Mastery Micro-adaptive Instruction Model with Problem-based Learning to Enhance Digital Technology Skills for Community College Students

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Abstract: This study aimed to analyze and synthesize the mastery micro-adaptive instruction model with problem-based learning to enhance digital technology skills for community college students. A total of 176 topics from local and international books, research papers, articles, and relevant documents were analyzed and synthesized using the systematic literature review method. Mastery of the aforementioned model for the community college students was obtained from the study results. The model was integrated from four bodies of knowledge; namely, (1) mastery learning, (2) micro learning, (3) adaptive learning, and (4) problem-based learning.

Keywords: Mastery learning, micro learning, adaptive learning, problem-based learning, digital technology skills

1. Introduction

The education system of the world today has changed rapidly, which can be observed from the situation of the spread of the Coronavirus Disease 2019 (COVID-19) that has had a major effect on the education system from the beginning of the pandemic in China at the end of 2019 until now. Hence, this has encouraged self-adjustment to the new normal, especially for educational institutions that have been unable to conduct normal teaching and learning and need to apply an online teaching and learning model to ensure uninterrupted learning (Wayo et al., 2020). Consequently, the Thai government has designated social distancing, prohibition of the use of buildings in all types of schools and educational institutions for teaching and learning management, except operations through distance and/or electronic communication. Under these circumstances, the Institute of Community Colleges of Thailand provided a practical guideline for community colleges nationwide to modify their instruction model from a normal to online one provided that instructors must design teaching and learning activities to achieve the learning standards equivalent to the normal instruction model (Institute of Community Colleges, 2020). The online instruction model does not only comprise teaching using the same characteristics by converting instructional documents into digital documents and placing them on websites or an instructional management system like Google Classroom, but also bringing and applying instructional theories to ensure learners would be able to accomplish the objectives set forth.

As mentioned earlier, instructors play an important role in enhancing learners to receive continuous education by bringing an instructional model complete with instructional media management and advanced devices to utilize and pass onto learners for their understanding and gaining knowledge in a more accessible way via online instruction (Panto, 2020). Managing online teaching and learning activities for subjects requiring practice is different from subjects associated with theories or general knowledge. Therefore, instructors should divide the teaching content into subunits (Santhuenkaewet al., 2020). Furthermore, development of the micro learning content must be accurate in terms of the efficiency of the content development (Park & Kim, 2018), thus making the subjects easily understood and memorized longer (Mohammed et al., 2018). Simultaneously, this would complete the gap of knowledge and be consistent with the learners' specific requirements (Buhu & Buhu, 2019). Moreover, it should be noted that each learner's learning ability is considerably different. As such, adaptive learning management would aim to adjust the teaching techniques to fit the differences among the learners in an efficient manner (Suriyakrai, 2007), which would be able to develop and respond to the differences among individuals quite well (Prakobpol, 2010). Moreover, mastery learning enables all learners to succeed in learning equally. At the beginning, learners would clearly learn about the objectives of the teaching, learning, and tasks they would be assigned (Block, 1971, as cited in Vichitpaisal et al., 2010). With regard to online instruction with practical lessons, learners would be expected to solve problems of tasks they would be assigned or undertake practical skills tests. Emphasis would be placed on allowing learners to solve problems by themselves, which is known as problem-based learning. Instructors would determine a problem as the motivator to encourage learning activities and seek practical guidelines that would result in the learners analyzing and calculating the answers or creating a body of knowledge (Paiboonsin & Sopeerak, 2016).

From the aforesaid importance, the researchers studied the relevant research papers by selecting mastery learning, adaptive learning, micro learning and problem-based learning to synthesize and design the mastery micro-adaptive instruction model with problem-based learning for enhancing digital technology skills among learners. This would be appropriate for community college students, who have different levels of learning. Simultaneously, learners in remote areas could save their travelling expenses in commuting to learn at a place where teaching and learning would take place.

2. Literature Review

2.1. Mastery learning

Mastery learning is about providing a range of differentiated instructional support to students in order to help each student achieve mastery (Block & Anderson, 1975). Its major components are the characteristics of the learners, teaching and learning, and learning outcomes (Bloom, 1968). Instructors would analyze the content and determine the objectives of learning thoroughly step by step and set a learning plan for each learner (or each group sharing the same requirement) in response to the different aptitudes among the learners by seeking methods, instructional media, or time in learning that would be different according to the learners' abilities. As a consequence, learners would be assessed on what they actually know in accordance with the determined objectives. If the learners are unable to achieve the determined objectives, instructors would need to seek various methods, instructional media, or innovation to help the learners learn in accordance with the objectives and achieve all of the set goals (Kammanee, 2018). As for the process of mastery learning, six procedures were synthesized by the researchers as follows: (1) create a learning plan, (2) determine the objectives, (3) learn according to the set plan, (4) assess the learning outcomes after teaching, (5) assess the learning outcomes of each subject, and (6) review after the class.

2.2. Micro learning

Micro learning is a new teaching method, and there is no specific definition to describe this type of learning (Mohammed et al., 2018). It deals with relatively small learning units and short learning activities; such as, 5-15-minute short video clips with special characteristics and specific information dimensions (Hamed et al., 2020). It can promote individual learning and learning according to the learners' requirements (Park & Kim, 2018). Two procedures synthesized from the process of micro learning are (1) to create content with one objective, and (2) to present the content using a video.

2.3. Adaptive learning

Adaptive learning is the process with an analysis of the differences in the individual requirements using a basic test (Holland, 1997). The learning management is consistent with the objectives and learners' abilities that are different. Importance is given to the knowledge levels of the learners to lessons until they succeed in learning (Park, 1996). The learning model is an online environment adjusted to meet the differences of each learner in terms of the learning abilities in a rapid manner. As such, advanced technology is applied to provide the maximum benefits (Sae-iab, 2018). The six procedures synthesized from the process of adaptive learning were (1) orientation, (2) to take exams before learning each subject, (3) to take exams before learning each learning unit, (4) to learn the content, (5) to take exams after learning each learning unit, and (6) to take exams after learning each subject.

2.4. Problem-based learning

Problem-based learning emphasizes the management of the learning experience from surveying, studying, and solving problems related to everyday life that learners may encounter (Torp & Sage, 1998). Emphasis would be placed on developing learners to have learning skills rather than knowledge that learners would gain, and developing learners to become people who could learn by guiding themselves (Gallagher, 1997). This would be suitable for digital learning, as learners participate in identifying and collecting information to solve problems in a meaningful way and are able to demonstrate knowledge by creating a body of knowledge (Saechan & Morsorn, 2016). Three procedures synthesized from the process of problem-based learning are (1) to define a problem, (2) to solve the problem, and (3) to conclude the way to solve the problem.

2.5. Digital technology skills

Digital technology skills are the abilities in understanding and utilizing information in various forms from numerous sources of information, and giving a presentation by using a computer connected to an Internet network (Glister, 1997). Digital devices, equipment, and technologies existing today; such as, computer, telephone, tablet, computer software, and online media are utilized for the maximum benefits in communication, operations, and

coordinating together, or for developing the process of the working systems in the organizations to achieve modernity and efficiency (Office of the Civil Service Commission, 2020). Therefore, instructors should provide knowledge and opportunities to learners for studying and practicing skills on how to use devices and equipment wisely, as well as creating information and communication technology correctly, appropriately, and efficiently (Office of the Royal Society, 2019). Four components synthesized from digital technology skills are (1) how to use a computer, (2) how to use computer software, (3) how to use the Internet, and (4) safety in the utilization.

3. Objectives of the Study

- To analyze and synthesize the mastery micro-adaptive instruction model with problem-based learning.

4. Methodology

The study was conducted on the basis of a documentary research method by examining documents, books, textbooks, research papers, and various types of literature related to mastery learning, micro learning, adaptive learning and problem-based learning from reliable online databases; such as, SpringerLink, Science Direct eBook, Pro Quest, Google Scholar, and the Thai LIS Digital Collection. The study was divided into two levels as (1) studying books by considering keywords from the titles associated with the issue of the study consistent with the research objectives. There was a total of 40 titles composed of 30 Thai language documents and 10 foreign language documents, and (2) studying from research papers and articles by considering keywords from the titles associated with the issue of the study consistent with the research objectives. There was a total of 68 titles comprising 35 in Thai language and 33 in foreign languages. Those documents were prepared during 2010-2020. The details are shown in Table 1.

Table 1. Details of the sources of information used in the study

Sources of Information	Types of Information Sources	Number/Title	Total/Title
Domestic	(1) Books	10	43
	(2) Research papers/articles	33	
International	(1) Books	30	65
	(2) Research papers/articles	35	
Total			108

5. Research Methodology

(1) Collected and studied various documents in the form of books, research papers, and articles related to the theoretical concept being studied.

(2) Conducted a content analysis from the various documents collected in a systematic manner (systematic analysis) to obtain a body of knowledge that the researchers could manage the mastery micro-adaptive instruction model with problem-based learning for enhancing digital technology skills.

(3) Conducted content synthesis and integrated the body of knowledge obtained from the previous procedure to develop the expected learning model.

6. Research Results

The analysis and synthesis of the relevant bodies of knowledge enabled the researchers to utilize the obtained body of knowledge to synthesize the learning model according to the mastery micro-adaptive instruction model with problem-based learning for enhancing digital technology skills for learners. The conceptual framework of the model was used as the core, while the micro learning technique and problem-based learning were used as activities according to the mastery adaptive learning conceptual framework in order to acquire the learning model (Figures 1 and 2).

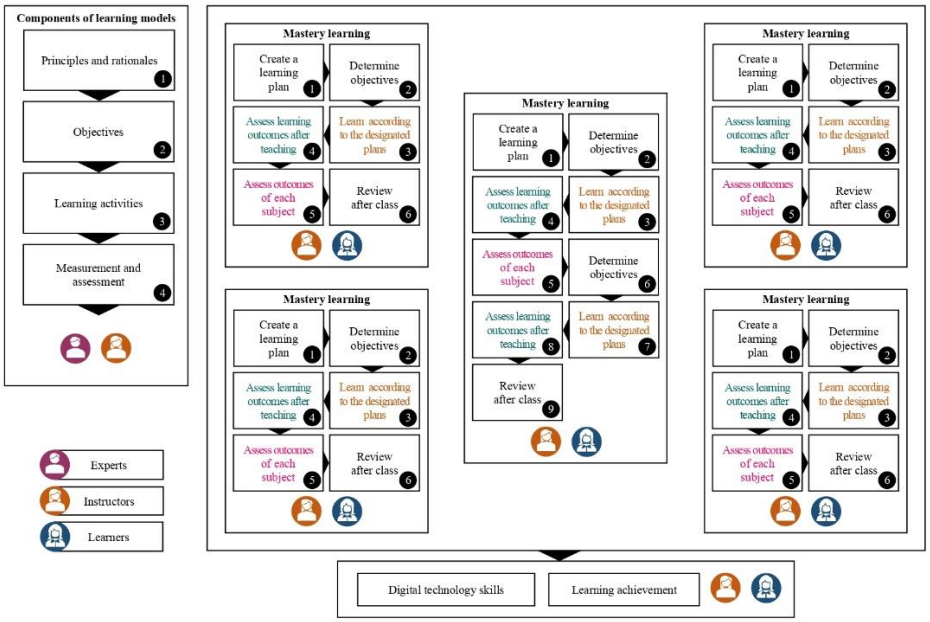

Figure 1. The first draft of the mastery micro-adaptive instruction model with problem-based learning to enhance digital technology skills for community colleges

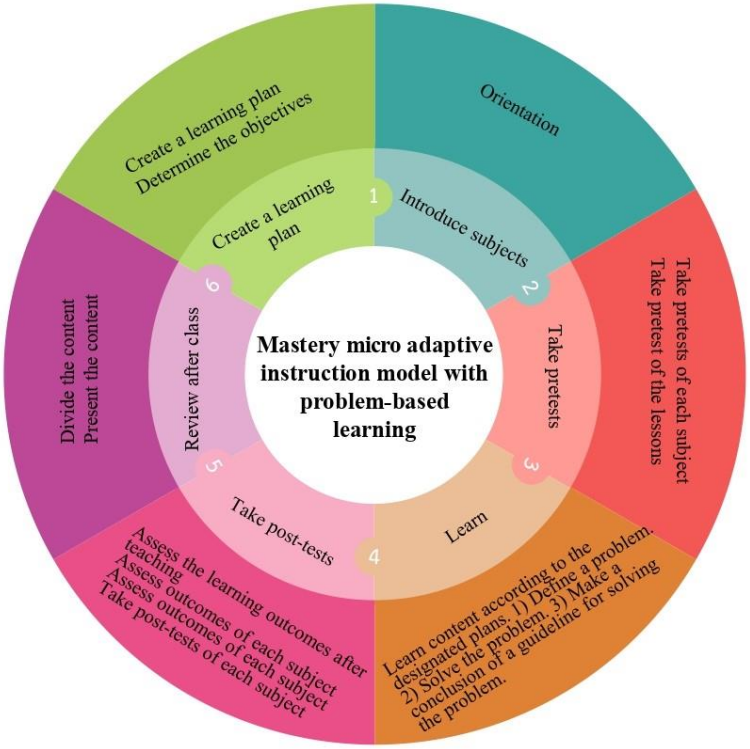

Figure 2. The second draft of the mastery micro-adaptive instruction model with problem-based learning to enhance digital technology skills for community colleges

Table 2. Details of the mastery micro-adaptive instruction model with problem-based learning to enhance digital technology skills for community colleges.

Sources of Information	Teaching and Learning Strategies	Roles of Instructors and Learners
(1) Create a Learning Plan	• Mastery learning • Micro learning	Instructors: (1) Create a learning plan and determine the learning objectives. (2) Make a video with one objective.

(2) Introduce the Subjects	•	Adaptive learning	Instructors: Orientate learners to let them learn about the principles, methods, and content of the subjects. Learners: Acknowledge the principles, methods, and content of the subjects for online learning.
(3) Take Pretests	•	Adaptive learning	Instructors: Distribute pretests of each subject to obtain scores for comparing to the scores obtained after learning each subject. Learners: Take a pretest of each subject.
			Instructors: Distribute a pretest and digital technology skills measurement test of a learning unit. Learners: Take a pretest and digital technology skills measurement test of a learning unit; those who score 60% or higher are able to pass to the next learning unit.
(4) Learning	• Mastery learning • Adaptive learning • Problem-based learning		Instructors: Lecture, demonstrate, and give advice about the content. Learners: Practice and get ready for listening to advice,
(5) Take Post-tests	• Mastery learning • Adaptive learning		Instructors: Distribute post-tests of the learning units. Learners: Take a post-test of each learning unit.
			Instructors: Distribute a post-test of each subject. The obtained scores are compared to the scores obtained before learning each subject. Learners: Take a post-test of each subject.
(6) Review after the Class	•	Micro learning	Instructors: Create and present the content. Learners: Review after the class through videos.

7. Conclusion

The mastery micro-adaptive instruction model with problem-based learning to enhance digital technology skills for community colleges was developed from studying various books, research papers, articles and documents. A total of 108 relevant topics enabled the researchers to be confident that such conceptual framework and learning process could be integrated to be a learning model to enhance digital technology skills for learners. The effects of the integration generated the learning model with six procedures of learning management. The fourth procedure, which the learning was inserted with problem-based learning, was the procedure of organizing learning activities to allow learners to learn according to the plan designated by the instructors. This comprised three steps as follows: (1) identify the problem where instructors would identify a problem that would be related to everyday life for learners, (2) solve the problem, which was a step that learners would study and determine the guidelines to solve the problem, select a certain guideline to solve the problem, and solve the problem according to the selected guideline, and (3) conclude the guideline for solving the problem where learners would present the guideline for solving the problem as implemented in the previous procedures. The sixth procedure, review after class, had two steps of micro learning; namely, (1) create content with one objective. This step would require instructors to create short content in the form of a video. Each content would contain only one objective, and (2) present the content using a video. This step would allow the instructors to present the content in the form of a video through different online channels.

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