Impact of E-Book Human Computer Interaction on Student's Motivation, Achievement and Cognitive Load

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Abstract

The research seeks to evaluate the efficacy of using the E-Book human computer interaction in terms of motivation, performance on achievement tests, and cognitive load experienced by students. The purpose of this study was to examine variations in motivation levels among students with varying levels of knowledge, establish the correlation between motivation and achievement test scores, and ascertain whether cognitive burden acts as a mediator between student motivation and test performance. The assessment was carried out by administering before and post tests using the Instructional Materials Motivational Scale (IMMS) survey questionnaire and the NASA Task Load Index cognitive load test (NASA-TLX). The research use experimental quasi-methods to collect data, which is then subjected to quantitative analysis utilizing pairs-t tests and PLS-SEM. Seberang Perai Polytechnic has a cohort of 80 students enrolled in the subject Human computer interactions for the first semester. There are notable disparities in the accomplishment test scores, motivation levels, and cognitive load of pupils before and after using the E-book Human computer interaction. The pair-t test findings indicated substantial disparities in achievement test performance across children, with t-values of -11.515 (p = 0.000) and -12.729 (p = 0.000). Prior to and following the utilization of the E-Book Human computer interaction, there was a substantial disparity in motivation levels among students. This was evident both before (T = -158.650, P = 0.000) and after (T = -158.796, P = 0.000) the implementation of e-books. Furthermore, motivation exhibited a significant correlation with students' academic progress (t = 5.597, p = 0.00). The analysis reveals that cognitive strain serves as a substantial mediator between motivation and student achievement test performance (β:0.106, t:4.904, p = 0.00). To summaries, the E-Book human computer interaction serves as a viable option for enhancing teaching materials. It may be used as a comprehensive resource for the study of human computer interactions, while also stimulating student engagement and academic performance. Essentially, this strategy may be used as a tool for teaching and assisting instructional material creators in selecting suitable applications and adapting to various kinds of learning, particularly those based on e-books.

Keywords: Human Computer Interaction E-Book, Motivation, Cognitive Level, Student Performance

1.0 Introduction

The education sector plays a crucial role in guaranteeing the long-term growth and advancement of the nation. Alias (2019) asserts that educational institutions have a crucial role in attaining the national educational goal of establishing a top-tier education system. Technical and vocational education (TVET) is also adapting to the rapid growth of information technology in the education sector. Technical and vocational education aims to provide students theoretical and practical learning experiences. It caters to students

who are interested in expanding their skills and interests and want to further their knowledge in this particular subject. In the realm of engineering and vocational education, the principles of teaching and learning are similar to those in general education, with a focus on theoretical knowledge rather than practical application. The teaching methodologies used in technical and vocational educational institutions continue to rely on conventional examination-focused techniques, despite the persisting issue of students unable to effectively assimilate prior knowledge with new information. Long (2019) asserts that in order to ensure successful student learning, it is necessary to use certain ways for delivering each topic. To effectively adapt to the evolving times, it is crucial to use suitable instructional tactics and approaches. Technology may serve as a solution to meet these challenges. Teachers must acquire proficiency in a range of teaching methods in order to cater to students' diverse learning styles, such as problem-based learning. Additionally, they should enhance students' general skills, including problem-solving abilities, group collaboration, effective communication, and fostering a sense of responsibility and active engagement in the learning process, ultimately promoting self-sufficiency.

Learning style pertains to the unique attribute of a learner to perceive, engage, and navigate within an educational environment. The cognitive styles of students may be categorized into four types: auditory, visual, tactile, and kinesthetic. Each type necessitates the use of materials that align with their respective cognitive style. Hence, the cognitive abilities of a student have a distinct influence on how they engage with their surroundings. Cognitive styles refer to the aspects of personality that impact an individual's views, values, and social interactions (Yahaya et al., 2019). In Messick's (2018) study, style was defined as a characteristic way in which a person thinks, remembers, or solves problems.

The Mayer Study (2017), which endorses this directive, is recognized as Multimedia Based Learning, a modification of multimedia cognitive theory. According to Abdullah et al. (2017), the multimedia cognition theory is synonymous with an information processing model. Multimedia-based learning refers to the use of text and graphics as a means of communication for educational objectives. Students need assistance and guidance, such as using multimedia-based instruction, to facilitate the execution and proficient application of intricate simulations. Conceptual learning is significantly influenced and guided by multimedia-based learning. The citation is from Mayer and Moreno's work published in 2016. Communication may be conveyed via several mediums, such as print media like e-books, followed by digital media and technology-driven means like computers. Printed words and speeches are classed as verbal expressions, while static visuals, such as drawings and pictures, or moving images such as animations and video clips, are categorized as visual representations. Indeed, these printed and digital media serve as fundamental means of communication that include both auditory and textual elements.

In a research conducted by Jabbour (2018), educators expressed their belief that static pictures are a passive form of reference and are not as effective as dynamic animations. From a different perspective, the debate around the superiority of static visuals compared to dynamic images has been addressed in comparable subject matter. This perspective aligns with the findings of Mayer et al. (2016), which suggest that static pictures in educational materials are more efficacious than moving visuals. The researchers have used multimedia-based learning approaches to explore the development of storms and lightning. The primary principle is to engage in the dissemination of printed media. This media consists of a sequence of still photographs accompanied by written explanations. Furthermore, the second premise is conveyed using animated visuals and spoken explanations. Based on this research, the results indicate that using the printed medium yields superior outcomes compared to employing the second principle. Dynamic visuals in animation offer an advantage over static images in conveying specific information based on the student's spatial skill level (Narayan & Hegarty, 2018).

2.0 Literature Review

Based on the background and rationality of the study, there are some weaknesses that can be identified in the teaching of the subject of the human computer interaction that uses the traditional approach, i.e. the process of teaching that is shaped as well as the lack of ability to exploit the various kinds of learning senses of students. Some students have cognitive learning styles such as Field Independence (FI) and Field Dependence (FD), (Witkin et al., 2015). Dunn (2021) states that students' failure is not caused by curriculum instead they can learn any math if it emphasizes the style they enjoy. Felder and Silverman (2003) also said that each student's learning style is different as well as the teaching of different teachers.

Each student is individually different in techniques and learning styles, problem-solving methods, behavior, motivation, willingness to learn, ability to learn, mental intelligence, ability of mastering something skills and values towards the subject even students from the same group or class (Kolb, 2021).

There are other studies being conducted to address student incomprehension and learning difficulties in the subject of human computer interactions and the study has shown that students do have problems in understanding the concept of a human computer interaction (Turgut et al., 2017; McDermott & Shaffer, 2018). Through the learning process, students are seen to be unable to perform as well as expected because of many elements and among them is a lack of science that exists in them. This science deficiency can be categorized into three types: confusion, uncertainty and imperfection (Chang et al., 2018). The main factor found to contribute to the student's failure to master the subject of this human computer interaction is the use of weak and ineffective teaching methods and strategies (Adu-Manu Sarpong et al., 2015). Teaching that is only teacher-centered and conventional is rude and does not meet the needs of today's learning (Mortensen & Nicholson, 2015). Most teachers use

static methods of enlightenment and learning activities, i.e. using the same activity at each learning session and excluding the diversity of learning capabilities. According to a study by Fazzlijan (2016), the diversity of teaching methods used by teachers can affect the interest and achievement of students in the subject being studied. The use of teacher-centric learning methods makes students passive and the type of interaction more of a day-to-day interaction. On the other hand, if a student-centered teaching approach is used, then the learning process will become more active because the student is fully engaged in learning activities, while the teacher acts as a facilitator and guide to the implementation of learning activities so that learning results can be achieved effectively.

According to Subari et al. (2021) to this day most professors have not been able to present their teaching effectively, so many students in higher education institutions are not interested in studying. One of the main reasons for the decline in academic achievement of students is that they fail to adjust to the way of teaching and learning in addition to not having the right learning style (Abu, 2000; Awang, 2020). The method of chalk and talk used by educators using blackboards is boring and less effective in giving understanding to students. The problem arises when the student's learning style cannot be adapted to the activities and teaching style of the teacher.

Failure of this traditional method will burden students with self-learning activities outside of class time to understand what they have failed to gain in class. Because the reference material for these subjects is also in the form of static media and the content of the lesson is beyond the limits of existing knowledge, the cognitive burden of the student will increase throughout the process of self-learning. Excessive loads in working memory will result in information leakage and information that is difficult to record in long-term memory throughout the activity (Tabbers, Martens & Van Merrienboer, 2019; Chandler, 2021; Klien, 2020).

As a result, students get bored and don't concentrate; they fail to score high on the exam, lose interest in a particular subject and then give up (Abu, 2000; Felder & Silverman, 2003; Godleski, 2002; Oxford et al., 2000; Smith & Renzulli 2022)

2.1 Research Objective

There are two (2) objectives in this study which are: -

H^1 Identify the relationship between motivation and student achievement test performance after learning using the e-book human computer interaction.

H^2 Identify whether the cognitive load is a mediator of the relationship between motivation and student achievement test performance after learning using the e-book human computer interaction.

3.0 Methodology

This study was conducted through a quasi-experimental method using the experimental group design of pre-posttest (Chua, 2016). The quasi-experimental method was chosen because it involves the selection of sampling criteria that have almost the same characteristics without using the random distribution procedure. This method occurs because students have been divided according to their respective class groups by the Polytechnic. The researchers chose this study design because the study samples were taken from existing classes without any amendment to the existing arrangement of students in those classes. Creswell (2016) states that quasi-experimental methods with pre-test and post-test design methods can be implemented with divide the existing group of students into treatment groups, administer pre-tests for both groups, perform experiments, and followed by the implementation of post-test. Specifically, the selected quasi-experimental research design is based on the design of the experimental group before and after the test. The choice of quasi-experimental design allows researchers to compare 127 data between research groups before and after the implementation of the study, find out causal relationships, and make it easier for researchers to generalize (Othman, 2018; Sekaran & Bougie, 2017). These two groups of students, novices and knowledgeable, occupy the same pre-test before any treatment. The purpose of pre-administered tests is to determine whether these students are equivalent or not in terms of level knowledge and level of achievement. The students were tested again by posttest. This post - test is administered aimed at detecting improvement in achievement after treatment is accepted in individual groups. Figure 1 shown the design research flow.

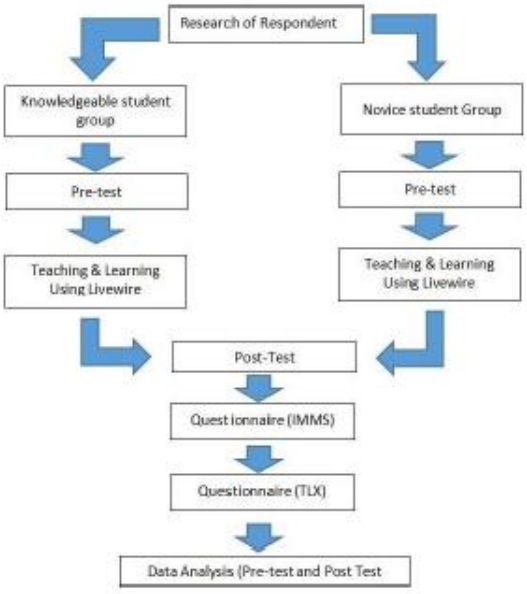

Figure 1: Research Design

4.0 Results and Discussion

In Table 1, H1 has significantly predicted cognitive load to be a mediator of the relationship between student motivation and test performance (figure 2.0).

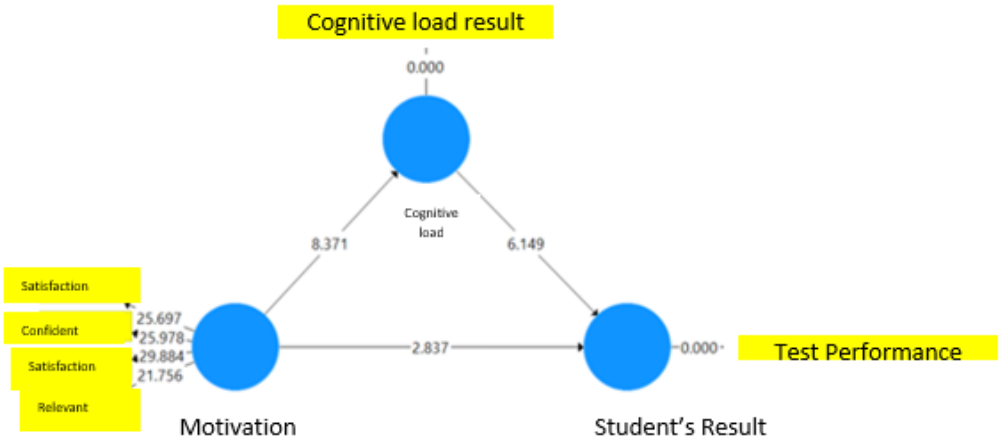

Figure 2: Relationship Between Student Motivation and Test Performance

The results of the analysis showed (table 1.0) that cognitive overload is a mediator between the relationship of motivation and student performance at significant values (β:0.106 t:4.904, p=0.00). This is because, according to conditions from Hair et al. (2017) and Ramayah et al. (2018), the T value should be above 1.96 and the p value should be less than 0.05. The findings of this study indicate that motivated students need other factors such as cognitive burden to help improve their score achievement. Therefore, hypothesis H1 for the fourth study question is accepted.

Table 1: The Results of The Cognitive Overload Hypothesis Are A Mediator to Student Achievement

H1	Beta	Standard Deviation	T Value	P Value	Result
Motivation → Cognitive load → Student Achievement	0.106	0.022	4.904	0.000	Accepted

Once the measurement model is valid and reliable, then the next step is to evaluate the structural model analysis (Figure 2.0). Structural models are elements that have a frame that are combined with each other. The relationship between these frameworks is determined on the basis of previous theories that have explained the relationship. However, the formation of the structural model of this study is based on the consolidation of coupling theory and previous study models that have not been proven. Therefore, the

evaluation of this structural model should be carried out to obtain information about the relationship between the constructs, namely the path coefficient (t and p values)

Figure 3: Structured Model for student motivation and achievement

Path coefficient (β) used to describe the relationship between constructs. To test the significance of the path coefficient, this research has applied the standard bootstrapping procedure with 5,000 samples (Hair et al., 2018; Ramayah et al., 2018). The p value also needs to be below 0.05 in order for it to be proven to be significant. In this research, the T value used is based on a confidence level of 95% and a t value equal to 1.96.

Table 2: Hypothetical results of student motivation and achievement

H^2	Beta	Standard Deviation	T Value	P Value	Result
H^2:Motivation →Student Achivement	0.247	0.044	5.597	0.000	Accepted
H^2:Motivation →Student Achivement	0.247	0.044	5.597	0.000	Accepted

Based on the results of the analysis of studies that have been conducted (Table 2.0), it was found that the motivation construct has a significant relationship with the student achievement construct with the value of t = 5.597 and p = 0.00. This is because according to the terms of Hair et al. (2017) and Ramayah et al. (2018), the T value needs to be above 1.96 and the p value needs to be less than 0.05. This means that motivation can help in the improvement of student achievement tests. Therefore, the H^2 hypothesis in this third study question is accepted.

5.0 Conclusion(s)

This study investigates the efficacy of using e-books to enhance motivation, cognitive load, and academic performance among students enrolled in an human computer interaction course. Diversifying and adapting teaching and learning methodologies is essential to mitigate student boredom during classroom instruction. There is no universally superior teaching and learning strategy that can be applied to every setting in a classroom. The disparity in the classroom environment necessitates the expertise of the instructors to

effectively manage the class. This issue pertains to the students' capacity to comprehend the teacher's intended message throughout the process of instruction and learning. Hence, it is important to thoroughly explore and effectively address this issue in order to avoid students from experiencing a lack of information and direction. Comprehensive information, comprehension, and collaboration from all stakeholders are crucial for the successful implementation of optimal learning and teaching practices at the polytechnic level.

The study of research investigating the correlation between motivation and student accomplishment test performance, after learning using an e-book human computer interaction, revealed that motivation may enhance student achievement test performance. Consequently, motivation has a significant impact on student accomplishment.

In the upcoming research, cognitive load serves as a mediator in the connection between motivation and student accomplishment test performance, after the utilisation of a learning system that operates via e-books. The study's findings indicate that cognitive overload acts as a mediator in the link between motivation and student performance, with a considerable impact. The results of this research suggest that motivated students need additional elements, such as cognitive strain, in order to enhance their academic performance. Furthermore, the results also provide a unique contribution to the advancement of instructional materials, learning via simulation, and the exploration of novel information. The following section of subtopics provides a detailed description of each of these individual contributions.

The results also inform students that they possess the capacity to enhance their critical thinking skills in relation to real-world contexts. By using electronic human computer interaction-books, students may effectively use critical thinking skills in practical scenarios, as shown in this study (Berge, 2018). This assistance aims to enhance students' academic performance, therefore providing them with additional incentive with the use of entertainment-based learning support.

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Author Contributions
This work was written by myself alone; no co-authors were involved.

Conflicts of Interest

The author declares no conflict of interest.

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