EFFECTS OF PERSUASIVE TECHNOLOGY WITH SEGMENTING PRINCIPLE IN MOBILE FLIPPED CLASSROOM ON UNIVERSITY STUDENTS' PERFORMANCE, ENGAGEMENT, AND PERCEIVED MOTIVATION

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by

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'This Dr. title is for me, but the benefit from it is for all of us.'

Thank you.

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ABSTRAK

Di Malaysia, penggunaan kaedah pembelajaran *'flipped classroom'* dalam pembelajaran semakin meningkat naik dan teknik ini biasanya digunakan oleh tenaga pengajar dalam sistem pendidikan tinggi. Kaedah pembelajaran *'flipped classroom'* terbahagi dalam tiga peringkat iaitu pra-kelas, dalam-kelas dan pasca-kelas. Tujuan kajian ini adalah untuk mereka bentuk, menghasilkan dan mengkaji kesan pembelajaran multimedia pemujukan yang dikenali sebagai *'Mobile Flipped Classroom (M-FC)'* terhadap prestasi pelajar, penglibatan dan motivasi pelajar terhadap bahan pembelajaran menggunakan reka bentuk kuasi eksperimen 2 x 2 faktorial. Pembolehubah tidak bersandar untuk kajian ini adalah dua mod pembentangan; M-FC dengan prinsip *'segmenting'* (M-FC-S) dan M-FC dengan prinsip *'non-segmenting*' (M-FC-NS). Pemboleh ubah bersandar adalah prestasi pelajar, penglibatan, dan persepsi motivasi terhadap bahan pembelajaran. Pemboleh ubah moderator adalah aliran pengajian pelajar yang dibahagikan kepada pelajar dari aliran sains dan aliran seni. Seramai 100 orang pelajar universiti tahun kedua yang terdiri daripada 50 pelajar sains dan 50 pelajar seni dari salah satu universiti awam Malaysia telah menyertai kajian ini. Data yang diperoleh daripada kajian dianalisis menggunakan statistik inferens deskriptif, iaitu ujian ANOVA. Hasil kajian ini menunjukkan bahawa prestasi pelajar yang menggunakan mod persembahan M-FC-S

mengatasi prestasi pelajar yang menggunakan M-FC-NS dengan signifikan dalam prestasi, penglibatan, dan persepsi motivasi terhadap bahan pembelajaran. Kajian ini menunjukkan bahawa pelaksanaan Prinsip *'Segmenting'* dalam aplikasi M-FC untuk *'mobile flipped classroom environment'* telah memberikan impak positif dalam meningkatkan prestasi, penglibatan, dan persepsi motivasi terhadap bahan pembelajaran di kalangan pelajar universiti. Selain itu, pembangunan aplikasi M-FC dalam kajian ini telah menyumbang kepada peningkatan bilangan aplikasi yang berasaskan *'mobile'* yang bertujuan untuk meningkatkan hasil kualiti pembelajaran dari kaedah pembelajaran *'flipped classroom'*. Kajian ini memperkenalkan istilah *'mobile flipped classroom environment'* yang merujuk kepada *'mobile'* sebagai platform baru untuk mengendalikan kaedah pembelajaran *'flipped classroom'*.

THE EFFECT OF PERSUASIVE TECHNOLOGY WITH SEGMANTING PRINCIPLE IN MOBILE FLIPPED CLASSROOM ENVIRONMENT TOWARDS UNIVERSITY STUDENTS' PERFORMANCE, ENGAGEMENT AND MOTIVATION FROM DIFFERENT FACULTY

ABSTRACT

In Malaysia, the use of flipped classrooms in learning is arising, and this technique commonly used by instructors in the higher education system. The flipped classroom environment usually comes in three stages, which are the pre-class, in-class, and post-class. The purpose of the study was to design, developed, and investigate the effects of persuasive multimedia learning application Mobile Flipped Classroom (M-FC) on university students' performance, engagement, and perceived motivation towards the learning material using 2 x 2 factorial quasi-experimental design. The independent variable for this study was the two modes of presentation; M-FC with segmenting principle (M-FC-S) and M-FC with non-segmenting principle (M-FC-NS). The dependent variables were students' performance, engagement, and perceived motivation towards the learning material. The moderator variable was students' stream of studies, which is separated by students from the science and arts stream. A total of 100 Year Two university students separated by 50 science students and 50 art students from one of the Malaysian public universities participated in the study. The data gathered from the study were analysed using descriptive, inferential statistics, namely the ANOVA test. The results of this study demonstrate that the performance of students who used the M-FC-S presentation mode surpassed the performance of students who used the M-FC-NS significantly in

performance, engagement, and perceived motivation towards the learning material. This study has shown that the implementation of the Segmenting Principle in the M-FC application for the mobile flipped classroom environment has yielded a positive impact in increasing the performance, engagement, and perceived motivation towards the learning material among the university students. Besides that, the development of M-FC application for this study contributed to increasing the number of mobile-based applications to improved outcomes for the flipped classroom environment. The study introduces the term of mobile flipped classroom environment for this study, which refers to mobile as the new platform to conduct the flipped classroom environment.

CHAPTER 1

INTRODUCTION

1.1 Overview

In this 21st century education, students need to engage more in their learning, where ‘spoon-feeding' by the lecturer is no longer a suitable way in class, especially in the higher education environment. Nowadays, the lecturer's role is no longer just as an instructor for the students, but in a more appropriate term is as a ‘guide on the side’ for the students (King,1993). In the realisation of making the lecturer as the ‘guide on the side,’ there are many teachings and learning approaches or modules used within the higher education environment. One of the popular approaches flipped learning.

In the 21st century, mobile devices widely used in daily life, especially among university students. Nowadays, each university student will at least have one personal smartphone. There are efforts to optimise the usage of smartphones for educational purposes, mostly in the higher education system. Some of the vast web 2.0 tools are Edmodo, Google Classroom, Kahoot, and iTunes U. All these apps serve as a platform for students to learn by connecting with the lecturer, collaborating with other students, or both. Even lots of apps serve that purpose to students, but none proved to be the best among all. There is always a new approach to improving the outcomes or effects by using the tools on the mobile platform. Some typical outcomes that have always discussed are performance, engagement, and motivation towards the use of a mobile platform for educational purposes.

Even though flipped learning usage is widespread in developed countries, there are still several factors related to the module needed to improvise in order to explore certain groups of learners that never been explored before by past

researchers. In order to improve the effectiveness of teaching in a flipped learning module for students, some significant factors such as engagement, learning platform, and instructional strategies for the module should be taken into consideration by the lecturers that use the flipped learning approaches.

Later on, in this chapter, the researcher will discuss in detail the background of the study, statement of the problem, research objectives, research questions, and significance of the study. This chapter will also provide a theoretical framework, limitations, and operational definition for the study conducted by the researcher. Lastly, the researcher will provide a summary of this chapter.

1.2 Background of Study

Flipped Learning (FL) model has been widely used in many developed and developing countries (Zainuddin & Halili, 2016). The implementation of the FL model commonly being used in the higher education environment and often called Flipped Classroom (FC) environment. The difference between FL and FC is that FL is a model to learn in class, while FC is a method and platform to conduct the FL model. According to Prust, Kelnhofer, and Petersen (2015) comparison of student outcomes in the form of grades performance did not show a consistent difference between the flipped learning environment and a traditional teaching environment. Before the rise of the FL model, blended learning commonly used in higher education among Malaysian students. As technology improves, and educators tend to improve learning among the students, the FL model was used to foster learning.

In Malaysia, undergraduate students in public universities separated into two mainstream studies, which are the sciences and arts. Sciences course separated into three major areas, which are physics, chemistry, and biology. Arts course separated

into many areas, and some of it is drawing, painting, printmaking, sculpture, ceramics, photography, moving images, interdisciplinary arts, and social practice. After consulting a few academicians in public universities to select a subject to be focused on this research, the researcher selects the video production subject as the learning materials for this research. Video production subject is selected because both students from either sciences or arts stream will at least produce one video during their undergraduate program based on consultation from academicians. The selection of video production subject suits the purpose of this research.

Some public universities in Malaysia implemented the FL module in their classroom. There are also several private universities in Malaysia such as Segi College, Lim Kok Wing University, and Universiti Teknologi Petronas that also used this FL model in their classroom. FL commonly consists of three sequential phases; pre-class, in-class, and post-class, in which each phase plays different essential roles in order to ensure the knowledge transfer occurs. In Malaysia, usually, the flipped classroom model used the provided Learning Management System (LMS) by the university itself as a platform to upload and share learning materials for the subject so that students can view the learning materials at home as preparation before coming to the class. During in-class, instructors will provide an active learning session with students, such as one-to-one discussions, group discussions, questions, and answer sessions and other kinds of activities that promote active learning. During the post-class, students required to do some projects or assignments assigned by the instructor to strengthen the concept learned and to ensure the learning process sequence completed so that the knowledge transfer occurs. Engagement is one of the main factors that contribute to the effectiveness of the FL model implementation in the FC environment. Figure 1.1 shows the proposed model for time segmenting

students' engagement. The letters L, M, and H represents the low, medium, and high level of student's engagement during pre-class, in-class, and post-class stages. From Figure 1.1, the engagement cycle should be at the desirable phase for each stage in the FC environment to get the best result from the implementation of the FL model.

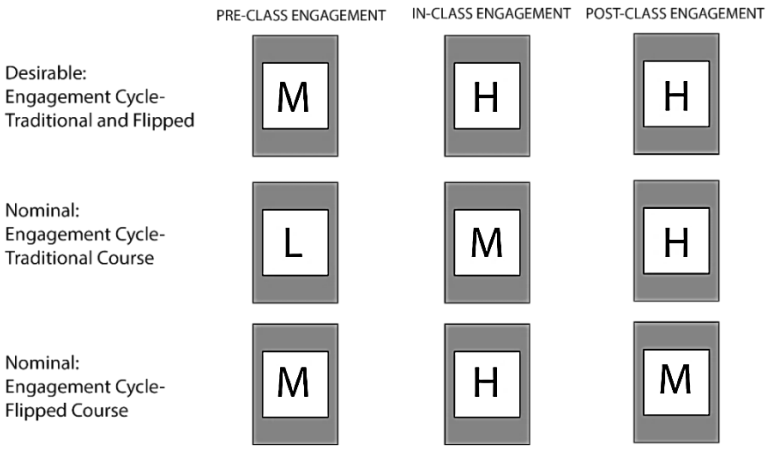

Figure 1.1. Proposed Model for Time Segmenting Student Engagement (Prust, Kelnhofer, & Petersen, 2015)

Even the FL model used widely; there is still some room for improvement for the FL model. The study by Prust et al. (2015) compares the students' outcomes in the form of grades and performance did not show a significant difference between the flipped classroom environment and a traditional teaching environment. Through the years in the higher education environment, there have been so many ways of conducting learning sessions in the classroom, and the FL model is one of the popular models used nowadays. There are several strategies and ways of implementing the FL model in the classroom that other researchers have tried, but there is still room for improvement in implementing the FL model in the classroom.

The FL model used in various subjects across contexts. Some factors related to the FL model needed to be considered by educators and learners. One of the factors is students' engagement, and according to Reeve (2014), engagement divided

into four types, behavioural, agentic, cognitive, and emotional. Students' engagement during the pre-class phase and post-class phase is crucial as, during this phase, students take full control of their learning. During the In-class phase, students' engagement towards instructors and participate in activities such as discussion and presentations is important to ensure active learning session happen as suggested in the FL model. The study by Reeve (2014) shows that engagement (behavioural, agentic, cognitive & emotional) in the classroom promotes active learning.

Another essential factor in the FL model is the students' motivation towards the learning material provided. Proper selection of learning materials for the class can increase a significant amount of perceived motivation towards the learning material. According to Keller (1983), motivation refers to the human inclination to make choices about the experiences, purpose that he wishes to pursue, and to make choices about the quality of the effort that is needed to achieve that choice. For this study, Instructional Material Motivation Scale (IMMS) was used to measure students' Perceived Motivation towards the learning materials provided.

M-learning environment is commonly used nowadays within the education system. The definition and depiction of mobile learning as 'merely' portable e-learning is a gradualist position which will ease its diffusion but weaken its contribution. In contrast, the definition and depiction of mobile learning as something wholly new and distinct is a radical position that will make diffusion and acceptance more problematic but maintain its identity and coherence (Traxler, 2005). Some examples of m-learning platform are Google Classroom, Edmodo, and Wikispaces. All of these web 2.0 tools offer users the ability to access learning material and learn on mobile. In this study, the m-learning environment will be the

new platform for the flipped classroom model to take place. In general, the flipped classroom model will move onto an m-learning environment platform.

Besides the commonly used learning management system (LMS), mobile learning (m-learning) environment is another excellent platform to be used in learning. M-learning environment will be the new platform for the flipped classroom in this study. The researcher believes that by combining the flipped classroom model with an m-learning environment as a platform, it will improve both flipped classroom and m-learning, hence open up a new area of exploration in the body of knowledge for both flipped classroom and m-learning. The researcher names this new combination of FL model and mobile learning platform as a mobile flipped classroom environment.

As the FL environment commonly being used in higher education, it should take into consideration that different streams of studies will result in a different level of performance for students. There have been a few studies researching the relationship between the FL environment across subjects in different streams. The researcher discovers that past research in the FL environment only includes one type of stream of studies for their research; it is either science or arts but never both. As an example, a study by Enfield (2013) discussed students' performance, engagement, and motivation for the student in the arts stream while the study by Mzoughi (2015) discussed students' engagement and performance for the student in science stream. When it comes to implementing the FL environment for university students from both stream of studies that focus on university students' performance, engagement, and motivation, there is room for improvement to producing better outcomes from the FL implementation. Based on this, the researcher decides to conduct the study

with samples from university students to produce a better outcome from this study in this area.

The rapidly advancing mobile technology in the last few years has enabled the learning process to be improved, and students are more motivated to learn (Cheung, Yuen, Li, Tsang & Wong, 2012). Compared to personal computers and laptops, tablets and smartphones are more portable. They have sufficient ability to carry out the required process to run the application with a suitable screen surface for mobility (Schlageter, 2006). The popularity of tablets, as well as its suitability in supporting the learning process amongst adolescents, has encouraged researchers to develop a mobile flipped classroom (M-FC) app to be used on this device. For this study, the app designed specifically to suit the target users' needs and embedded with features that will provide ease of use for the target users.

Even though several web 2.0 tools used to improve performance in the flipped classroom, there is a lack of significant results in terms of students' performance, engagement, and motivation. A study by Enfield (2013) found that flipped classrooms provided an engaging learning experience to which students found to be effective in helping students to learn the content and increased self-efficacy in their ability to learn independently. However, this study only involves arts (multimedia) students. Another study by Panuwatwanich (2017) shows that the flipped classroom provides opportunities for students to apply relevant knowledge within a controlled environment, but this only limited to science (engineering) students. The study underlines the need for the development of the M-FC app that is more comprehensive, engaging, and appropriate within the context of university students with different streams of studies in Malaysia.

Focusing on the factors related to the FL model for the M-FC environment, motivation, and engagement is a form of behaviour and attitude. As we entered the era of advanced technology, technology often used to persuade people in order to change people behaviour and attitude. Persuasive technology is known as an interactive computing system designed to change people's attitudes and behaviours (Fogg, 2003). In persuasive technology, there is an overlap between the computers and persuasion named captology, which stands for 'computer as persuasive technology.' Captology focuses on the design, research, and analysis of interactive computing products created to change people's attitudes or behaviours (Fogg, 2003).

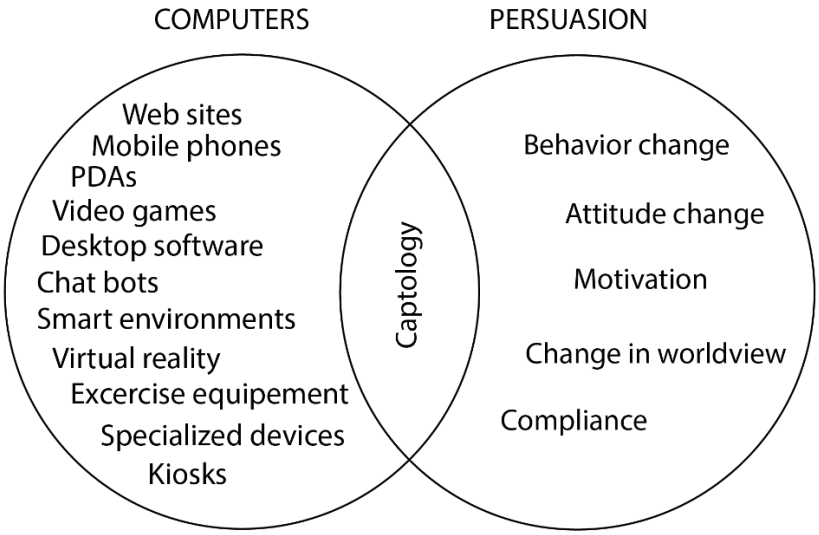

Figure 1.2. Captology (Fogg, 2003)

Persuasion is an attempt to change attitudes or behaviours or both without using coercion or deception (Fogg, 2003). According to Fogg, persuasion divided into two levels, which are Macro and Micro. Macro persuasion, or in another term, macrosuasion describes the overall persuasive intent of a product in which persuasion and motivation are the sole reasons such a product exists. For micro-level persuasion or so-called microsuasion by Fogg, some computing products, such as

email programs or image manipulation software, do not have an overall intent to persuade. However, they could incorporate smaller persuasive elements to achieve a different overall goal. Both levels of persuasions may exist independently or simultaneously in a product depends on the design and intention of the product towards the users.

According to Fogg (2003), there are seven principles of persuasive design principles for persuasive technology tools: Reduction, Tunnelling, Tailoring, Suggestion, Self-monitoring, Surveillance, and Conditioning. In this study, two principles implemented in the persuasive technology itself, which are ‘Tunnelling' and ‘Reduction.' The principle behind ‘Tunnelling' is that computing technology will have higher persuasive power if it is leading users through a predetermined sequence of actions or events, step by step. As an example, when users want to install software, for the most part, the computer will take users through a process step by step. At some points during the installation tunnel, users can select aspects of the application to install and where, but the users are still in the tunnel. Tunneling technology is like riding a roller coaster at an amusement park: once user boards the ride, the user is committed to experiencing every twist and turn along the way. (Fogg, 2003). The ‘Reduction' principle uses computing technology to reduce complex behaviour to simple tasks, increases the benefit/cost ratio of the behaviour and influences users to perform the behaviour. As an example, the Instagram filter applies the reduction principle as users can select the preset filter to apply to their photo and adjust it accordingly. The users did not have to waste time using other editing software before they can share their photos on Instagram. In order to relate these two principles with the flipped classroom model, the persuasive technology will motivate students on preparations before a class session at the right time. The

persuasive technology reduced the preparation before class by simplifying the learning materials by sorting out and organize it according to the needs of learning objectives during the in-class session.

The M-FC app is crafted individually for this study. The learning materials if the M-FC app for this study related to video production subject. The M-FC app comes with features that are commonly being found in other multimedia app as this will ease users to navigate and operate the M-FC app. The M-FC app designed for a smartphone with either android or iPhone operating systems. In addition to that, the the M-FC app only requires a small touch screen, a small keyboard, a limited battery, and limited bandwidth to operate.

Moreover, once the M-FC app was downloaded, users with the Android operating system can use it offline via an articulate storyline player, while for iPhone operating system (iOS), the app can be open through the safari browser as HTML5. Therefore, the user does not have to wait for loading information over the internet connection. Another feature of the M-FC app that makes it ideal for this research is that the app design is in a simple form to improve student motivation to use the app in accessing the learning materials. The researcher develops the M-FC app in English to provide knowledge and understanding of the subject they learned explicitly for university students. This M-FC app developed with two different modes of presentation. Namely, the Mobile Flipped Classroom Segmenting (M-FC-S), and Mobile Flipped Classroom Non-Segmenting (M-FC-NS) because the main researcher focus was to delve deeper into the effects of segmenting principle on students' performance, engagement, and motivation within the mobile flipped classroom environment.

Segmenting principle emphasizes that people learn better when a multimedia message is presented in user-paced segments rather than as a continuous unit (Mayer, 2014). When an essential material is too difficult, it will likely overwork the working memory of the learners, making it intolerable to comprehend at once. Mayer (2014) stated that in this situation, the learner might be able to select only a few sections of the lesson, but unable to gain an in-depth understanding. Ideally, with smaller and manageable chunks that allow user control, students could learn at their own pace. Segmenting is the multimedia learning principle tested out in this study. As all factors related to this study discussed above, in general, the researcher believes that students' performance, engagement, and perceived motivation towards learning material in mobile flipped classroom environments would improve with the use of M-FC app.

1.3 Statement of Problem

Performance in Flipped Classroom (FC) environment is one of the significant factors discussed across various studies related to FC environment implementation. A study by Wright, Greenfield, and Hibbert (2017) shows that performance is not the single contributing factor towards the effectiveness of implementing FC. From the systematic review of literature on the FC environment area, the researcher found out another factor that sequentially contributes to the performance in the FC environment. The factor is students' engagement towards the implementation of the FC environment. A study by Seery (2014) discussed student engagement in the flipped classroom, and results show that students tend to engage with the flipped classroom model, and this engagement worked better with in-class active learning components. Engagement also mentioned in Gilboy, Heinerichs, and Pazzaglia

(2015), where FC used in order to enhance student engagement in class. Other than engagement, student performance on the subject taught increases as they easily understand and apply the knowledge in order to complete the assignments or answering the quizzes. The researcher also discovers that students' motivation towards learning materials provided in the FC environment is also a contributing factor for the FC implementation.

Segmenting principle chunk ample information into smaller segments and allow the user to understand the information in a bite-size. As an example, a subject consists of a lot of sections and parts, but by segmenting the subject accordingly, it is much easier to understand the information rather than read and learn all of it at one time. When developing this M-FC app, it is of utmost importance that the researcher includes elements of social cues; for example, a button shape commonly used in most apps. Using the familiar button, make it easier for the user to navigate through the app, and this will aid users' inactivation of response, and subsequently increase active cognitive processing. As this increased, the quality of the learning outcome will also increase. Meaning that, when students exposed to M-FC app with the segmenting principle, their performance and engagement in the FC environment will increase. Furthermore, perceived motivation towards this learning material will also increase.

For this research, the researcher aims that students' performance, engagement, and perceived motivation towards learning materials in the FC environment would increase. Apart from studying the increase in performance and engagement in the FC environment, it is also essential for a researcher to study the level of perceived motivation of students towards the learning material. Perceived motivation toward learning materials is one of the factors that also enhance cognitive processing and

engagement. Motivation affects what and how information is processed because motivated learners are more likely to pay attention and try to understand the material instead of merely going through the motions of learning in a superficial manner (Kanfer and Ackerman, 1989). Therefore, perceived motivation included as one of the dependent variables in this research. Understanding the relationship between a different stream of studies with the segmenting principle is an essential aspect of this research. The results of this study will provide a better picture of which stream of studies is more suitable to be exposed to segmenting or non-segmenting learning material in the M-FC app.

1.4 Objectives of the Study

The primary purpose of the study is to improve student's performance, engagement, and perceived motivation towards learning materials in the mobile flipped classroom environment through the 'M-Flipped Classroom' application developed for this study. This purpose leads to the following research objectives:

i. To investigate the effect of two different presentations mode of 'M-Flipped Classroom' application (M-FC-S and M-FC-NS) by conducting an experimental study with university students from two different faculties that assess their performance before and after the implementation of the 'M-Flipped Classroom' application.

ii. To study the engagement appeal of the 'M-Flipped Classroom' application, which assesses the behavioural, agentic, cognitive, and emotional engagement of university students from two different faculties to engage towards the learning material after the exploration of the two different presentations mode (M-FC-S and M-FC-NS).

iii. To study the motivational appeal of the ‘M-Flipped Classroom' application, which assesses the perceived motivation of university students from two different faculties to learn towards the learning material after the exploration of the two different presentations mode (M-FC-S and M-FC-NS).

1.5 Research Questions

The objectives trigger the following research questions:

A. What is the effect of M-Flipped Classroom App with segmenting (M-FC-S) and M-Flipped Classroom App with non-segmenting (M-FC-NS) towards university students’ performance in mobile flipped classroom environment? The subsidiary questions for Research Question A are:

1) Is there any significant difference in university students’ performance in a mobile flipped classroom environment between M-FC-S and M-FC-NS?

2) Is there any significant difference in university students’ performance in mobile flipped classroom environment between faculty A (Science) in both presentation modes (M-FC-S and M-FC-NS)?

3) Is there any significant difference in university students’ performance in mobile flipped classroom environment between faculty B (Arts) in both presentation modes (M-FC-S and M-FC-NS)?

4) Is there any significant difference in university students’ performance in mobile flipped classroom environment between faculty A and B in M-FC-S?

5) Is there any significant difference in university students' performance in mobile flipped classroom environment between faculty A and B in M-FC-NS?

B. What is the effect of M-Flipped Classroom App with segmenting (M-FC-S) and M-Flipped Classroom App with non-segmenting (M-FC-NS) towards university students' engagement in mobile flipped classroom environment? The subsidiary questions for Research Question B are:

1) Is there any significant difference in university students' engagement towards the learning material between M-FC-S and M-FC-NS?

2) Is there any significant difference in university students' engagement in mobile flipped classroom environment between faculty A (Science) in both presentation modes (M-FC-S and M-FC-NS)?

3) Is there any significant difference in university students' engagement in mobile flipped classroom environment between faculty B (Arts) in both presentation modes (M-FC-S and M-FC-NS)?

4) Is there any significant difference in university students' engagement in mobile flipped classroom environment between faculty A and B in M-FC-S?

5) Is there any significant difference in university students' engagement in mobile flipped classroom environment between faculty A and B in M-FC-NS?

C. What is the effect of M-Flipped Classroom App with segmenting (M-FC-S) and M-Flipped Classroom App with non-segmenting (M-FC-NS) towards university students' perceived motivation in mobile flipped classroom environment? The subsidiary questions for Research Question C are:

1) Is there any significant difference in university students' perceived motivation towards the learning material between M-FC-S and M-FC-NS?

2) Is there any significant difference in university students' perceived motivation in mobile flipped classroom environment between faculty A (Science) in both presentation modes (M-FC-S and M-FC-NS)?

3) Is there any significant difference in university students' perceived motivation in mobile flipped classroom environment between faculty B (Arts) in both presentation modes (M-FC-S and M-FC-NS)?

4) Is there any significant difference in university students' perceived motivation in mobile flipped classroom environment between faculty A and B in M-FC-S?

5) Is there any significant difference in university students' perceived motivation in mobile flipped classroom environment between faculty A and B in M-FC-NS?

1.6 Research Hypotheses

The hypotheses for this study are formulated as null hypotheses. In this research, the researcher will reject the null hypothesis when the *p*-value turns out to be less than the significant level, which is 0.05. The null hypotheses that correspond to the above three primary research questions are:

A. The effect of M-Flipped Classroom App with segmenting (M-FC-S) and M-Flipped Classroom App with non-segmenting (M-FC-NS) towards university students' performance in mobile flipped classroom environment. The subsidiary null hypotheses are:

$H_{0.A.1}$ There is no significant difference in university students' performance in a mobile flipped classroom environment between M-FC-S and M-FC-NS.

$H_{0.A.2}$ There is no significant difference in university students' performance in mobile flipped classroom environment between faculty A (Science) in both presentation modes (M-FC-S and M-FC-NS).

$H_{0.A.3}$ There is no significant difference in university students' performance in mobile flipped classroom environment between faculty B (Arts) in both presentation modes (M-FC-S and M-FC-NS).

$H_{0.A.4}$ There is no significant difference in university students' performance in mobile flipped classroom environment between faculty A and B in M-FC-S.

$H_{0.A.5}$ There is no significant difference in university students' performance in mobile flipped classroom environment between faculty A and B in M-FC-S

B. The effect of M-Flipped Classroom App with segmenting (M-FC-S) and M-Flipped Classroom App with non-segmenting (M-FC-NS) towards university students' engagement in mobile flipped classroom environment. The subsidiary null hypotheses are:

$H_{0.B.1}$ There is no significant difference in university students' engagement in a mobile flipped classroom environment between M-FC-S and M-FC-NS.

$H_{0.B.2}$ There is no significant difference in university students' engagement in mobile flipped classroom environment between faculty A (Science) in both presentation modes (M-FC-S and M-FC-NS).

$H_{0.B.3}$ There is no significant difference in university students' engagement in

mobile flipped classroom environment between faculty B (Arts) in both presentation modes (M-FC-S and M-FC-NS).

$H_{0.B.4}$ There is no significant difference in university students' engagement in mobile flipped classroom environment between faculty A and B in M-FC-S.

$H_{0.B.5}$ There is no significant difference in university students' engagement in mobile flipped classroom environment between faculty A and B in M-FC-S

C. The effect of M-Flipped Classroom App with segmenting (M-FC-S) and M-Flipped Classroom App with non-segmenting (M-FC-NS) towards university students' perceived motivation in mobile flipped classroom environment. The subsidiary null hypotheses are:

$H_{0.C.1}$ There is no significant difference in university students' perceived motivation in mobile flipped classroom environment between M-FC-S and M-FC-NS.

$H_{0.C.2}$ There is no significant difference in university students' perceived motivation in mobile flipped classroom environment between faculty A (Science) in both presentation modes (M-FC-S and M-FC-NS).

$H_{0.C.3}$ There is no significant difference in university students' perceived motivation in mobile flipped classroom environment between faculty B (Arts) in both presentation modes (M-FC-S and M-FC-NS).

$H_{0.C.4}$ There is no significant difference in university students' perceived motivation in mobile flipped classroom environment between faculty A and B in M-FC-S.

$H_{0.C.5}$ There is no significant difference in university students' perceived motivation in mobile flipped classroom environment between faculty A and B in M-FC-S

1.7 Significance of the Study

This research contributes to improving performance, engagement, and motivation in mobile flipped classroom environment among university students. The M-FC App constructed will increase students' performance in the mobile flipped classroom environment, particularly on video production subjects. This app also aims to improve students' engagement in the mobile flipped classroom environment by providing relevant notes, videos, and questions related to video production subject. This app is also carefully crafted to increase students' perceived motivation towards the learning material in the mobile flipped classroom environment. The results of this study could also benefit parties which aim to increase students' performance, engagement, and motivation in mobile flipped classroom environment for video production subject; for instance, lecturers, teachers, and also tutors.

From the learning aspects, the design and development of the persuasive multimedia application in this study that based on persuasive technology as a tool in Persuasive Technology (Fogg, 2003) and Multimedia learning principles (Mayer, 2014) will contribute to the body of knowledge in terms of technology development and practical use of the technology in higher education. In terms of Persuasive Technology itself, this study will contribute to the development of a working model for attitude formation in addition to the existing Fogg Behavior Model (2009), which limited to behavioural components only.

1.8 Research Framework

This research investigates the effects of using the 'M-Flipped Classroom' application with two-mode of presentations (M-FC-S and M-FC-NS) as independent variables towards performance, engagement, and perceived motivation towards learning materials as dependent variables. The moderating variable for this study would be the different stream of studies, which is science or arts based on their educational background**.** Figure 1.3 shows the research framework for this study.

In this study, the M-FC-S and M-FC-NS were used to measure the dependent variables, which is the performance, engagement, and perceived motivation. The M-FC-S and M-FC-NS used by both science stream and arts stream students for this study in order to see the difference in their performance, engagement, and perceived motivation. The stream of studies that divided into science and arts used to separate the result of students' performance, engagement, and perceived motivation before and after using the M-FC-S and M-FC-NS. The stream of studies chosen as the moderator variable for this study. The purpose is to see the effects of M-FC application on science students (left-brain users) and arts students (right-brain users) towards their performance, engagement, and perceived motivation towards learning material in the mobile flipped classroom environment. This is a new exploration of using stream of studies as moderator variables in an experimental educational research.

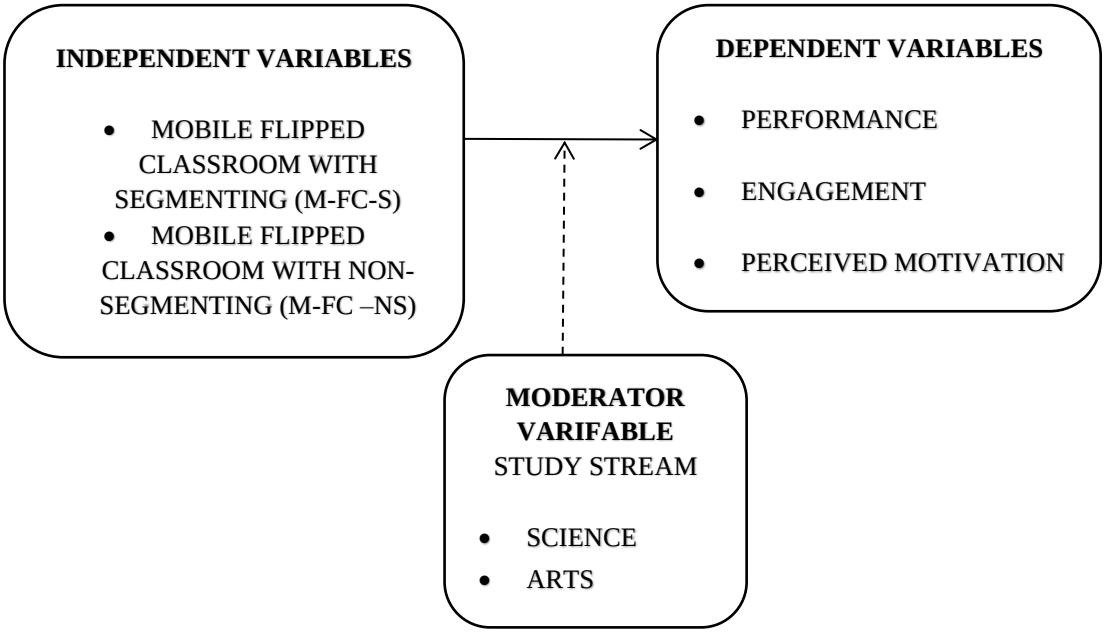

Figure 1.3. Research Framework

1.9 Theoretical Framework

This research uses Cognitive Theory of Multimedia Learning (CTML) by Mayer (2014), Persuasive Technology Principles, and Persuasive Design Principles by Fogg (2003) as a macro strategy as the M-FC app function as a tool for the students. Meanwhile, the principles of multimedia learning (Mayer, 2014) and Fetaji and Fetaji's usability framework for m-learning used as a micro strategy for this research. The use of segmenting principles from the principles of multimedia learning (Mayer, 2014) aims to reduce students' cognitive load, and it suits studying the effects on performance, engagement, and motivation for this study. Fetaji and Fetaji's Usability Framework chosen as a guideline in developing the M-FC app. Reigeluth and Merrill (1978) state that a macro strategy focused on the order of the selection, and the order of the topics to present. While the micro-strategy focused on the effective presentation of content learning strategies. Figure 1.4 shows the theoretical framework. The related theories were discussed comprehensively in Chapter Two.

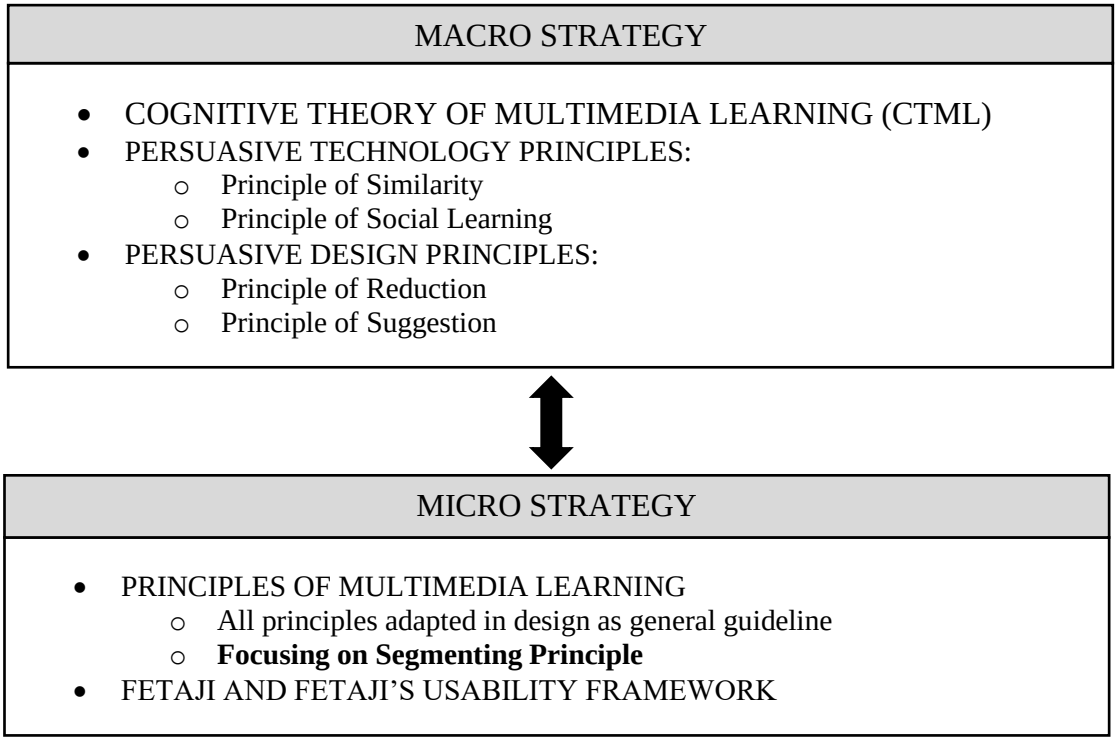

Figure 1.4. Theoretical Framework

1.9.1 Persuasive Technology

Persuasive Technology is the study related to attitudes and how to changes attitudes and behaviour (Fogg, 2003). Persuasive Technology plays an essential role in education (Lucero et al., 2006). In this study, two Persuasive Technology Principles and two Persuasive Design Principles applied as the macro strategy in designing the Multimedia App.

i. Persuasive Technology Principles:

   a. Principle of similarity – Learners easily persuaded by a technology that is similar to them is some ways.

   b. Principle of social learning – Learners can learn through observations of others from vicarious experience through others, and can learn from watching another person's experience of a situation.

ii. Persuasive Design Principles:

a. Principle of Reduction – Persuasive Technology reduce complex behaviour to simple task increases the benefit/cost ratio of the behaviour and influences learners to perform the behaviour.
b. Principle of Suggestion – A computing technology will have higher persuasive power if it offers suggestions at opportune moments.

1.9.2 Cognitive Theory of Multimedia Learning (CTML)

This theory assumes that each person separates the verbal and visual channels to process information input. The ability to process a certain amount of information limited at one time. At the same time, the student will actively try to create a visual and verbal model from the presented materials and creating connections between them. The student will only be able to master a few words and images at one particular time. According to Mayer (2014), knowledge or information delivered in the form of multimedia will improve the effectiveness of teaching and learning. Therefore, to ensure the information stored in long term memory, the learning process involves multimedia presentation go through three stages, as shown in Figure 1.5. Start with selecting relevant words to process in verbal memory and select relevant images to be processed in the visual working memory. Organise selected words into verbal, mental models and organise selected images into visual mental models. Integrates verbal and visual representation with existing knowledge to build long-term memory. Figure 1.5 shows the Cognitive Theory of Multimedia Learning Model.

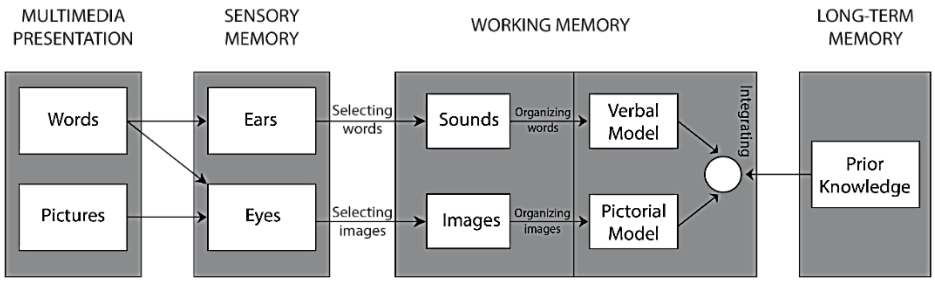

Figure 1.5. Cognitive Theory of Multimedia Learning model (Mayer, 2014)

1.9.3 Principles of Multimedia Learning

Based on the coordination of cognitive processes that occur during learning, Mayer (2014) proposes 12 principles in the design of multimedia learning materials:

i. **Multimedia principle**: Users learn better from words and pictures than from words alone.

ii. **Spatial Contiguity Principle**: User learns better when corresponding words and pictures presented near rather than far from each other on-screen.

iii. **Temporal Contiguity Principle**: User learns better when corresponding words and pictures are presented simultaneously rather than successively.

iv. **Coherence Principle**: User learns better when extraneous words, pictures, and sounds excluded from the presentation.

v. **Modality Principle**: User learns better from animation and narration than from animation and on-screen text.

vi. **Redundancy Principle**: User learns better from animation and narration than from animation, narration, and on-screen text.

vii. **Signalling Principle**: The user learns better when cues that highlight the essential material added.

viii. **Segmenting Principle**: User learns better when a multimedia message is presented in user-paced segments rather than as a continuous unit.