AN INSTRUCTIONAL MODEL OF COMPETENCY-BASE SIMULATION COMBINE WITH MIAP LEARNING AND MICROLEARNING TO FOSTER COMPUTER NETWORK INSTALLATION DESIGN

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ABSTRACT
This research aimed to 1) study the data of competency-based simulation teaching combined with MIAP learning using microlearning, 2) develop a competency-based simulation teaching model combined with MIAP learning using microlearning, and 3) evaluate the suitability of the competency-based simulation teaching model combined with MIAP learning using microlearning. Since Thailand has faced a shortage of personnel with networking skills, the study of learning through video demonstrations of real-world practice (Micro Learning) and hands-on simulation (Simulation) was conducted in the MIAP learning process. There are 4 components: 1) Motivation with simulation, 2) Information study through micro-presentation (Microlearning), 3) Application with simulation, and 4) Success, focusing on competency-based outcomes in network installation. All models were confirmed by 9 experts in a focus group meeting and evaluated for suitability in 4 aspects. It was found that the appropriateness standards and the usefulness standards were at the highest average level, while the feasibility and correctness standards were the average is at a high level.
Keywords: Simulation, Competency-Base, MIAP Learning, Microlearning, Computer Network Installation

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INTRODUCTION

The needs of learners and society. Competency-based learning has thus become a key approach gaining attention (Kenya Institute of Curriculum Development, 2017). This approach emphasizes enabling learners to apply knowledge and skills in real-world situations, aligning with the importance of 21st-century skills across the economic, social, and technological dimensions, impacting the way of life and the demand for an efficient workforce. Traditional education may not align with the needs of the changing world, necessitating the development of curricula to enhance the skills, knowledge, and competencies needed by current and future learners (Saikhampha, 2021). Thailand has struggled to find personnel with modern skills, particularly in artificial intelligence (AI), cybersecurity, and cloud networks, posing recruitment challenges for many organizations. Future infrastructure trends are focused on the development of the Thai government's Thailand 4.0 initiatives, such as 5G, smart cities, and cybersecurity frameworks. This necessitates the use of highly skilled networking professionals with high-demand skills, creating opportunities in both domestic and ASEAN markets (Paynter et al., 2024).

Learning through demonstration videos that emphasize real-world practice is a subset of microlearning (Hug, 2010). It is often emphasized as a successful learning method in various learning phenomena (Hou Keat Khong & Muhammad Kamarul Kabilan, 2020) and hands-on training (Spencer & Jordan, 2001). Competency-based (Gervais, 2016) approaches linking theory to practice, with well-defined assessment criteria covering indicators, through simulations (Gredler, 2004), and is an assessed and adapted processing method suitable for those lacking necessary tools and high costs (Sonmez et al., 2018). Through the MIAP learning process, learners are stimulated in the problem-solving stage (Motivation), leading to the multi-method content perception stage in the information study stage. After completing the lesson, they are given exercises in the application stage (Application), and finally, they are given a test score with answers. This allows learners to self-evaluate during the progress evaluation stage (Saenbunsong & Sinthanakul, 2017). These processes can be used to design practical skills-based learning processes (Lohakan & Seetao, 2024).

The aforementioned personnel shortage has led to the development of a competency-based simulation-based learning model combined with MIAP learning with microlearning, a learning management process that equips learners with the skills to design computer network installations that are consistent with the problem of finding personnel with modern skills and the future trend of infrastructure that emphasizes the development of the Thailand 4. 0project.

Objective of this research:

1) To study competency-base simulation combine with MIAP Learning and Microlearning model

2) To develop competency-base simulation combine with MIAP Learning and Microlearning model to Foster Computer Network Installation Design.

3) To evaluate suitability standards of competency-base simulation combine with MIAP Learning and Microlearning model to Foster Computer Network Installation Design.

LITERATURE REVIEWS

Simulation is a process of creating a virtual situation that is close to real life so that learners can practice their skills and make decisions under specified conditions without having to face any potential risks (Pasawan et al., 2024). The characteristics of a simulation have 4 important parts: 1) Realistic: able to simulate an environment that is close to a real situation; 2) Interactive: learners can respond to the situation according to their understanding; 3) Measurable: able to measure the learning outcomes or skills of learners; and 4) Flexible: able to change the format according to the teaching objectives and needs of the learners. It consists of 5 steps in the creation process: 1) Define the problem; 2) Create a model;

3) Transform the model; 4) Verify and test; and 5) Test and apply the results (Elendu et al., 2024).

Competency-based curriculum (CBC) is an education management that emphasizes learner competencies as the primary goal. It emphasizes the application of knowledge, skills, characteristics, and attitudes in real life rather than memorizing content. Competency-based learning (CBI) aims to develop learners through practical experience, cross-disciplinary knowledge integration, and learning according to their individual potential. Instructors play a key role in providing feedback for continuous learner development. Competency-based assessment (CBA) emphasizes formative assessment, assessment as learning, and assessment for learning, using authentic assessments. Summative assessment is also used to determine outcomes based on holistic competencies and evidence of learners' learning, all of which reflect practical application (Serirat, 2024). Students' practical skills are emphasized in realistic simulated situations. Learners can learn at their own pace, regardless of time or location. Assessment emphasizes learning outcomes from skills and abilities derived from problem-solving in simulated situations (Donchai, 2025). The benefits of competency-based learning include meeting labor market demands and preparing students for skilled work. Students gain the necessary knowledge and skills for practical work, enabling them to evaluate, problem-solve effectively, and solve problems effectively. Build confidence in learners (Boonprakob et al., 2025). In conclusion, competency-based learning is a learning method that focuses on enabling learners to develop skills and abilities that can be applied in real life and work, using assessments that emphasize actual practical results, which will help build skills necessary for employment and effectively meet the needs of the labor market.

MIAP is a process in which learners are stimulated or prepared, self-directed, tested, or perform post-learning activities, and can review their progress at any time after completing the activities or tests (Saenboonsong & Sinthanakul, 2017). The learning process is a stimulating process within the learner, emphasizing the promotion of learner participation, practical application of knowledge, and continuous assessment to ensure effective learning outcomes (Phunaploy et al. 2021). It is divided into four stages: motivation, information, application, and progress. It is mainly conducted with students in undergraduate computer studies programs (Thanachawengsakul et al., 2023).

Microlearning is a learning approach that emphasizes presenting content in a short, concise, and to-the-point format. The goal is to enhance learners' learning and retention of information and skills (TechSmith, 2024). Microlearning breaks content into small, accessible units that can be learned in a short period of time. It uses images, audio, video, or short texts to focus on clearly defined learning objectives. Learners can manage their learning as appropriate (TalentCards, 2024). Accessing content at their own convenience allows learners to retain information effectively due to the short timeframe. This allows for multiple learning sessions and effective reinforcement of desired topics. The development process for microlearning should clearly define learning objectives to ensure content covers all objectives. This goal creates concise, concise content that can be learned in a short period of time, resulting in effective learning (Helpjuice, 2024).

Thus, MIAP Learning serves as a foundational instructional framework consisting of four essential components: motivation, information, application, and progress. Microlearning, which involves the delivery of focused and concise content within a 3-5 minute timeframe to facilitate rapid comprehension and reduce cognitive load, is integrated into the Information and Competency-Based phases. The use of simulation-based activities further enhances authentic learning experiences while minimizing the costs and risks associated with utilizing real materials and equipment that may otherwise be damaged during hands-on practice.

RESEARCH METHODOLOGY

1) Study the teaching model consisting of 1) competency-based simulation, 2) MIAP learning management, and 3) microlearning content presentation to promote the design of computer network installation work from relevant information sources as per Table 1.

Table 1 Data sources for competency-based simulation-based instruction components combined with MIAP learning with microlearning.

Subject studied	Data type	Number	Total
simulation	Thai	5	12
	Oversea	7	
competency-based	Thai	5	10
	Oversea	5	
MIAP learning	Thai	8	11
	Oversea	3	
microlearning	Thai	7	12
	Oversea	5	
Total			**45**

2) Design a framework for teaching and learning through simulation-based competency-based learning combined with MIAP learning with microlearning.

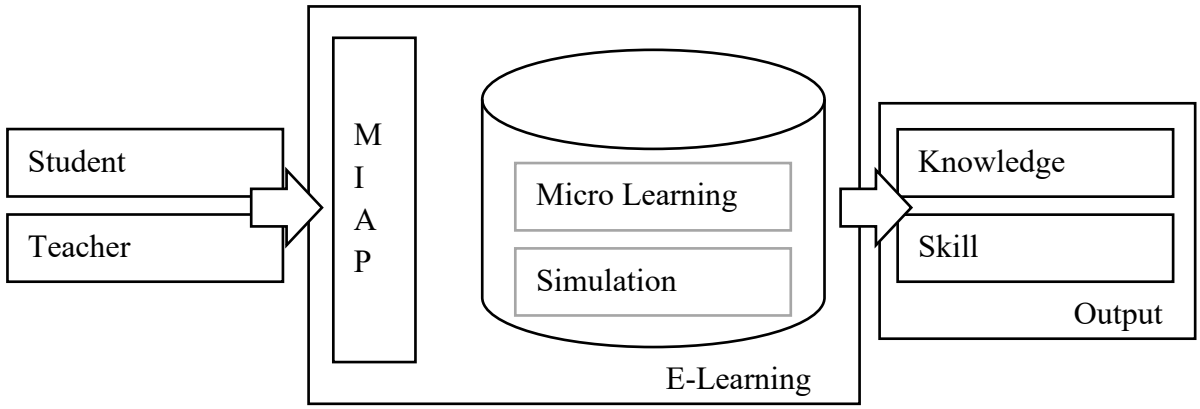

Figure 1 Outline of the competency-based simulation-based learning model combined with MIAP learning using microlearning.

3) A questionnaire was designed to gather opinions from nine experts regarding the suitability of the competency-based simulation instructional model framework combined with MIAP and microlearning in four dimensions: 1) suitability standards, 2) usefulness standards, 3) feasibility standards, and 4) accuracy standards. A questionnaire was also developed to assess the suitability of the instructional process.

4) A Zoom-based focus group meeting was convened to discuss and refine the competency simulation instructional framework in alignment with the MIAP model and microlearning principles. The session involved nine experts, including two entrepreneurs, three specialists in information technology, communication, and education, and two experts in educational research, measurement, and evaluation. The purpose of the meeting was to enhance the framework's effectiveness and ensure its practical applicability for learners.

5) After revising the competency-based simulation instructional model framework combined with MIAP and microlearning as recommended by the experts in the group meeting, the framework was used to design the instructional process.

RESEARCH RESULTS

1) The teaching model through simulation based on competency combined with MIAP learning with microlearning and summarizing the opinions of experts in the focus group meeting, which allows for adjustments to be more appropriate to the components and theory. There is an addition in the measurement and evaluation section to make it more clearly visible according to the competency base of computer network installation, including a clear picture of the entire process (as shown in Figure 2).

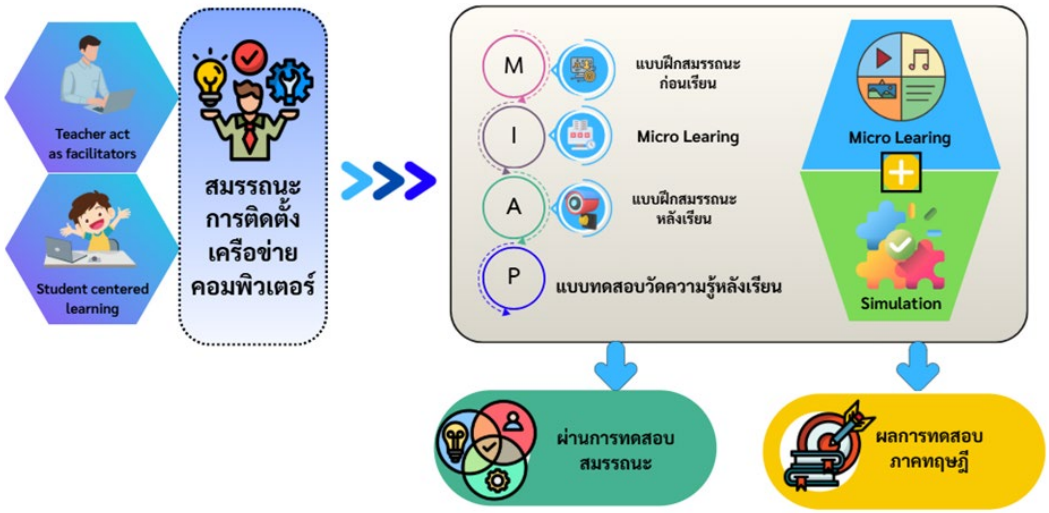

Figure 2 Competency-based simulation-based learning model combined with MIAP learning Using microlearning to promote computer network system design.

2) The competency-based simulation-based learning model, combined with the MIAP learning model, was applied to design the learning process (Table 2). Nine experts assessed the appropriateness standards (Table 3), and the learning process and analysis results were presented (Table 4).

Table 2 Competency-based simulation-based learning process combined with MIAP learning with microlearning

Learning Process	**Activities**	
	Instructor	**Learner**
1) Orientation - Program Usage Process - Learning Process - Learning Outcomes Summary	Explains the details of the orientation before entering the CSB learning process.	Listen carefully to the details before entering the CSB learning process.
2) Do competency-based exercises through simulated problem situations before studying.	2.1 Explain how to do competency-based exercises through simulated problem situations before studying.	2.1 Complete competency-based exercises through simulated problem situations before learning.
3) Present content using a microlearning learning format.	3.1 Open a multimedia video about the design and installation of network systems, approximately 3-5 minutes / 1 story.	3.1 Watch a multimedia video about the design and installation of network systems, approximately 3-5 minutes / 1 story.
4) Do competency-based exercises through simulated problem situations after learning.	4. Do competency-based exercises through simulated problem situations after learning.	4.1 Complete competency-based exercises through simulated problem situations after the lesson.

Learning Process	Activities	
	Instructor	**Learner**
		4.2 Review your scores after completing the competency exercises, along with correct answers. 4.3 Discuss the cause and effect of your results.
5) Take the knowledge test (academic achievement).	5.1 Explain how to take the post-learning knowledge test.	5.1 Take the post-test. 5.2 View your post-test scores and correct answer key. 5.3 Discuss the cause and effect of your results.

Table 2 shows the CSB teaching process, which consists of five steps: 1) orientation, 2) competency-based exercises, 3) content presentation using a microlearning learning format, 4) competency-based exercises through post-lesson simulations, and 5) knowledge assessment. Each step involves collaborative activities between the instructor and students.

Table 3 Evaluation of the suitability of the competency-based simulation-based learning model combined with MIAP learning with microlearning to promote the design of computer network installation work (N=9)

Module	Standard		
	μ	**σ**	**Meaning**
1) Suitability standards			
1.1) The principles of the model are based on relevant principles and theories.	4.50	1.50	Most
1.2) The purpose of the model is to promote the design of computer network installation work.	4.50	0.50	Most
1.3) The format is easy to understand and not complicated.	4.50	1.50	Most
Average	**4.50**	**1.17**	**Most**
2) Benefit standards			
2.1) Teachers can apply this to promote the design of computer network installation work.	4.50	2.50	Most
2.2) Promote the systematic design of computer network installation work.	4.50	1.50	Most
2.3) The research results are used as guidelines for preparing students with the developed model.	4.50	0.50	Most
Average	**4.50**	**1.50**	**Most**
3) feasibility standards			
3.1) Application of the learning management process	4.50	0.50	Most
3.2) Resources and technology are appropriately utilized	3.00	0.82	Middle
3.3) The format is acceptable	3.00	0.82	Middle
Average	**3.50**	**0.71**	**Very**
4) Accuracy standards			
4.1) Clearly state the objectives.	4.50	0.50	Most
4.2) Clearly identify the tools used to develop students.	3.67	1.25	Very
Average	**4.08**	**0.87**	**Very**
Total average	**4.15**	**1.06**	**Very**

From Table 3, the results of the evaluation of the appropriateness of the teaching model through competency-based simulation combined with MIAP learning with microlearning to promote the design of computer network installation work were shown. The overall average score was

at a high level, equal to 4.15, with a standard deviation of 1.06. Considering each aspect, it was found that the standards for appropriateness and usefulness had the highest average score, equal to 4.50, followed by the standard of correctness, equal to 4.08, and the standard of feasibility, equal to 3.50, respectively.

Table 4 Results of evaluation of CSB teaching process (N=9)

Activities process	**Suitability**		
	μ	***σ***	**Meaning**
1) Orientation	4.6	0.6	Most
2) Competency-based exercises through virtual problem-solving scenarios before the lesson (Motivation)	4.8	0.4	Most
3) Content is presented using a microlearning learning format (Information)	4.8	0.4	Most
4) Competency-based exercises through virtual problem-solving scenarios after the lesson (Application and Progress)	4.6	0.8	Most
5. Knowledge assessment test (Achievement) (Progress)	4.2	0.4	Very
Average	**4.6**	**0.52**	Most

Table 4 shows the evaluation results of the CSB teaching and learning process, which consists of 1) microlearning, 2) simulating a virtual problem situation in the motivation step and performing competency-based exercises in the (Application and Progress) step, 3) presenting information content using microlearning, and 4) measuring learning achievement (Progress). The overall mean score was 4.6 with a standard deviation of 0.52, which is very good. However, if considering each item, the learning achievement score was at a good level with a mean score of 4.2 with a standard deviation of 0.4. Therefore, a competency-based simulation teaching and learning model combined with MIAP learning using microlearning was developed to promote the design of computer network installation work, as shown in Figure 2.

DISCUSSION & CONCLUSION

This research examined data on competency-based simulation-based instruction combined with MIAP learning using microlearning to promote the design of computer network installation (CSB) projects. Thirty-one books, textbooks, and related research were used to design an instructional model comprising five components: 1) instructor, 2) learner, 3) learning activities, 4) content, and 5) competency assessment and learning outcomes. The instructional activities included: 1) orientation, 2) competency exercises via simulation before the lesson, 3) learning sub-content using microlearning for approximately 3-5 minutes, 4) competency exercises via simulation after the lesson, and 5) a multiple-choice knowledge test after the lesson. The evaluation results are as follows:

1) The suitability of the teaching model through simulation based on competency combined with MIAP learning with microlearning to promote the design of computer network installation work. The overall average score was at a high level, equal to 4.15, with a standard deviation equal to 1.06.

2) The appropriateness of the CSB teaching process from 9 experts from the focus group discussions was at the highest level, with an average value of 4.6 and a standard deviation of 0.52. This teaching process used 4 theories, namely:

2.1) The MIAP was self-studied based on the concepts of Saenboonsong and Sinthanakul (2017). The stages consist of motivation, information presentation, effort, application, and progress. This approach, as proposed by Thanachawengsakul et al. (2023), can be applied to learning management with good results in many studies. Research consistent with this concept includes Babenko et al.'s (2023) study of an online learning environment in the Department of Electrical Engineering, which yielded satisfactory results in subject-area competence during

study, and Lohakan et al.'s (2024) study of a learning design for developing students' artificial intelligence (AI) skills using the MIAP format. Results showed significant increases in student average scores, increased satisfaction, and significantly improved programming and AI technology application skills.

2.2) Simulation is a process of creating a virtual situation that closely resembles a real-world situation, allowing learners to practice skills and make decisions under specified conditions without facing risks. According to Yuwanich Nattapon et al. (2024), simulation has four key characteristics: 1) Realistic: It can simulate an environment that closely resembles a real-world situation. 2) Interactive: Learners can respond to the situation based on their understanding. 3) Measurable: Learners can measure learning outcomes or skills. 4) Flexible: According to Sasikarn (2024), it can be applied to learning management and has yielded positive results in many research studies. Research consistent with this concept includes Sonmez et al.'s (2018) research on a cloud computing network simulator that efficiently simulates computing infrastructure and services. Larsen et al.'s (2017) research on the development of an atomic simulation environment (ASE), which aims to configure, control, and analyze atomic simulations in various ASE tasks. The results of the research found that Structure optimization, molecular dynamics, constraint management, and more consistent elastic band calculations have been implemented.

2.3) Competency-based learning is a learning process that focuses on enabling learners to develop skills, knowledge, and practical abilities that can be applied in their work or daily lives. This follows the concept of competency-based curricula (Kenya Institute of Curriculum Development, 2017) and aligns with the research of Maksymchuk (2020) on developing health care competencies for future teachers. The results of the process of emphasizing health care competencies in future teachers are summarized as follows: Health care competencies were successfully developed through the implementation of the developed system and the implementation of the established teaching conditions.

2.4) Microlearning emphasizes presenting content in a short, concise, and to-the-point format. The goal is to enhance learning efficiency and learner retention of information and skills, as conceptualized by TechSmith (2024). This approach breaks content into small units, using images, audio, video, or short text messages at appropriate times, as conceptualized by TalentCards (2024). Research consistent with this approach includes Shail (2019), on how microlearning maintains neurotransmitter sequences to maintain neurochemical efficiency. The use of portable devices allows learners to easily pause and continue a lesson, and Danilah Salleh et al. (2022), on how microlearning can stimulate learner interest in learning. The study found excellent student engagement. Microlearning enhances student interest in learning.

Suggestion

Suggestions for Implementing Research Results

1) The competency-based simulation-based learning model combined with the MIAP learning model and microlearning to promote the design of computer network installation (CSB) can be developed into a digital platform-based learning management system for students enrolled in competency-based curricula.

2) The evaluation results of the suitability of the CSB learning process require improvements in the steps and assessment activities to ensure clarity and address each competency.

Recommendations for Further Research

1) The competency-based simulation-based learning model combined with the MIAP learning model and microlearning to promote the design of computer network installation (CSB) can be developed into learning activities that emphasize practical skills or student competencies.

2) The evaluation results of the CSB learning process suggest that it is suitable for designing short-term training activities for internal organizational practices.

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