Enhancing Logistics Education Using Simulation Mobile Learning

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Abstract
Engagement in the virtual learning environment for logistics education is becoming increasingly important, especially at the Higher Education level. Previous studies have shown that to achieve learning objectives by increasing student engagement during the learning process, it is necessary to consider 'how it happened'. Academics and logistics practitioners have also reported the need to find common denominator in preparing students for real-world experiences. This study investigates the need of Simulation Mobile Learning in enhancing logistics education. Action research was applied in this study and two intervention plans were designed and developed to examine the changes in enhancing logistics education. Cycle-1 is to identify the need for Simulation Mobile Learning in enhancing logistics education and finally to access the students' interest in Simulation Mobile Learning and evaluate the usability level perception. In Cycle-2 the purpose is to measure the students' knowledge by comparing their score marks and evaluating their usability level perception. With that, the research design employed in this study was the mixed methods approach by combining qualitative and quantitative method accordingly by using ADDIE model phase. The questionnaire was distributed to Diploma in Logistics and Supply Chain Management students. A usability questionnaire categorized four primary domains, which are usefulness, ease of learning, efficiency of use and satisfaction was applied to evaluate the Simulation Mobile Learning usability level perception. Data were analysed using SPSS to find comparative analysis and significant value. The outcomes revealed that the usability level of the proposed method had been high among the students, for the contexts of usefulness, ease of learning, efficiency of use and satisfaction. Therefore, the use of Simulation Mobile Learning is indeed relevant and appropriate in enhancing logistics education.

Keywords: Logistics, Simulation, Mobile learning

Introduction

"Educational needs" are where educational conditions are required in a particular subject determined by a vacancy in professional or work experience (Smith, 2004). In terms of logistics, this is a condition that relates to the inconsistency or difference between what the logistics market demands of a professional logistician and what is currently happening now. Studies on the interaction between the logistics programmes provided by higher education institutions and the logistics education needs gained substantial coverage in the logistics education literature (Gravier & Farris 2008). Such interest might be attributed to the belief that logistics programmes facilitate logistics graduates' knowledge of logistics, non-logistics, and related competencies.

In higher education, simulations are becoming more prominent. They are used to encourage a greater understanding of topics and links between them, as well as advance inquiry, problem solving, and decision making in STEM (science, technology, engineering, and mathematics) education. This research comprises a review of the study on how Simulation Mobile Learning can enhance logistics education for Diploma of Logistics and Supply Chain Management (DLS) students.

The fatal adversary known as COVID-19 had affected hundreds of thousands of people around the world by March 2020. It was in the blink of an eye that the usual tight weekday routine and hectic weekend lifestyle shifted when you stay indoors. The slogan 'stay-at-home' has become a mantra sung throughout social media to remind people how dangerous the virus is. COVID-19 has also severely slammed the Malaysian higher education market. In accordance with government policies, universities and colleges are quick to deploy a crisis plan to support their largest customers – students. In order to begin the academic session with the current standard of social distance and MCO, online learning has been introduced to ensure a seamless teaching and learning process.

In the 21st century, when knowledge and technology grew exponentially, educators and researchers increasingly stressed the potential power of educational technology to improve STEM learning outcomes (Anderson, 2015). Therefore, the use of educational technologies such as augmented reality, simulations and robotic applications has become an important issue for researchers in STEM education (Anderson, 2015). Research show that simulations can provide STEM literacy development (Nico Rutten, 2011) and STEM awareness in students (Gül & Taşar, 2020). D'Angelo *et al*., (2013) argued that the positive effects of the simulations are evident in studies, but there is still a lot to learn about the educational benefits of computer simulations in STEM areas.

Although recent studies shown an increasing interest in the role of digital learning in supporting the teaching and learning process, there is a limited discussion in the literature on how sustainable digital learning tools can be effectively adopted to help teaching and learning methods (Nortvig, 2018). The educational institutions have a major responsibility to prepare students for the complex logistics careers. They must constantly challenge their study programs and teaching methods to allow potential logistics professionals to acquire adequate knowledge, skills, and abilities. Simulation is one promising way to enhance logistics education (Wood, 2012).

Methodology

Case description

In logistics education, warehousing is one of the key activities. Efficient warehouse operations will ensure that a company distributes and receives vital stock in time for replenishment on store shelves or in manufacturing facilities. Therefore, it is important for students to really understand the concepts in the subject of warehouse during their Diploma course at Polytechnic to comply with the future working environment.

One of the discipline subjects in Diploma Logistics and Supply Chain Management is Fundamental of Warehouse Operations that the students take during their second year (Semester 3). The course learning outcome is to ensure the students can display a limited range of practical skills, essential tools, methods, and procedures to perform required tasks on warehouse operations.

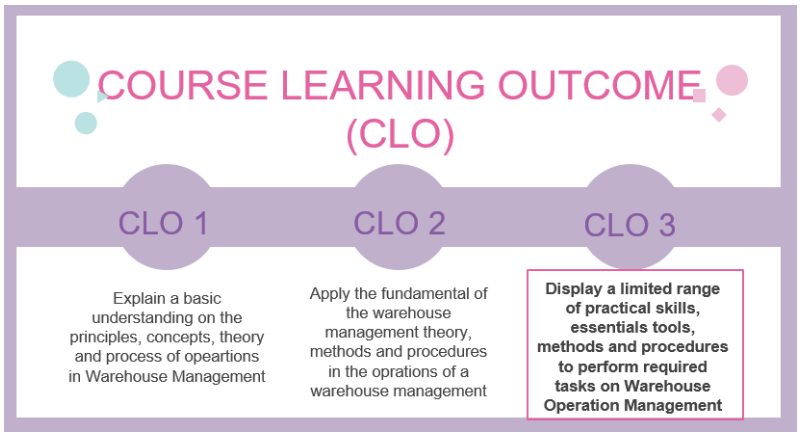

Figure 1: Course Learning Outcome (CLO) for Subject Fundamental of Warehouse Operations

There is a practical assessment in Chapter 2 (Topic: Warehouse Operations) that students need to carry out separately in the classroom.

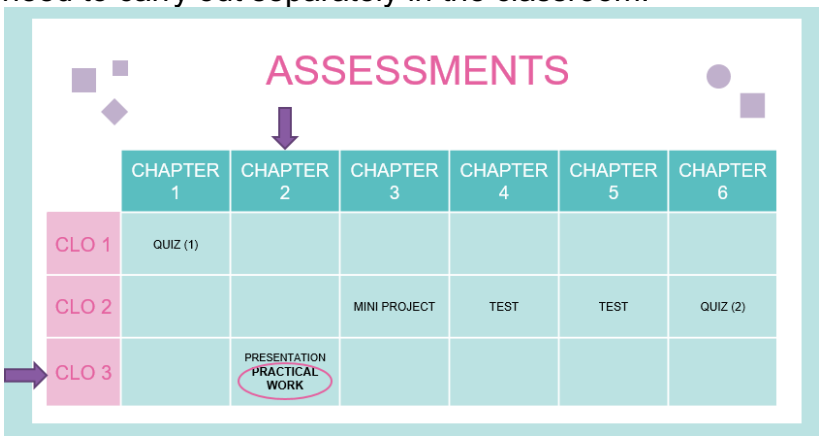

Figure 2: Assessments in Subject Fundamental of Warehouse Operations

The assessment of Practical Work in Chapter 2-Warehouse Operations consists of subtopic below:

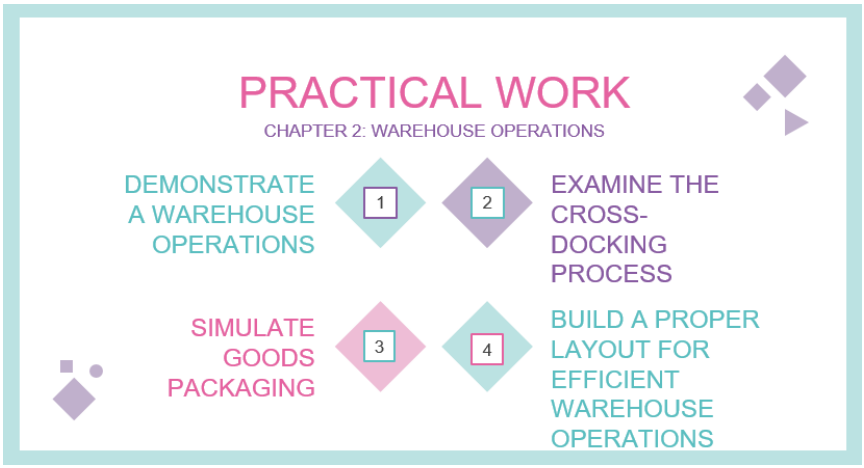

Figure 3: Subtopic for Practical Work Assessment in Chapter 2

Table 1 below shows the details of the assessment in Chapter 2 that need to be done in the classroom.

Table 1: Details of Practical Work Assessment in Chapter 2

Practical Work	Content
Activity 1: Demonstrate a warehouse operation	Students need to show the basic process involved in warehouse operations: • Receiving • Put away • Replenishment and Storage • Picking and Packing • Dispatch
Activity 2: Examine the cross-docking process	Students need to show a process involved in warehouse operations with cross-docking: • Receiving • Cross-docking • Dispatching
Activity 3: Simulate Goods Packaging	Students need to show a different packaging category of goods with referring to the levels of packaging: • Primary • Secondary • Tertiary
Activity 4: Build a proper layout for efficient warehouse operations U-flow warehouse (racking and shelf layout) Through-flow warehouse (basic layout for ABC classification)	Students need to show the related area within the warehouse which require space calculations: • Receiving and dispatching areas • Storage space • Aisle width • Other space outside the building

In the present scenario, this activity can take some time because students need to perform some activities such as build the warehouse layout by using cardboards and other materials. The lecturers have therefore taken the opportunity to do so in groups. Unfortunately, when this activity is done in groups, students pay less attention to theories on the topic of warehouse operations because they will focus more on how to build the warehouse layout. Whereby, the student supposed to cover their C1 Knowledge in taxonomy bloom for this topic. Moreover, this assessment is getting harder to do during the Covid-19 pandemic as all students are away from campus. The lecturers need to find ways to solve this issue in order to ensure that students are able to complete the task even when they are at home.

Theoretical Framework

The Mayer's cognitive theory of multimedia learning (CTML) has been used in this study to explain a phenomenon of interest to support the using of Simulation Mobile Learning in enhancing Logistics education. This theory shows an effective and useful visual representation might look like and will guide this research to fill in the gaps of the identified literature, to organize knowledge and to guide this study in develop the simulation design. The research framework will provide a broad and general explanation between the concepts being studied and conceptual framework used to explain the theories of variables being studied. (McGraw-Hill Education Europe, 2018)

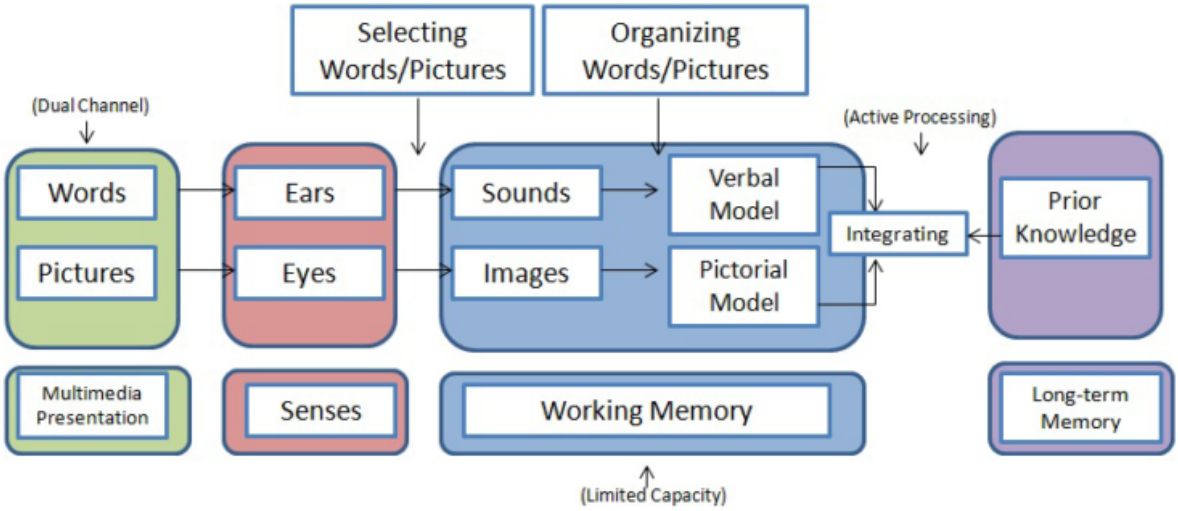

Figure 4: Cognitive Theory of Multimedia Learning (CTML)

Mayer's Cognitive Theory of Multimedia Learning tells that the words and pictures can give a sensory memory to the students. By selecting the right words and images, their memory will work and integrate to convey the information and save in the long-term memory. They will capture the visuals much faster and will be able to stay in their memory longer than expected. Mayer explains that the brain takes in information and process it in multiple channels which are through visualized and spoken words. With two separate channels, the students will be able to work with more information because they can hear and speak about the information that they hear and see. (McGraw-Hill Education Europe, 2018)

In working memory, the students can choose selected image and relevant words that they can remember and work with. This sets of information will process and organized into model that help the students to remember and understand the

information that they received. Once all the material is combined together, the new knowledge will move into long-term memory. Initially, the student should find simulation and modelling more convincing than other more conventional forms of learning process. (McGraw-Hill Education Europe, 2018)

Model

The ADDIE Model proposes as an instructional design and possibly the best known as Instructional Design Model. The ADDIE refers to Analyze, Design, Develop, Implement and Evaluate. It provides step-by-step process that help instructional designers to plan and create program with framework to ensure their instructional program are effective and efficient as they can possibly be. (Kurt, 2018).

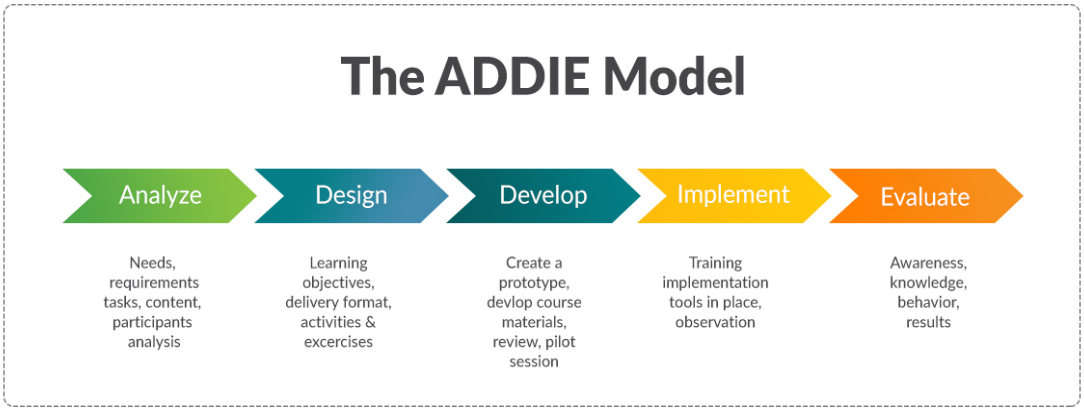

Figure 5: ADDIE model

Throughout this study, ADDIE model will help in development of the mobile simulation learning.

Table 2: Adoption from ADDIE Model

	Phase	Details
1	Analysis	Determine problem and need analysis
2	Design	Plan a strategy to accomplish the problem and user need through the learning objectives
3	Development	Create the content and test the simulation
4	Implementation	Deploy the simulation and run pre and post test
5	Evaluation	Measure the usability and compare the results before and after the intervention

As illustrate in the table 2 above, at analysis phase is to determine the problem and need analysis. Next, plan a strategy to accomplish the problem and user need through the learning objectives. Then, deploy the simulation and run pre-test and post-test during the implementation phase. Lastly, measure the usability and compare the results before and after the intervention.

Transformation

The results from the Need Analysis survey, there is a need in Mobile Learning development from the Diploma in Logistics and Supply Chain Management (DLS) students. This simulation is composed of four scenarios that happen to be the practical

work assessments in Fundamental of Warehouse Operations Management subject. This Simulation might work at any point, with minor modifications, and is applicable if the simulation is implemented over a semester as illustrate in the Figure 6 below.

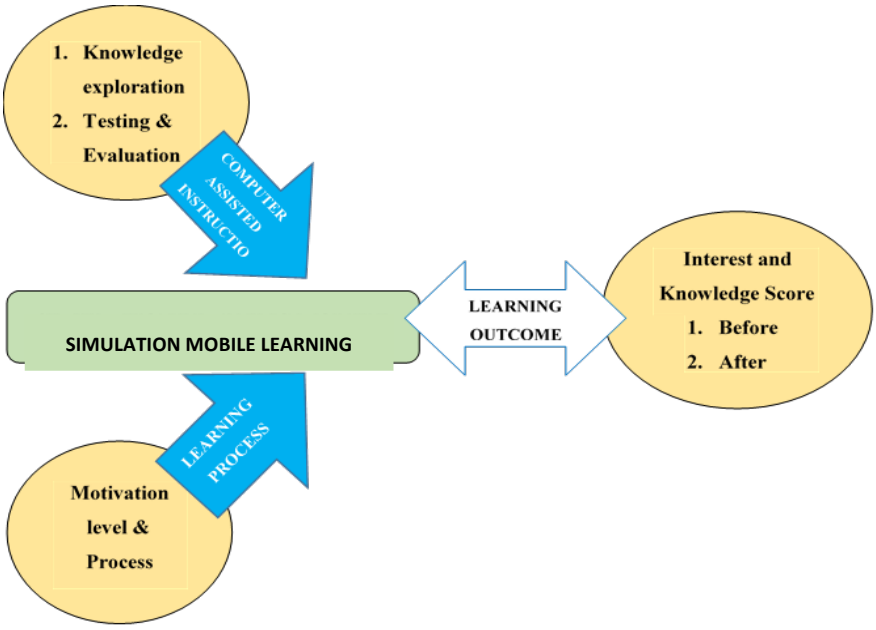

Figure 6: Intervention Diagram in Simulation Mobile Learning

Simulation Mobile Learning is develop based on infographic to effectively stimulate students' learning. Infographics consist of many visual components such as pictures, symbols, and graphics which been used for the purpose of conveying information. Innovations brought through infographics are the use of visual components to deliver information as mentioned in Mayer's Cognitive Theory of Multimedia Learning and have a unique way of building content. Infographics facilitates learning and may be used for the purpose of teaching Fundamental of Warehouse Operations Management course to convey information through the warehouse design layout.

The first step of the development during Cycle 1 is to define the problem and the need for the users. The second step is planning a strategy for accomplishing the problem and user need. Next on step three, the simulation is being developed and tested by the professional and the beginner user. In the last step, simulation and assessment will be carried out using mobile learning to assess the use of the module.

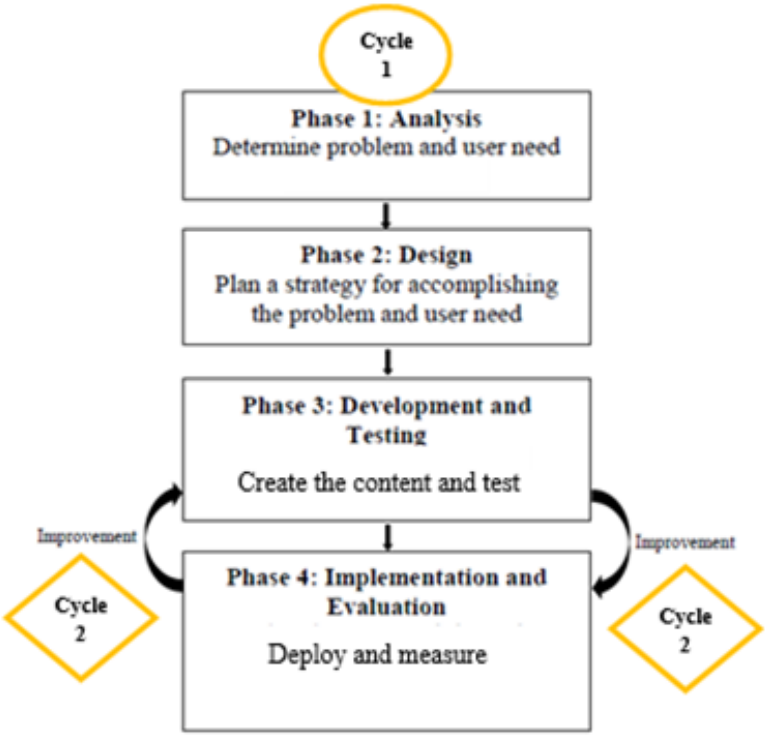

Figure 7: Phases on Developing The Simulation During Cycle 1 & Cycle 2

Development of Simulation Mobile Learning is using ADDIE model as ADDIE reflects a systematic model that can provide a framework guide to develop effective educational products or learning resources that is easy to follow. There are four phases on developing the simulation beginning with analysis, design, development and testing, and the last phase is implementation and evaluation as show in the above diagram. Phase 3 and 4 has been repeated during Cycle 2 to measure the usability of Simulation Mobile Learning.

Research Instrument

The main data collection techniques used in this research study is mixed method by adapting the ADDIE Model. The summary of data collection and sampling method for Cycle 1 and Cycle 2 are illustrate in the table below:

Table 3: Summary of data collection and sampling method for Cycle 1

Type	Number of Respondents	Data Collection	Sampling Method
Qualitative	3	Problem Diagnosis	Purposive Sampling
	3	Effectiveness of Intervention	Purposive Sampling
Quantitative	76	Descriptive Analysis	Purposive Sampling
	76	Before and After the Intervention	Purposive Sampling

Table 4: Summary of data collection and sampling method for Cycle 2

Type	Number of Respondents	Data Collection	Sampling Method
Qualitative	1	Problem Diagnosis	Purposive Sampling
	1	Effectiveness of Intervention	Purposive Sampling
Quantitative	50	Descriptive Analysis	Purposive Sampling
	50	Group 1 vs Group 2	Purposive Sampling

Participants

In this study, entities are individual level (the content expert) and group level are the students. Developmental interventions and comparisons were tested on both groups.

Table 5: Summary of Data Collection Method and Research Instrument

Participant	Method	Content
Individual Level (content expert) 3 people	**Qualitative** (Interview)	Problem Diagnosis
		Evaluation of results towards Simulation Mobile Learning
Group Level (DLS students) 126 people	**Qualitative** (Interview)	Pre-survey on current method
		Post-survey on Simulation Mobile Learning

Research Question

In this study, the questions that attempts are as follows:

1. What is the need of Simulation Mobile Learning to enhance logistics education?
2. How Simulation Mobile Learning can enhance logistics education?
3. What is the usability of Simulation Mobile Learning in enhancing logistics education?

Results and Discussion

There is the need of Simulation Mobile Learning to enhance logistics education based on the interview in focus group discussion conducted by the researcher at the Cycle 1. Both content expert in this field agreed that there in need of Simulation Mobile Learning in logistics education. The Simulation Mobile Learning can enhance logistics education from the four domains that measure the usability. The researcher measures the usability in both Cycle 1 and Cycle 2. In Cycle 1 the researcher observes the students' interest whereby in Cycle 2 the researcher observes students' knowledge by comparing their score marks.

Through need analysis survey and focus group discussion that has been conducted earlier of the stage, the researcher gathered the data and feedbacks to develop pre and post-test. There are 25 items of questions which divided into five sections and based on four domains adopted from previous literature. The same questionnaire will be using in conducting Cycle 1 and Cycle 2. The four domains are

usefulness, ease of learning, efficiency of use and satisfaction were measured the Simulation Mobile Learning in enhancing logistics education.

In this research, usefulness refers to a person that feels using the method that proposed during pre and post-test. Meanwhile, ease of learning is defined as in order for the user to quickly get on with his or her work. As for efficiency of use referring to a person believes that using a particular method would be free from effort. Lastly, satisfaction refers to the judgement that the method features itself fulfil the pleasurable level.

Intervention that has been implemented by researcher in Action Research Cycle 1 solely focus on the needs to enhance logistics education. Based on the analysis, there were a total of 76 respondents in Cycle 1. In order to determine whether the intervention that were implemented in Cycle 1 give an impact to the respondents or not, the researcher use Paired Sample t-test to analyses the data based on the normal data that identified during normality test. Both data from pre- and post-intervention were compared to identify its significant value. The results are as in table 6 below:

Table 6: T-test Result for Cycle 1

	Variables	Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre-Usefulness	2.85	76	0.67102	0.07967
	Post-Usefulness	3.85	76	0.67219	0.07711
Pair 2	Pre-Ease of Learning	2.67	76	0.58001	0.06653
	Post-Ease of Learning	3.74	76	0.78914	0.09052
Pair 3	Pre-Efficiency of use	3.15	76	0.83482	0.09576
	Post-Efficiency of use	3.72	76	0.73246	0.08402
Pair 4	Pre-Satisfaction	3.02	76	0.84473	0.09690
	Post-Satisfaction	3.72	76	0.29296	0.07921

Based on the t-test analysis that has been conducted, the findings indicate that the mean value for post-intervention for all four variables are higher than pre-intervention.

Whereby, in Action Research Cycle 2, researcher will implement intervention on the same Simulation Mobile Learning towards the student's score marks between two-groups to observes students' knowledge using the same four domains in Cycle 1 which are usefulness, ease of learning, efficiency of use and satisfaction. The total of 50 students are divided into two groups: control and experiment. Control group is a group of students that used Excel, whereby Experiment group is a group that used MyWarehouse Apps. The results are in table 7 below:

Table 7: Central Tendencies Measurement for Variables Under Study

Group	N	Mean Score
Experiment Group **(MyWarehouse Apps)**	25	83.7
Control Group **(Excel)**	25	74.7

In analyzing the mean score between each variable of the components that contribute towards Simulation Mobile Learning, it displays the differences in the mean scoring marks of the students. Gender does not alter based on students scoring marks. As a result of the findings, students who use MyWarehouse Apps perform significantly better than students who use Excel to complete their practical work.

Table 8: T-test Result for Cycle 2

Variables		Mean	N	Std. Deviation	Std. Error Mean
Usefulness	MyWarehouse	4.80	25	0.41231	0.08246
	Excel	3.48	25	0.74404	0.14881
Ease of Learning	MyWarehouse	4.72	25	0.43205	0.08641
	Excel	3.46	25	0.63172	0.12634
Efficiency of Use	MyWarehouse	4.76	25	0.35119	0.07024
	Excel	3.40	25	0.71526	0.14305
Satisfaction	MyWarehouse	4.78	25	0.36478	0.07296
	Excel	3.40	25	0.73030	0.14606

The data and information that collected for this research has been interpreted and concluded under the descriptive analysis, thematic analysis and paired-sample t-test analysis. The descriptive analysis summarized the demographic profile of 50 respondents into the table form. Interview session has been analyzing by using Thematic Analysis while the survey questionnaire generated through SPSS software. The outcomes revealed that the usability perception level of the proposed method had been high among the students.

Table 9: Summary Findings of t test for Variables

Condition	Findings	Result
p-value < Alpha value	0.000 < 0.05	**Significant**
Calculation value > Critical value (N=50)		
Usefulness	7.712 > 2.021	**Significant**
Ease of Learning	8.206 > 2.021	**Significant**
Efficiency of Use	8.484 > 2.021	**Significant**
Satisfaction	8.477 > 2.021	**Significant**

The P-value obtained from the test is lower than the critical value (0.000<0.05) and this indicates that the result is significant. The calculation value obtained from the analysis is more than the critical value from the Critical Value table. A small p value (near zero) would indicate strong evidence against the null hypothesis, whereas a large p value (near one) indicates little evidence against the null hypothesis.

From this observation, the experiment students that using MyWarehouse Aps are getting higher marks compared to the control group students that using Excel. The variation in student scores in terms of neatness and punctuality is the result of factors in efficiency of use.

Conclusion

MyWarehouse Apps is an example of Simulation Mobile Learning method that able to enhance logistics education among the DLS students. The fundamental benefit of example-based learning is that it diverts students' attention away from unnecessary information-seeking activities and helps them focus on studying the problem-solving methods offered, allowing them to create a problem-solving scheme in long-term memory. The use of infographics in MyWarehouse apps assists users in summarizing the educational process and improving student learning. Real-world learning opportunities provide students with hands-on experience that allows them to connect knowledge with action for practical competency. According to the study findings, institutions should include simulation-based learning through mobile applications into students' courses.

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