINUES UNCHANGED, THREE YEARS AFTER THE DATE OF APPROVAL;**

2. **WHERE THERE IS ANY CHANGE TO THE PROJECT, FROM THE DATE OF THAT CHANGE;**

3. **WHERE THERE IS ANY CHANGE TO THE LEGISLATION/REGULATIONS AFFECTING THIS PROJECT, FROM THE DATE OF THAT CHANGE.**

**APPENDIX A**

**SUBSTANCES TO BE GIVEN TO PARTICIPANTS:**

*(Special drugs etc.) List the names and doses of any drugs to be given. State route of administration and effect expected. Does it form part of the participant's treatment? Is any routine treatment to be withheld? Health assessment of participants needed? Evidence of a safety/risk assessment form will be required under COSHH Regulations.*

***Has NHS LREC/MREC approval in this country, or, the equivalent committee/government department overseas, been requested and obtained? If so, please supply a copy of the application form submitted and LREC/MREC letter of approval. If not, please explain.***

*List other substances which are not prescription drugs.*

---

**SAMPLES TO BE TAKEN FROM THE PARTICIPANTS:**

*(Saliva, urine, etc.) State type, frequency and amount. Would the sample(s) be taken especially for this investigation? If the samples are taken during normal patient care, will larger quantities than normal be required? How will samples be retained, how disposed of, and when?*

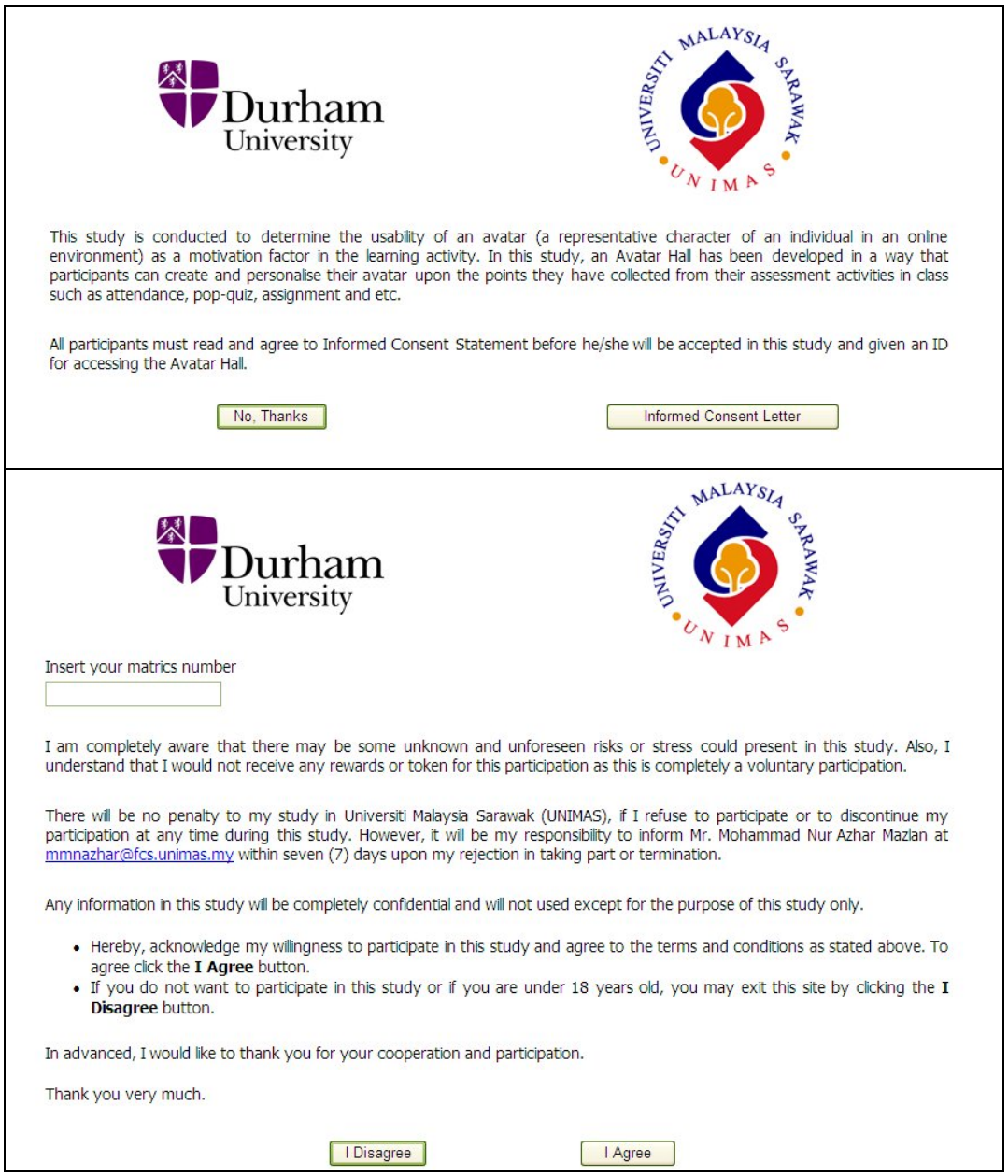
***NHS LREC/MREC approval in this country, or, if abroad, from the equivalent committee/government department overseas, must be requested and obtained for this. Please supply a copy of the application form submitted and LREC/MREC/equivalent letter of approval.***

---

**OTHER PROCEDURES:**

*Describe the exact procedures, which will be applied to/used with each participant. If questionnaires are to be used, please attach copies.*

Appendix 3.2



Durham University

UNIVERSITI MALAYSIA SARAWAK UNIMAS

This study is conducted to determine the usability of an avatar (a representative character of an individual in an online environment) as a motivation factor in the learning activity. In this study, an Avatar Hall has been developed in a way that participants can create and personalise their avatar upon the points they have collected from their assessment activities in class such as attendance, pop-quiz, assignment and etc.

All participants must read and agree to Informed Consent Statement before he/she will be accepted in this study and given an ID for accessing the Avatar Hall.

No, Thanks | Informed Consent Letter

Durham University

UNIVERSITI MALAYSIA SARAWAK UNIMAS

Insert your matrics number

I am completely aware that there may be some unknown and unforeseen risks or stress could present in this study. Also, I understand that I would not receive any rewards or token for this participation as this is completely a voluntary participation.

There will be no penalty to my study in Universiti Malaysia Sarawak (UNIMAS), if I refuse to participate or to discontinue my participation at any time during this study. However, it will be my responsibility to inform Mr. Mohammad Nur Azhar Mazlan at mmnazhar@fcs.unimas.my within seven (7) days upon my rejection in taking part or termination.

Any information in this study will be completely confidential and will not used except for the purpose of this study only.

- Hereby, acknowledge my willingness to participate in this study and agree to the terms and conditions as stated above. To agree click the **I Agree** button.
- If you do not want to participate in this study or if you are under 18 years old, you may exit this site by clicking the **I Disagree** button.

In advanced, I would like to thank you for your cooperation and participation.

Thank you very much.

I Disagree | I Agree

Appendix 3.3

Message to Participants

Dear all,

My name is Mohammad Nur Azhar Mazlan, a lecturer of Faculty of Cognitive Science and Human Development (FCSHD). At the moment, I am pursuing my PhD in Durham University, Durham, England, United Kingdom. Currently I am carrying out a PhD project investigating students' perception of motivation toward avatar.

In order for you to join the study, firstly, you need to log on to this website http://tel.dur.ac.uk/~azhar/consent in which there will be an Informed Consent Statement that you need to read and agree.

In order to complete this study, you will be required to engage with avatar's environment called Avatar Hall, until the end of the semester. I hope you will be enjoying exploring and personalising avatar throughout the study. In advance, I thank you for your cooperation, participation and willingness to participate in this study.

Yours sincerely,

Mohammad Nur Azhar Mazlan

# Introduction to the Avatar Hall System

Appendix 3.4

# Introduction to the Avatar Hall System

Purpose

The Avatar Hall system is developed based on two purposes:

**Purpose 1:** To measure students' perception of motivation to learn and students' perception of motivation to use an avatar.

> The emergence and interest of having an avatar in online environments such as computer games and social networking, shows an indication of the perceived value student's place on their avatar. Additionally, the ability to personalise an avatar has engaged interest among the student of an avatar. Therefore, this experiment is trying to identify students' perception of motivation toward an avatar, and the impact this have on motivation to learning.

**Purpose 2:** To observe students' performance through their learning activities.

Two types of Avatar Hall has been designed, namely, the Attribute-based Environment (AbE) and the Ranking-based Environment (RbE).

- In the AbE environment, students can observed their learning performance by looking at the number of items belongs to their avatar. An avatar who has many items shows that the owner of the avatar has performed well in their learning activities.

- In the RbE environment, students can observed their learning performance by positioning their avatar on the ranking board. An avatar who has performed

well in their learning activities will see their avatar position at the top on the ranking board.

What is the Avatar Hall?

The Avatar Hall is an online environment for avatar. The environment can be accessed via the internet. Further description of the Avatar Hall is explained under the topic of 'Category of the Avatar Hall'.

What is Avatar?

An avatar is an object where it is to represent student in an online environment on the Internet. In this experiment, the online environment is named the Avatar Hall. An avatar is categorised in two, namely, a human character avatar and a text avatar. Example, Yahoo! Avatar.

| | |
|---|---|
|  | Optimus Prime |
| Human Character Avatar | Text Avatar |

Categories of the Avatar Hall

The Avatar Hall is developed into two categories:

*Category 1*: Attribute-based Avatar Hall

In the AbE environment, student is presented with a human character avatar, as well as the avatar accessories such as clothing, etc.

In order for the students to personalise their avatar, therefore, students need to have some amount of points. Example, a certain amount of points, say 70 points, is required for buying a new cloth for their avatar.


Attribute-based Avatar Hall

*Category 2*: Ranking-based Avatar Hall

In the RbE environment, student is presented with a text avatar. In this environment, text is used to represent student as an avatar. The text avatar is displayed on the ranking board. This means that students can have their text avatar at the top of the ranking board once their points are higher than another avatars.

Appendix 3.4


Ranking-based Avatar Hall

**Notes:**

Students will be divided into three groups as follows.

- Group 1 (Human Character Avatar)
- Group 2 (Text Avatar)
- Group 3 (Non-Avatar)

<u>How Point is Collected?</u>

Point is collected by fulfilling the learning activities for the course attended. These activities are as follows.

- Attendance
- Accessing eLearning Portal (Morpheus)
- Answering forum questions in the Morpheus

Apart from these activities, point can also be collected by simply login to the Avatar Hall.

- Login to Avatar Hall System

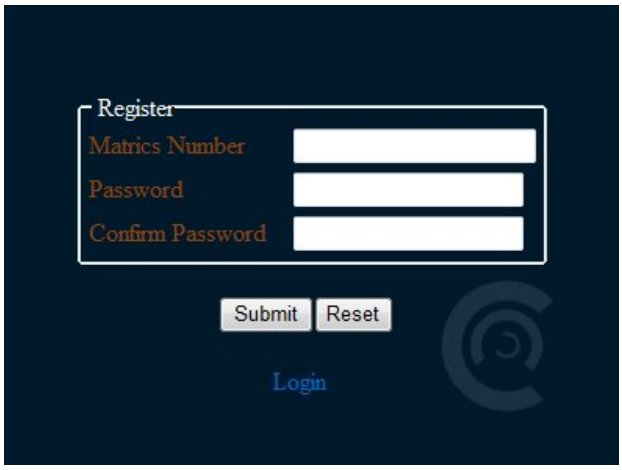
Appendix 3.4

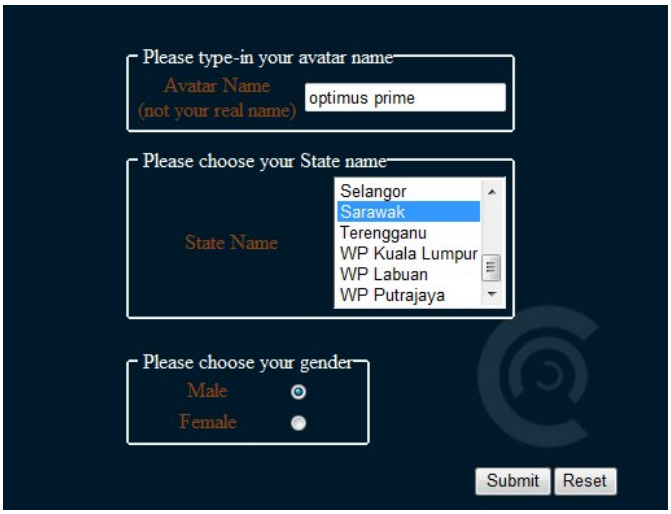
How to Register to the Avatar Hall System

Students need to register with the Avatar Hall system in order to access into the system.

Steps for the Registration to the Avatar Hall System

| | | |
|---|---|---|
| Step 1 | : | Click at the link 'Register' on the Login window<br><br>* Student who has successfully registered could immediately type-in their username and password in the Login window<br><br>  |
| Step 2 | : | Students will then be transferred to Registration page (as shown in figure in this step).<br><br>Matrics Number: This space is refers to student ID number. E.g.: 12345.<br><br>• The student ID number must be simlar to the one in the attendance list. |

| | | |
|---|---|---|
| | | ** Please click the 'Submit' button once every space is filled. Students will then be transferred back to the login page, as shown in Step 1. |
| | |  |
| Step 3 | : | Once the registration process is complete, and students login to the system for their first time, students will be transferred to the First Time Login window. This window is shown to the students ONE time only.<br><br>In this page, students are ask to enter their avatar name, name of their state, and their gender. |

| | | |
|---|---|---|
| | |  |
| Step 4 | : | Once the 'Submit' button is clicked, students then will be transferred to the Avatar Hall main menu.<br><br>There are five sub-menu in the Avatar Hall main menu, and these sub-menu is described as follows.<br><br>This is the start page of the Avatar Hall System.<br><br>  |
| | | ***Sub-Menu 1: My Avatar.*** On this page, students can see their |

| | | |
|---|---|---|
| | | avatar, their total and balance points. Apart from that, an ability to change the password is also available within this page, by clicking the 'Change Password' button.<br><br>  |
| | | ***Sub-Menu 2: My Inventory.*** On this page, students can access and retrieve their avatar accessories.<br><br>• Note that all the items bought from Sub-Menu Store is kept in this page.<br>• Example: In this page, there are two categories of accessories have been activated, namely clothing and trouser (hidden). Name of the category will only appear once the cursor is hovering over the category box. |


***Sub-Menu 3: Hall of Fame.*** On this page, students get a chance to see other avatars.


***Sub-Menu 4: Store.*** On this page, students can view and buy all the items for their avatar. The ability to view and buy all the items for their avatar is highly dependable to the amount of points they have in the Avatar Hall.

* The collection of avatar's accessories are entirely dependable

| | | |
|---|---|---|
| | | on how much points is available in the Avatar Hall. E.g.: a total points of 150 will activate avatar accessories collection – 'Clothing'.<br><br>  |
| | | ***Sub-Menu 5: Contact.*** Finally, on this page, student gets to know about researcher contact details.<br><br>  |

**IMPORTANT**

All the figures shown previously are refer to the Avatar Hall Category 1, namely, the AbE environment of the Avatar Hall.

The presentation of the Avatar Hall Category 2, namely, the RbE environment is different compare to the Avatar Hall Category 1, namely, the AbE environment. In the RbE environment, an avatar is presented as a text avatar whereas in the AbE environment, an avatar is presented as a human character avatar. However, the layout design for both categories are the same, namely, the colour of the background, the button, etc.

The differences between the AbE and the RbE environments are presented in the table as follows.

| **Attribute-based Avatar Hall** | **Ranking-based Avatar Hall** |
|---|---|
|  |  |
| On this page, the main menu is divided into five categories which is based on My Avatar, My Inventory, Hall of Fame, Store, and Contact. | On this page, the main menu is divided into five categories which is based on learning activities. These activities comprises of Attendance, Activities, Quizzes, Project, and Examination. |
| | |

Appendix 3.4

| | |
|---|---|
|  |  |
| On this page, the avatar is based on human character. | On this page, the avatar is based on text. |