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The effect of ubiquitous learning management system using imagineering to enhance learning achievement and multimedia creation skill for upper secondary school

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Abstract

The research objectives were: (1) to analyze the efficiency of the Ubiquitous Learning Management System using Imagineering; (2) to compare the student's learning achievement and student's multimedia creation skill between experimental group and control group. The samples consisted of 120 grade 11 students from three classrooms who enrolled in the Digital multimedia course, Liberal arts structure plan at Satri Samutprakarn School, in the second semester of the academic year 2019, selected by using cluster random sampling and randomizing the classrooms into 3 groups by lottery method. The first classroom was 40 students who were tested for efficiency of the Ubiquitous Learning Management System using Imagineering (E1/E2). The second was 40 students who were an experimental group. The third was 40 students who were a control group. The research instruments were 3 sets of: (1) the Ubiquitous Learning Management System using Imagineering; (2) the assessment form of multimedia creation skill; and (3) The achievement test. Statistics for data analysis included Mean, Standard Deviation and Hypothesis testing by One-way Multivariate Analysis of Variance (One-way MANOVA). The research results found that the efficiency of the Ubiquitous Learning Management System using Imagineering (E1/E2) was 81.00/ 80.15. The learning achievement and the multimedia creation skill of the experimental group yielded a higher score than the control group at the statistical significance level of .05.

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Introduction

The advancement of computer and communications technology support how to learn from traditional learning to E-leaning, M-learning, and U-learning. Such aims to support learners in various learning methods by focusing on providing sufficient information that the student needs all the time. The definition of ubiquitous learning or U-learning is learning in the environment where people can have their own computer more easily as well as being able to use one in daily life with more efficient technology. In addition, they can access the wireless internet easier than in the past, so they are able to use it more extensively (Khlaisang, 2018; Khlaisang, & Koraneekij, 2019). The learning environment of ubiquitous learning is the digital media module learning enabling study anywhere and anytime by searching for the data via a laptop that has internet access. This way, we have flexibility in learning with easier access to a variety of information, which corresponds to different environments according to the learner's context (Laisema & Wannapiroon, 2014). Therefore, ubiquitous technology could support learning in the 21st century. It has important learning features that are conducive to education such as mobility, interactivity and flexibility, which enhance learning in terms of content and joining the activities. In addition, it gives priority to changing data and always keeping up with new information technology. Therefore, the technology that is suitable for ubiquitous learning is mobile technology. It is flexible and easy to access via devices on different platforms, such as smartphones, tablets, laptops, or personal computers (PC) (Khlaisang, 2018; Khlaisang & Koraneekij, 2019). The purpose of using information technology and communication is to develop a Learning Management System (LMS), which is a program that supports learning and E-learning to proceed completely when comparing with the past without LMS systems. The instructors have to develop the teaching websites on digital media, tests and teaching and learning activities on the website, which require a lot of time and budget. However, the program of learning management system is designed to be easy to access and used anywhere and anytime for teachers, learners and administrators (Thammetar, 2014).

Imagineering learning is a new concept in learning management. Imagineering means changing the imagination to be real. In practice, it brings the visualization in our minds into inventions and tangible innovations. Imaginative engineering learning is in line with the development of learners' characteristics in the 21st century. In the case of the objective being multimedia works, the students need to start from a thinking process such as how they produce their works and select the platform to communicate with the learners. As Riojas, Lysecky, & Rozenblit (2012) said, teaching and learning in technology and engineering have challenged learners because it is quite a new method. There are both ways to direct teaching or researching the solution and doing the project. These ways are especially effective for engineering teaching according to the article by Nilsuk & Wanpirun (2013); Kanoknitanunt, Nilsook, & Wannapiroon (2021) said that imagineering learning is a new concept in the 21st century. This concept allows learners to reach their goals by encouraging self-learning, creativity, critical thinking and innovation skills. Generally, it is accepted that learning is most effective when students are able to learn by themselves like learning by doing. Well-organized and proper processes will lead to systematic learning.

Digital multimedia course is an additional course for upper secondary school grade 11, according to the curriculum of Satri Samutprakarn School, 2009, revised version, 2019. The content is to create multimedia works that aim to give students more knowledge of multimedia design and more understanding of how to do such and create it properly via the multimedia application software. Previously, the problem of teaching in this course was too many students, thus there were not enough learning media to meet the students' requirements. In addition, the students had different knowledge and skills to create multimedia works as well as there being a limited time period. Therefore, the students could not improve their skills effectively. Regarding the concepts and problems as mentioned above, imagineering can encourage creativity and innovation skills that are important to create learners' works, which can be achieved through both classroom and self-learning. It is relevant to the concept of ubiquitous learning management that supports all devices and can help learners study anywhere and anytime, and the teacher can interact with learners in real-time. Therefore, this way will help the students learn anywhere and anytime by using any devices that depend on the students' context. The students can enhance

their skills that are useful nowadays via a new learning process. The researchers need to adapt both concepts of Ubiquitous Learning and Imagineering in order to design and develop the Ubiquitous Learning Management System using Imagineering. It will enhance learning achievement and multimedia creation skill for upper secondary students excellently.

This research aimed to analyze the efficiency of the Ubiquitous Learning Management System using Imagineering and to compare the student's learning achievement and student's multimedia creation skill between experimental group and control group.

Literature Review

The researchers studied the theories and concepts in the following topics: (1) Ubiquitous learning is the learning paradigm that occurs in the environment of ubiquitous computing thus leading to learning the right things, at the right place and at the right time. The characteristics of ubiquitous learning are as follows: permanency, accessibility, immediacy, interactivity, and context awareness (Yahya, Ahmad, & Jalil, 2010). The ubiquitous environment helps promote learning in the 21st century. It is a learning management method that allows students to study anywhere and anytime by using mobile devices in the learners' context (Khlaisang, 2018; Khlaisang, & Koraneekij, 2019); (2) Imagineering learning process for teaching and learning in technology and engineering can be done in direct teaching, providing research, problem-solving and doing projects. These methods are especially effective for engineering teaching. The process focuses on learners to learn by themselves, have creativity and be able to create innovation. The Imagineering learning process comprises six steps as imagination, design, development, present, improvement and evaluation. (Kanoknitanunt, Nilsook, & Wannapiroon, 2021; Nilsuk & Wanpirun, 2013; Riojas et al., 2012); (3) Learning management system (LMS) is the program to supports E-learning that was designed for easy access and can be used anywhere and anytime for teachers, learners and administrators. (Thammetar, 2014); (4) The system development life cycle (SDLC) includes five steps, namely, requirement analysis, design, development, testing, and implementation. (Iamsiriwong, 2012; Laisema, 2014). The researchers applied the principles of design and development of Ubiquitous Learning Management System using Imagineering; (5) Finding the efficiency of the system was done according to the concept of Brahmawong (2013), who stated that the definition of the efficiency criteria by evaluating student's behavior to be two types: continuous behavior (process), set as E1 = efficiency of the process and final behavior (result), set as E2 = efficiency of the product; (6) The assessment of Multimedia creation skill by Rubrics based on students' multimedia works and using the analytic rubrics scoring criteria considered by each work part and defining guidelines for grading with definitions or descriptions of work in each level clearly (Bureau of Educational Testing, 2017); and (7) learning achievement using the theory of Bloom (Revised Bloom's Taxonomy by Anderson et al. (2001), by classifying the behavioral hierarchy into six levels as follows: remembering, understanding, applying, analyzing, evaluating and creating. (Bureau of Educational Testing, 2015) In addition, this research measured the cognitive domain in levels 1–4, namely, remembering, understanding, applying, and analyzing.

Methodology

The Population and Samples

The population consisted of 191 grade 11 students who enrolled in the Digital multimedia course, Liberal arts structure plan at Satri Samutprakarn School, in the second semester of the academic year 2019, from five classrooms. The samples were 120 students selected by cluster random sampling and randomizing the classrooms into 3 groups by lottery method; The first classroom was 40 students who were tested for efficiency of the Ubiquitous Learning Management System using Imagineering (E1/E2); The second was 40 students who were tested for learning achievement (the experimental group). The third was 40 students who were tested for traditional learning (the control group). The experiment was conducted in the second semester of the academic year 2019 for 7 weeks, 2 periods per week, a total of 14 periods.

The Research Instruments

1. The Ubiquitous Learning Management System using Imagineering was developed according to the system development life cycle (SDLC), and the system was installed on the web server. The researchers applied the 6 processes of Imagineering to be used in the designing system. The accessing system was divided into three modules consisting of: (1.1) Learner module: this was a part of the learner system so the students can study the lesson content and participate in learning activities according to the Imagineering learning process through collaborative learning in the ubiquitous learning environment. The learner module consisted of 4 parts: personal information management, lesson content, doing learning activities, and testing and evaluation; (1.2) Instructor module: this was part of the teacher system so that teachers can manage content and learning activities according to the Imagineering learning process. The instructor module consisted of 7 parts: personal information management, member management, course management, lesson content management, increasing learning activities, event calendar management, and testing and evaluation management; and (1.3) Administrator module: this was part of the system administrator to manage all parts of the system to proceed with the system as the user's requirement. The admin module consisted of 5 parts: personal information management, member management, course management, system display management, and system usage reports. The administrators can log into the teacher's and students' systems to manage data or solve system problems. The researchers examined the system quality evaluated by three experts. The result of quality evaluation concluded that the content was at the highest quality (mean = 4.91, *SD* = 0.29) and the web-based design was at a high quality (mean = 4.46, *SD* = 0.50).

2. In the assessment form of multimedia creation skill, the characteristics were the scoring rubrics using the analytic scoring rubrics in which there were three levels of the mean as follows: 3 = High, 2 = Medium, and 1 = Low. The researchers determined the guidelines to create the multimedia works by producing the short movie under the topic of environmental preservation in which there were six evaluation points including screenplay, movie integrity, techniques for shooting, movie editing, picture and sound quality, and creativity as well as examining the quality of the assessment form by three experts who checked the content validity. The assessment form of multimedia creation skill had the Index of Item-Objective Congruence (IOC) of 1.00. In addition, this form had also searched the reliability by using the method of inter-rater reliability: IRR from two assessors. The Pearson Product Moment Correlation Coefficient was analyzed by using the reliability of the skill assessment of 0.90.

3. The achievement test on creating multimedia works were 4 choices from 20 items, which passed the process of creating test blueprint. This is based on Bloom's cognitive theory that was revised by Anderson et al. (2001). Measuring the cognitive behavior in 4 levels included remembering, understanding, applying and analyzing. The total preliminary examination of 40 items by taking the exam to find the quality of the achievement test by three experts, checked the content validity. The IOC results of all 40 items were between 0.67–1.00. Then, trying out the test with 40-grade 12 students who studied the subject on creating multimedia works and selecting 20 items that had the difficulty (p) between 0.25–0.60, the discrimination (r) between 0.20–0.60 as well as doing the achievement test to find the reliability as internal consistency by Kuder-Richardson's KR-20 formula, with the reliability equal to 0.79.

Data Collection

The researchers applied the system to conduct with the three groups of 120 students; the first classroom was 40 students who were tested for efficiency of the Ubiquitous Learning Management System using Imagineering (E1/E2); the second was 40 students who were an experimental group; the third was 40 students who were a control group. The second and third groups tested the hypothesis. This research conducted the experiment according to the experimental pattern that was nonrandomized control group posttest-only design. (Leekitchwatana, 2016)

Data Analysis

1. Analysis of the efficiency of the Ubiquitous Learning Management System using Imagineering as E1/E2 and comparing with the efficiency criteria of 80/80.

2. Data analysis to compare the students' learning achievement and the multimedia creation skill

between the experimental group and the control group by analyzing the data with basic statistics such as mean, standard deviation, and hypothesis testing by One-way Multivariate Analysis of Variance (One-way MANOVA).

Results and Discussions

The Efficiency of the Ubiquitous Learning Management System Using Imagineering

The efficiency analysis of the Ubiquitous Learning Management System using Imagineering indicated that efficiency of the process (E1) and the efficiency of the results (E2) was 81.00/80.15, which was higher than the criteria of 80/80 (Table 1). When considering the efficiency of the process to the efficiency of the result, it was 81.00/80.15. So, the total score of the test during the study was higher than the total score of the posttest. Due to the studying, students learned through the Imagineering learning process combined with using the developed system. In addition, the system development had developed the system according to the system development life cycle (SDLC), which had passed validation and assessment of the quality of the content system and web-based learning design by experts, who suggested improvement before use. The finding conforms to the research by Srichailard & Sinthanakul (2017), who developed web-based instruction on a learning management system for a competency-based lesson plan with blended learning and MIAP process for a computer graphics and animation course and found that the instruction had the efficiency of 84.89/82.15. It also conforms to the research by Boonyok, Petsangsri, & Kiddee (2018), who developed online lessons using flipped classrooms to enhance learning achievement on a presentation using computer software for grade 10th students. It found that the online lesson had the efficiency of 85.56/84.67.

Table 1 The efficiency of the Ubiquitous Learning Management System using Imagineering indicating efficiency of the process (E1) and the efficiency of the results (E2)

Efficiency	*n*	Full score	Average score	Percentage of total average
E1	40	30	24.30	81.00
E2	40	20	16.03	80.15

The Comparison of Learning Achievement and Multimedia Creation Skill of Students between the Experimental Group and the Control Group

Data analysis results with basic statistics to show mean (M) and standard deviation (*SD*) of the learning achievement score and multimedia creation skill of students revealed that the experimental group (learning achievement; $M = 16.05$, $SD = 2.47$, multimedia creation skill; 26.13, $SD = 2.60$) was higher than the control group (learning achievement; $M = 13.03$, $SD = 1.85$, multimedia creation skill; 23.45, $SD = 2.02$).

The comparison results by One-way MANOVA revealed that variance of the learning achievement and the multimedia creation skill of the experimental group was higher than the control group at the statistical significance level of .05. It showed that there was at least one variable in the learning achievement or multimedia creation skill of the experimental group higher than the control group (Table 2). Also, the variance of the learning achievement and the multimedia creation skill of the experimental group was higher than the control group at the statistical significance level of .05. The analysis of learning achievement and multimedia creation skill was divided into groups of students learning through the Ubiquitous Learning Management System using Imagineering (experimental group) and students learning through traditional learning (control group). Therefore, pair-test was not needed, which showed that the experimental group had higher learning achievement and multimedia creation skill than the control group at the statistical significance level of .05 (Table 3).

However, expanding from the results, the assumption test on One-way MANOVA found that: (1) Assumption test on population distribution by analyzing with Shapiro-Wilk statistics found that the data were not normal distribution (learning achievement, $p = .009$, multimedia creation skill, $p = .000$), but this research

Table 2 Result of Wilks' Lambda test on learning achievement and multimedia creation skill between the experimental group and the control group

Effect	Multivariate Test	F	*p*
Treatment	Pillai's Trace	31.96*	.00
	Wilks' Lambda	31.96*	.00
	Hotelling's Trace	31.96*	.00
	Roy's Largest Root	31.96*	.00

Note: *$p < .05$.

Table 3 Test of Between-Subjects Effects

Effect	Dependent variable	SS	df	MS	F	*p*
Group	learning achievement	183.01	1	183.01	38.49*	.00
	multimedia creation skill	143.11	1	143.11	26.31*	.00
Error	learning achievement	370.875	78	4.755		
	multimedia creation skill	424.275	78	5.439		
Total	learning achievement	17461.00	80			
	multimedia creation skill	49721.00	80			

Note: Box's M Test: F = 2.290, df1 = 3, df2 =1095120, p = .076.
Levene's Test: learning achievement, F = 2.811, p = .098, multimedia creation skill, F = .323, p = .571.
*p < .05.

had a sample size of 40 people in each group which was more than 20 samples. This showed robustness in this assumption and not to change the power of the test. (Tabachnick & Fidell, 2001 as cited in Phu Si-On, 2008); (2) Assumption test on the variance testing homogeneity of the variance-covariance matrix. From testing the Box's M Test statistics, it was found that F = 2.290, df1 = 3, df2 =1095120, p = .076, which was greater than the statistical significance level of .05. This showed that the variance and covariance matrix were the same in all groups, and testing the homogeneity of variance for each dependent variable with Levene's Test statistics found the learning achievement, F = 2.811, p = .098, multimedia creation skill, F = .323, p = .571, which was greater than the statistical significance level of .05. This showed that each variable had a homogeneity of variance, which confirmed the statistical test with MANOVA was robust (Piyapimontsit, 2018); and (3) The assumption test on the correlation of variables. Multivariate analysis of variance is appropriate when the variables considered are related to statistical significance as well as the correlation of the dependent variables not being higher than .80 (Phu Si-On, 2008). In testing, Pearson Correlation statistics found that r = .29, p = .009. According to the assumption on the variable correlation the above testing assumptions showed that One-way MANOVA could be analyzed. Therefore, Wilks' Lambda's statistical analysis method was used and found that the learning achievement and multimedia creation skill of the experimental group were higher than the control group because the researchers had designed the web-based learning and activities which were appropriate for the learners' age and abilities. The contents were modern. Students were able to access the system in ubiquitous environment using all portable devices. It was useful for students to learn anywhere, anytime and study by themselves easily and quickly. Due to the combination of systems and Imagineering learning, a new concept of learning management conforms to the development of learners' characteristics in the 21st century . It is a learning process that encourages learners to learn by themselves and create works from imagination systematically and have collaboration skills according to the Imagineering learning process to improve multimedia creating skill through cooperative learning by the works and activities. As a result, this finding conforms to the academic articles by Nilsook & Wannapiroon (2013), who stated that Imagineering can be used in teaching and learning for all education levels because imagination can occur at all student levels. Such encourages learners to systematically create what they imagine, determine the problems that lead to work, and work with others as well. This also conforms to the research by Chusawatdikul (2015), who researched on psychomotor and cognitive learning achievement of students learning through e-learning with project-based learning via cloud computing learning management system on computer programming applications, that the subject was higher than those who studied through traditional methods at the statistical significance of .05. It also conforms to the research of Kaanklao & Suwathanpornkul (2020), who researched the development of the learning management process to enhance the chemistry learning achievement and conceptual comprehension of organic chemistry using Posner's approach with design-based research. The results analyzed with MANOVA found that the organic chemistry achievement and conceptual comprehension scores of the students in the experimental group were significantly higher than for the control group at a level of .05.

Conclusion and Recommendation

The research findings revealed that: (1) the efficiency of the Ubiquitous Learning Management System using Imagineering was efficient to meet the criteria; and (2) the learning achievement and multimedia creation skill of the experimental group were higher than the control group at the statistical significance because this system can apply both learning in classes and online classes during a social crisis that requires mainly online learning or blended learning.

The researchers have the recommendations as follows: the system implementation requires the preparation of the tools and the necessary infrastructure in the ubiquitous learning environment including portable devices and wireless internet networks. There should be student orientation to clarify access to the system, methods, procedures and learning activities for the most efficient use of the system. In addition, in organizing the learning activities, all activities according to the 6 steps of the Imagineering learning process should be considered. For future research, the teaching and learning activities should be designed on the Ubiquitous Learning Management System using Imagineering to get feedback that will better reinforce the learners' interest and such should study effects such as collaboration skills and satisfaction.

Conflict of Interest

There is no conflict of interest.

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