ผลการเรียนรู้แบบโครงงานเป็นฐานผ่านระบบอีเลิร์นนิ่ง
รายวิชาระบบการจัดการเรียนรู้ออนไลน์

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บทคัดย่อ

การเรียนรู้โดยใช้โครงงานเป็นฐานสามารถส่งเสริมผู้เรียนเป็นศูนย์กลางการเรียนรู้ เสริมสร้างทักษะใน
ศตวรรษที่ 21 แก่ผู้เรียน เมื่อนำการเรียนรู้โดยใช้โครงงานเป็นฐานมาใช้ร่วมกับระบบอีเลิร์นนิ่ง จะส่งผลให้การ
ดำเนินโครงงานของผู้เรียนสำเร็จได้ดีขึ้น การวิจัยนี้ศึกษาผลสัมฤทธิ์ทางการเรียนและความพึงพอใจของผู้เรียน
ที่มีต่อรูปแบบการเรียนรู้โดยใช้โครงงานเป็นฐานในระบบอีเลิร์นนิ่งในรายวิชาระบบการจัดการเรียนรู้ออนไลน์
งานวิจัยนี้ได้ทดลองกับนักศึกษาระดับปริญญาตรี จำนวน 31 คน ซึ่งจัดการเรียนรู้ผ่านระบบอีเลิร์นนิ่ง ด้วย
Moodle LMS แบ่งผู้เรียนออกเป็น 7 กลุ่ม กลุ่มละ 4-5 คน โดยวิธีคละเกรดเฉลี่ยและทดสอบความรู้ก่อนและ
หลังเรียนรวมถึงมอบหมายให้แต่ละกลุ่มทำโครงงาน ผลการศึกษาพบว่า ผู้เรียนมีผลการเรียนเฉลี่ยหลังเรียนสูง
กว่าก่อนเรียนอย่างมีนัยสำคัญทางสถิติ ในเนื้อหาทั้ง 2 บทเรียน ผู้เรียนสามารถนำเสนอและส่งผลงาน
โครงงานได้ทันตามกำหนดเวลาทุกกลุ่ม และผลงานโครงงานทุกกลุ่มได้รับการประเมินจากผู้สอนและเพื่อน
ร่วมชั้นเรียนมีคุณภาพอยู่ในระดับดี ผู้เรียนมีความพึงพอใจต่อรูปแบบการเรียนรู้อยู่ในระดับมาก จึงสามารถนำ
รูปแบบการเรียนรู้แบบโครงงานเป็นฐานในระบบอีเลิร์นนิ่งขยายผลไปยังรายวิชาอื่นต่อไป

คำสำคัญ: การเรียนรู้โดยใช้โครงงานเป็นฐาน การเรียนรู้ผ่านสื่ออิเล็กทรอนิกส์ การเรียนรู้แบบออนไลน์ โมเดล
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Project-based Learning Management Model through E-Learning System for Online Learning Management System Course

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Abstract

Project-based Learning (PjBL) enhances the learners to become the learners-center and develop the necessary skills in the 21st century. In addition, when project-based learning is used together with the e-learning system, it helps the learners achieve the project more successfully. This research aimed to study through the learning achievement and learners' satisfaction towards the project-based learning through the e-learning system for the online learning management system course. The sample group was 31 undergraduate students, managed by the e-learning system using the Moodle Learning Management System. The students were divided into seven groups, 4-5 persons per group. They were selected by the mixed Grade Point Average (GPA) and pre-test/post-test, including the project assignment of each group. The research result revealed that the students had the result of average point scores for the post-test higher than the result of average point scores of the pre-test by statistical significance through the contents of the two units. Every group of students could propose and send their project contributions in time. Furthermore, the project contributions of every group were evaluated from the instructor and classmates as having a quality at a good level. Besides, the students were satisfied from the learning model at a high level. Hence, the Project-based Learning Management Model through the e-Learning System can be extended the results to other courses further.

Keywords: Project-based Learning, E-Learning, Online Learning, Learning Management Model

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Introduction

The technological advancement of the internet and the internet associated affects daily life, work, and learning (Cary, 2020). The disruptive technology makes a rapid change from the traditional forms and methods by originating novel innovations as a replacement, including the online instruction model considered well-known to be used as a replacement or used together with the traditional classroom widespread, which is the e-Learning System. The system represents the contents as an electronic material by using an online channel that everyone is able to access from everywhere. It opens a chance to learn mutually through the online society (Phumpuang et al, 2020). E-learning system emphasizes the design of its instructional strategies and the representation of feedback information for the learners. It helps stimulate them to learn under the determined objectives. The learners can access the contents as required. Furthermore, the system provides exercises and tests for practicing and checking their understanding. (Jintavee Khlaisang and Prakob Koraneekij, 2016). In addition, the e-learning system takes more and more roles during the time of COVID-19 pandemic since the traditional class cannot be organized (Li and Lalani, 2020).

However, the learning problem on the e-learning system still focuses on a lecture, discussion, exercise, test, and homework (Ozadowicz, 2020). Thus, the system cannot enhance the students to generate the skills of analysis, synthesis, application, and skills of mutual work (Rana et al, 2014), which are considered as the necessary skills in this 21st century. Moreover, the system lacks enhancing the students to practice authentically and procedurally, including promoting the skills of teamwork. Therefore, the lecturers should take the role as only consultants and advisors for the students to develop their contributions, especially the contributions created from the Project-based Learning through e-learning system, managed by the software of Learning Management System (LMS). This system has the characteristics which are able to support the learning process of Project-based Learning to enable the learners to achieve effectiveness and efficiency more because they can choose and link the online learning resources full of learning materials with various styles to explore then use them to support their learning. Furthermore, the learners can access any learning resources and contents conveniently, everywhere and every time. Besides, e-learning system enhances the active learning in aspect of learners' free feeling to learn, having an opportunity to react with the lecturers or their classmates, having learning materials which appear both images and sounds. Also, the learners can review the lessons repeatedly until they can achieve the target goals of learning (e-Learning Industry, 2020).

This research brought the project-based learning management model to adjust and apply, together with the learning environments, through the e-learning system to let the learners have an opportunity to cooperate for building the knowledge bases and contributions together and find out the learning effectiveness from the learning management model. Both learners and their instructors evaluate the quality of learners' contributions to their projects and learners' satisfaction of each group. The learners were the undergraduate students who were studying the online learning management system course. It is expected that the findings from this research are useful for developing the graduates' quality and can apply in the learning management with other subject courses. Moreover, the students would be promoted to get the skills of the 21st century, especially in terms of communication and information technology because they have the opportunity to study, research, and practice by themselves (Jintavee Khlaisang and Prakob Koraneekij, 2016). Therefore, this research objectives were 1) to investigate and develop the project-based learning through e-learning system in online learning management system course, 2) to study the project-based learning achievement through developed e-learning system and 3) to assess the learners' satisfaction on the project-based learning achievement through developed e-learning system.

Literature Review
Project-based Learning

Project-based learning focuses on the learners who have to bring the knowledge and experiences they got from the classroom and external sources, self-access learning, including selecting the topic of project they are interested in, to study, research, and practice systematically. The learners have to do the research, find the meanings, solve the problems, and use mutual learning, including self-access learning until they achieve the new meaningful knowledge. Moreover, such knowledge has to remain for the long term. Instructors should take this role as facilitative helpers and advisors, and the learners are the persons who select work, make a plan, be responsible, and evaluate such work by themselves (Sutthirat, 2010).

The stage of project-based learning consists of 8 procedures: 1) readiness preparation, 2) topic selection and setting, 3) research doing, 4) project outline writing, 5) project operation, 6) report writing, 7) project representation, and 8) project evaluation. All of the eight procedures of project-based learning can bring to apply the learning management together with the courses through the e-learning system since it is a learning management model that enhances the learners as a learners-center. Project is an activity of assignment. It determines

the learners to cooperate for project operation in groups and follows the steps of project-based learning. The instructors only take their roles as consultants and advisors through the communication tools in the e-learning system and social media such as line group, learning community of Google current or e-Mail. Besides, this includes the instruments which support an operation cooperatively in Clouds System such as google drive, google docs, and google slide.

The advantage of project-based learning is that it is about mutual learning between the instructor and learners. This kind of learning can practice the learners' skills in terms of an inter-relationship and conflicts problems solving. Furthermore, it enhances various skills such as discussion, analysis, and criticism to lead to the learners' decision making. Also, this learning prepares the learners to work with others in a real situation of working, such as preparing the skills of self-mind control and group process. Besides, it helps develop the skill of teamwork from learning by the real experiences of working (Mora, 2018). However, project-based learning also has its limits that should be considered (Vanishree & Tegginamani, 2018), which include it uses quite a long time to operate the project, and the operational steps require an instructor who performs the duty as a consultant and advisor at the same time with having both knowledge and skills on the topic proposed by the learners so that the learners feel confident through such suggestions. Hence, using project-based learning with an e-learning system is expected to be suitable and helps reduce the limitation of project-based learning. Moreover, it enhances the learners to operate their project successfully according to the given time and reach quality.

Learning by the e-Learning System

Electronic learning or e-Learning is a learning platform through various channels and digital media existing on the online system. It is done via the internet network using the Learning Management System (LMS) software as a management and facilitative instrument to support the learning management to achieve the goals. Open source software such as Moodle, Chamilo, Open edX, etc., is used widespread (Christopher, 2020). This kind of software can be used for managing the curricular, classrooms, instructors, learners, courses, contents, learning activities, measurements, and evaluations, including analyzing and reporting learners' behaviors, including analyzing and reporting the learners' behaviors so that the instructors can take the report of this analysis result to improve and develop the learning management and e-learning lessons to reach higher quality further.

E- learning lesson represents the contents as the digital multi- media. Learning Management System has the instruments to support the communication and response between the instructor and the learners, and between the learners' group, including other facilitative tools, both synchronous learning method and asynchronous learning method, to enhance the learning management to achieve the set purposes (Changkamanon & Dullayachai, 2017; Morrisson & Nzuki, 2016). The advantages of e- Learning are that it is convenient and flexible, provides several learning activities, responds to learners' needs as individuals, be able to learn everywhere and time, and reduce the cost (e-Learning Industry, 2020). Bravo (2019) recommended about the educational institutes that the institutes should invent the instruments, forms, and strategies for the learning technique as the learners-center through the e- Learning System because it can help both instructors and learners to seek effective education. Nevertheless, e- learning also has limits of use, which include feedback provision because the instructor and the learners stay at different places. This issue makes them lack the interactions and responses of the instructor directly. Moreover, the learners might have a lonely society that they have to create internal motivation by themselves. The learners, therefore, should have the self-time management skills and Information Technology skills for the instruments used (Tamm, 2019). The stages of e-learning lessons development according to the framework of the ADDIE model can be presented as follows; 1) Analysis: need assessment, job analysis, content analysis, and learner analysis 2) Design: learning objectives design, content deliver design, activities and exercises design, 3) Development: Creating a prototype, course materials, and pilot session, 4) Implementation: installing e-learning lessons, lesson use training, lesson implementation in actual circumstances and outcome assessment, and 5) Evaluation: achievement assessment of lesson use on target groups in learners' learning awareness, knowledge, understanding, behaviors and learning outcomes.

Related Research

Project- based learning management is used widespread, including learning management through the e- Learning System and online social media. According to the research about the Project- based learning model to enhance the competence of action research of the practice teachers program in Industrial Education, the sample group had the research ability at a very high level. Furthermore, the educational achievement result on the post- learning was higher than the pre- learning by a statistical significance. Besides, the satisfaction toward the learning model as the overall image was at a high level (Wongdee,

2019). Moreover, Praphin et al (2019) revealed that using Project-based Learning can increase the efficiency and effectiveness of learning management. Furthermore, project contributions reach the quality, and the learners feel satisfied with the learning at a high level. Moreover, the learners had better attitudes toward their learning (Kortam et al, 2018), and it should apply such method to manage the instructions continuously (Tiwari et al, 2017). It is in accordance with the research of Changkamanon & Dullayachai (2017) which indicated that the satisfaction of the instructional management system using the online social network technology is considered a part that helps the communication between the instructor and the learners at a high level as well. For Srivastava & Haider (2020), they found that e-learning system has various methods to develop content learning or exercises by using the learners' perceptions theory. It helps the learners get knowledge sustainably. Besides, it can help the instructors practice the learners to understand the learning structures even though they might have some learning disabilities. Brahim & Lotfi (2020) also suggested that using a learning system through e-Learning is regarded as an evaluation of the knowledge level. It can be done by the indicators associated with the dimension of interaction between the learners and system. Baldelovar (2017) revealed that the satisfaction, learners' participation in the software use had a positive relationship with the effectiveness of such system use (Gerhana et al, 2017; Fitton et al, 2020). It is concordant with the study of Shahzad et al (2020) which identified that the quality of information and system had a direct relationship with the satisfaction of the users as well. Moreover, Mbarek (2016) found that the motivation, individual's efficiency, and anxiety toward technology are the factors used to determine the situations of such use for the system. Furthermore, Al-Gahtani (2016) viewed that electronic learning of the organization in terms of management and control is increasingly acceptable. Besides, the organization can apply it effectively. Moreover, Gupta et al (2013) found that e-learning system in the educational institutes, full-time and over-time curricular, or distance education, has applied the system to the learning process, for the classroom more. It is a software system that is complete and able to create safety for the learners (Onengiye & Chukwunazo, 2016). However, Lee & Hung (2015) revealed that gender and system of the institutes do not affect the e-learning use of the learners. While Almulla (2020) also indicated that the technique of project-based learning through the e-learning system helps increase the learners' participation by stimulating the knowledge and sharing the information for discussion. Furthermore, this technique also can apply with the ability to use the perception of problem-solving and describing the phenomena as a guideline of scientific learning very well (Miller & Krajcik, 2019).

This is similar to the literature review on project-based learning in the past of Guo et al. (2020) which found that the literature review focuses on the students' results and emotional results, such as the usefulness of the project-based learning and the experiential perception of project-based learning, which are used the most. Secondly, it was about the results of perception such as knowledge and perceptional strategies, and the behavioral results such as skills and participation of such learners.

Research Methodology

The development of the Learning Management Model emphasizes the study and analysis for the Bachelor of education program in computer education, Yala Rajabhat University, Thailand. The course selected was the Online Learning Management System (OLMS). The concepts and theories of the project-based learning were studied then synthesized as the framework to develop as "project-based learning management model through e-learning system for online learning management system course". Next, the factors were drafted to propose the experts and organized the learning management plan, which was, "e-learning lessons development". The instruction consists of 2 units: Unit 3; e-Learning and Management System, and Unit 4; e-learning lessons development. These are the contents in OLMS course. The learning management plan was specified to enhance the basic knowledge and skills for doing project. The planning factors comprise the objectives, contents, learning activities, learning materials, evaluation activities, and online learning sources. After that, such plan was improved to be the lessons developed under the stages of the ADDIE Model and was ready to publicize at http://elearning.yru.ac.th. The instruments for data collection consist of 1) multiple-choice of learning achievement test, 2) evaluation form of contributions together with the rubric score criteria, and 3) evaluation form of learners' satisfaction by rating scale. It can be stated that all research instruments, including multiple-choices learning achievement test, project performance assessment test, and learner satisfaction test, were validated by using Index of Item-Objective Congruence (IOC) from three experts which presented the acceptable values (0.89) for further investigation. In addition, reliability was also tested by using Cronbach's alpha which showed the acceptable values between 0.71-0.75 (Hair et al., 2010).

For the model preparation and experiment, it was done with the sample group that experienced learning through the e-learning system: 17 undergraduate students studying the same Program as the sample group of this research. The students were categorized into three

sub-groups. The first group emphasized the test of the single efficiency model on three students classified by their accumulated grade. Also, the second group contained 9 participants focuses the test of the sub-group efficiency model. The Last group emphasized the fieldwork efficiency model test on 17 students in actual circumstances before implementing with targeted sample group. This experiment was carried out to investigate the efficiency and quality of the e-Learning lessons and find the errors to correct them for getting the complete lessons before taking them to real use with the sample group of this study.

The population was the 166 undergraduate students who are studying a Bachelor degree in computer education (5 years curriculum), Yala Rajabhat University. There were 31 participants, as a sample group in this research, which were purposively selected by focusing on students registered in online learning management system course in Semester 1, 2020 and they had online learning experiences. The group was split into 4-5 students per group by mixing the Grade Point Average (GPA) for completing their projects. For data collection and data analysis, the data were collected between August and October 2020. The samples did the pre-test then did the exercise during learning. Next, they were assigned the development project entitled "e-learning lessons development project managed by Moodle LMS". After that, the samples practiced this project in a group; 1 course per group. After finishing the lesson, the sample students did the post-test and evaluation test of satisfaction. Finally, each group of the samples represented and delivered their contributions to get a quality assessment of the project. The primary analytical statistics used in this research include the mean and standard deviation, and comparison of difference between pre-test and post-test learning achievement results using the statistic paired samples t-test, and the data analysis was carried out using SPSS Software.

Research Results

According to the development for the learning management model evaluated by the experts in terms of the appropriateness for the learning management application, the result revealed that it was at a high level and could apply to the learning management authentically. The model consists of the crucial factor: model principle aspect; it is about the bringing of the learning management principle in the e-learning system to manage using the learning management system (LMS) software, and the representing of the contents in the electronic materials form. Then, the learning activities were organized online. Both learners and instructor accessed the lessons and did the exercises everywhere and every time. The learning was

organized as learners center by setting the activities as project-based learning by managing the instruction through an e-learning system. After that, the assignment was provided. The learners had to practice in these eight stages as follows: 1) preparing for the readiness 2) selecting an interesting topic, 3) studying and do the additional research, 4) proposing the project draft, 5) self-operating the task, 6) writing the report of results, 7) representing the contributions, and 8) evaluating the results. The instructor took a role of an advisor and consultant until the learners could create the contributions or a task, write a report, and represent their masterpieces. For the purpose aspect: the objectives and goals of the learning management model using the project-based learning through the e-learning system was determined by selecting the online learning management system course, entitled e-learning lessons development. The crucial goal was to enhance the learners to be knowledgeable and skillful in the 21st century. The goal was done through the practicing process, and the project was operated via online channels in the e-Learning system environments until the learners can apply such knowledge and skills to their real-life and their teaching vocations further. For the content aspect: it included representing the contents for e-learning lessons managed by the moodle learning management system software. The content was prepared for the learners to learn before starting the project. The project consisted of two units: Unit 3 (e-learning and management system) and Unit 4 (e-learning lessons development). Besides, it included the stages for doing the project. For learning activities: 1) learning activities for e-Learning lessons; the learners learned the contents from the electronic materials in various forms such as PDF File, slide for contents summary, video clip, the web linked to the substances given by the instructor, and additional exercises to review the learners' knowledge and understanding, and 2) project-based learning activities, which were the assignments for practicing in groups. Finally, measurement and evaluation aspect: It includes measuring and evaluating the learners. It consisted of pre-test, post-test, exercises during learning, project evaluation form; the criteria of scores and quality level given in advance, and evaluation form of the learners' satisfaction towards the learning management model.
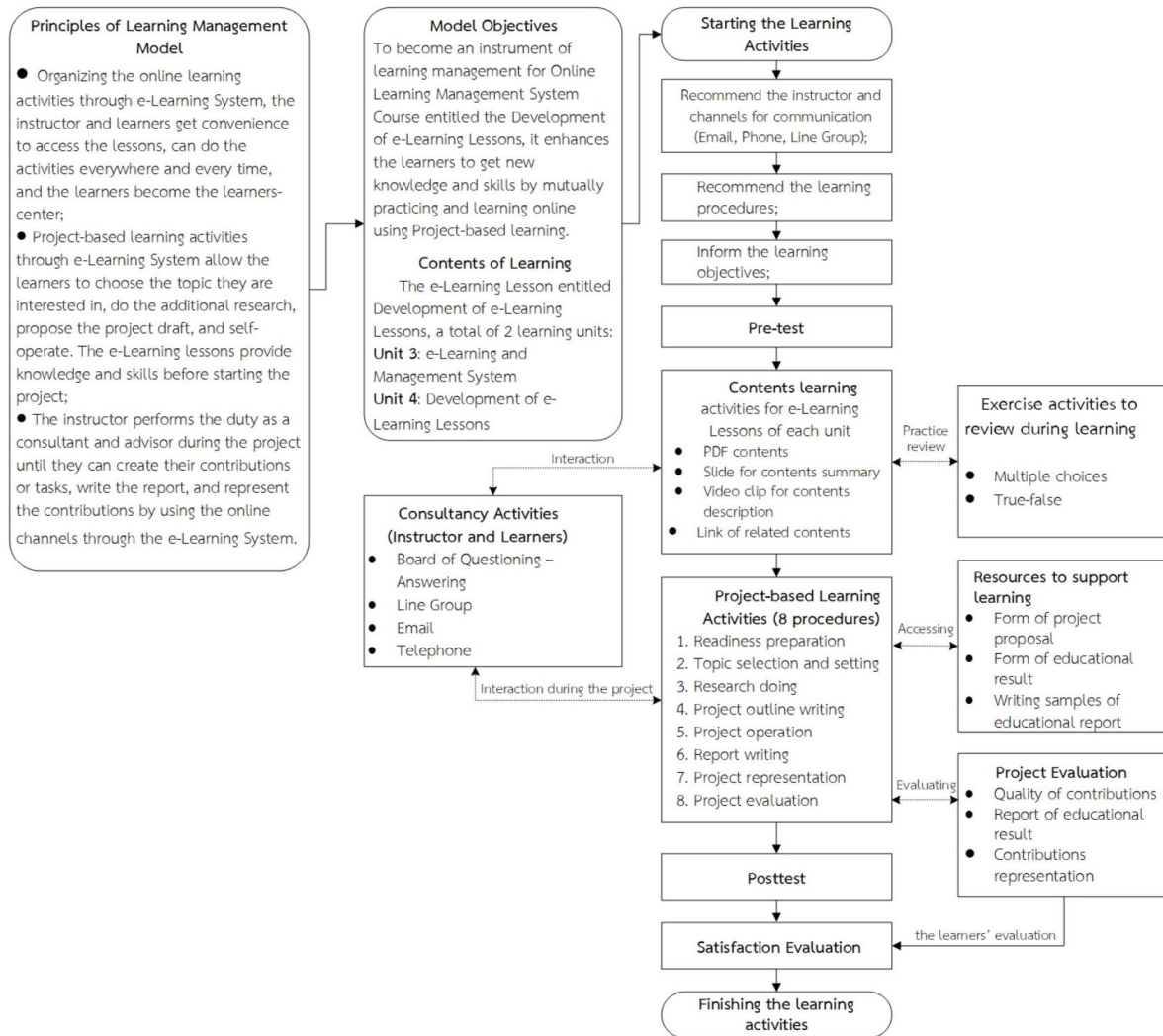
Figure 1 Project-based Learning Management Model through e-Learning System

Table 1 Comparison of learning achievement scores for pre-test and post-test

Unit	Score	N	$\overline{\mathrm{X}}$	S.D.	T
Unit 3: e-Learning and Management System	Pre-test (20)	31	11.61	3.63	11.89**
	Post-test (20)	31	19.23	1.15	
Unit 4: Development of e-Learning Lessons	Pre-test (20)	31	11.06	2.17	10.11**
	Post-test (20)	31	18.06	2.80	

** t value has the statistical significance at .05 level

The comparison results of the learning achievement on pre-test and post-test revealed that the average point scores of the learners on their Post-test were higher than the average point scores on their Pre-test by statistical significance at .05 level from both Units. For Unit3 (e-learning and management system), the learners' average point scores on the Post-test were

19.23, while the average point scores on the Pre-test were 11.61. And Unit 4 (development of e-learning lessons), the learners' average point scores on the post-test were 18.06, while the average point scores on the Pre-test were 11.06, calculated from the total of 20 scores.

For the result of quality evaluation for the project contributions (a total of 35 scores), it was found that the students of every group could operate their projects completely and could deliver the tasks in time. The project evaluation scores were at a very good level in every group. The average scores equaled 29.63 while the evaluation result of the learners' satisfaction toward the learning management, through the developed model was found that the learners had the satisfaction toward the leaning management model at the most level.

Discussion and Conclusion

The result of the project-based learning management model through the e-learning environments could enhance the learners to operate the tasks as teamwork. Moreover, the learners had their post-test learning achievement higher. Besides, they could do the projects and finished them in time and reach the standardized quality at a very good level. It is because of the e-Learning system' characteristics that use the electronic materials and channels to represent the substances. Therefore, the learners could cooperate with the activities conveniently and easily. Besides, they could manage their learning everywhere and every time online with high flexibility. Furthermore, the instructors could represent the materials and learning sources online continually. The instructor also could give suggestions through the online channels quickly, by synchronous communication and asynchronous communication (Srivastava & Haider, 2020). When using the project-based learning management strategies with e-Learning system, by preparing the lessons for knowledge and practice before operating the project, and using the project-based learning, there are crucial procedures, which comprise as follows: the learners had to do the additional research, they had to perceive the teamwork process and divide the task, including exchange and learn in groups, operate, do the report, and represent their contributions together. These stages could use the instruments to support online by using e-learning system and social media online to support the project efficiently, conveniently, and rapidly, everywhere and every time. Hence, the learning model in this research could develop the learners for the goal achievement as required.

Moreover, the learners had satisfaction with the project-based learning through the e-learning system with the online environments because it can respond to the livelihood and learning styles of the learners who are considered a new generation Z (Gen Z). The sample

group of learners was between 20-21 years of age. They were grown up with the familiarity of the internet and technology use for living, learning, and working, especially the learning outside the classroom. They are considered the digital native persons since they have associated with the internet, social media online, and mobile system until they have the technological skills. Therefore, the experiences of an online learning system that the learners have collected are crucial for their educational system at a higher education level today (Lavanya, 2020; Francis & Hoefel, 2018). Moreover, because the learners had an opportunity to operate the projects from the e-learning system and additional research through the learning sources of online digital, including the mutual work, by using the supportive instruments which the learners had skills to work for, hence it was challenging and exciting for the learners. These mentioned above can make satisfaction to the learners.

E-learning system is learning through digital that substitutes the learning management in the regular classroom. However, other learning management strategies such as case study, mutual learning, and group learning also can be used mutually with the e-learning system in various forms. Hence, the additional research mixed with such instructional strategies through the e-learning system is expected to be useful for the learners and the educational fields in the future. As mentioned by Lavanya (2020), creating a suitable atmosphere for electronic learning is challenging. The instructor and learners have to change the methods of instructional management. Furthermore, the educational institutes have to provide various suitable strategies to adjust to the changing situations these days by focusing on the instructions which can be used more authentically through such technologies.

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