The Development of the Phenomena- based Learning Model Accompanied by STEM for Enhancing Students' Competency in Science Learning Management

Kamolchart Klomim
Faculty of Education, Phetchabun Rajabhat University, Thailand
Boonsong Kuayngern*
Faculty of Education, Pibulsongkram Rajabhat University, Thailand
Suthep Dhamatrakool
Faculty of Education, Phetchabun Rajabhat University, Thailand
E-mail: kamolchat.klo@pcru.ac.th, boon.ku@psru.ac.th* and suthephs897@gmail.com
*Corresponding author
(Received: 9 October 2023, Revised: 22 November 2023, Accepted: 4 December 2023)
https://doi.org/10.57260/csdj.2024.268387

Abstract

The objective of this research is; 1) to study basic information in developing learning management model using phenomena as a base in conjunction with STEM learning management to enhance learning management science competencies for the student teaching practice, 2) to create and examine the quality of a learning management model using phenomena as a basis in conjunction with STEM learning management, in order to strengthen learning management science competencies for the student teaching practice, 3) to study the results of an experiment using a phenomenon- based learning management model in conjunction with STEM learning management, in order to strengthen learning management science competencies for the student teaching practice. A research and development process, the research methodology consists of the following 3 research steps; 1) research fundamental data for creating a learning management system, 2) create a learning management system and evaluate its effectiveness, 3) use the learning management approach to analyze the experiment's findings. The sample group is the student teaching practice in year 3, Faculty of Education, Phetchabun Rajabhat University, academic year 2023, totaling 25 people, this is obtained using a lottery approach of simple random drawing. The research instruments include a knowledge exam, a test of critical thinking on learning management design, and a test of drafting a learning management plan, and data analysis using t-statistics.

The results of the study found that; 1) The generation of learning management plans, student analyses, and curriculum analyses were deemed to be very acceptable based on the findings of the study of foundational data used to build the learning management model, 2) the results of creating and assessing the five components of the learning management system for quality; 1. 1) principle 1. 2) objective 1. 3) learning content 1. 4) learning activities and 1. 5) measuring and evaluating learning outcomes, the five phases for planning educational activities are as follows; explore, engage, engineer, plan, and evaluation, 3) utilizing the learning management paradigm, the experiment's outcomes revealed that; 3.1) with a statistical significance of. 05, the student teaching practice has a greater understanding of learning management science than they had before to their studies, 3. 2) with statistical significance at the .05 level, the post-study learning design thinking capacity of the student teaching practice is higher than the 80% limit, and 3.3) if student involvement above the limit of 80%, the student

teaching practice may generate learning management plans after class, with statistical significance at the .05 level.

Keywords: Phenomena as a base, STEM learning management, Learning management science, Student teaching practice

Introduction

The five-year operating strategy (2023–2027) of Phetchabun Rajabhat University places a strong emphasis on the realization of each person's potential throughout their lifetime. In addition to having a broad knowledge and skill set for the twenty-first century, the goal is for school-age and teenage students to love learning, be civically conscious, possess moral courage, be able to solve problems, and have enhanced capacities for adapting, communicating, and working well with others throughout their lives. The development guidelines are; 1) encourage the growth of 21st-century abilities, especially those related to synthesis, analytical thinking, solving challenging challenges, creativity, and teamwork, 2) promote the growth of career skills that are in accordance with national demands while encouraging the development of innovative thinkers, innovators, and entrepreneurs; this includes teaching individuals life skills that will enable them to coexist in and contribute to a multicultural society.

Journal Royal's 13th National Economic and Social Development Plan (2023–2027) outlines indicator 1.4, which states that 30 percent of students will be enrolled in education to produce competency-based graduates. The plan aims to fully develop Thai people at all ages and ensure that they acquire the skills necessary for the modern world, possess traits that align with acceptable societal standards, morals, and ethics, are resistant to rapid changes, and can coexist peacefully in society. It is consistent with sub-strategy 1.2 to provide kids the digital literacy, self-awareness, and other skills they require for living, learning, and working. It consists of; 1) developing and implementing cutting-edge learning management strategies to help students take care of themselves, communicate, collaborate as a team, think critically through proactive learning management, and be inspired to take action through trial projects with schools that are ready and nearby colleges that support knowledge and proficiency in a variety of subjects, 2) A screening system that reflects teachers' professional competencies should be developed. Redesigning the role of the teacher from "instructor" to "coach" will help students learn by placing them at the center of the classroom and will help instructors achieve a high degree of professionalism. Planning the number of teachers required in each sector and creating a curriculum for producing teachers with academic preparation would improve the development and production of teachers, both in terms of quantity and quality. Furthermore, it aligns with sub-strategy 1.3, which emphasizes the need for students in higher education to gain the skills necessary to participate in the labor market and innovate in the future. It does this by highlighting the significance of higher education institutions in mitigating the learning decline caused by the COVID-19 pandemic, bridging the gap between the work and learning domains, and customizing learning to individual preferences. Lastly, it expands public-private partnerships in education management to foster and promote learning management innovation using high-tech educational innovation mechanisms, higher education institutions in the area are urged to raise academic standards and hire personnel who can support development initiatives while also being cognizant of the social context and local communities in order to produce a workforce that can satisfy the needs of the country.

A notice in the Royal Gazette announcing the specifics of the higher education standards committee on learning outcomes in accordance with the higher education qualification standards 2022 also included the word "learning outcomes". This means that the experiences, education, and training that students gain from their practical training or real learning while working during their undergraduate studies must align with the curriculum of the higher education institution, the industry, the nation, and the global community. It consists of at least 4 aspects namely; (4.1) "Knowledge" is defined as information acquired through study, research, or experiences as a result of the curriculum; it is information that is sufficient and necessary for applying to jobs, advancing knowledge in social interactions, and sustainable development for living in the digital age, (4.2) "kills" are aptitudes that develop through training and practice to become quick, quick, and skillful for social, academic, professional, and personal development. Some examples of skills for surviving in the digital age are inquiry skills, critical thinking, reasoning, creativity, learning, communication, collaboration, teamwork, leadership, entrepreneurship, problem solving, and multitasking skills, (4.3) "ethics" describes personal actions or behaviors that uphold morals, morality, and ethics for the good of the public and oneself, both in public and behind others' backs, examples of ethical behavior include public service, environmental preservation, honesty, kindness, generosity, and generosity, and (4.4) "character" refers to a person's personality, character traits, and values as they emerge through learning and applying experiences from the curriculum to be suitable for each level of qualification standards in higher education, these traits should reflect specific characteristics of a science, profession, or institution, examples of personal characteristics are reliable personality, friendly, charming, a leader, eager to learn, assertive, decisive, compassionate, loves working as a team, observant, think critically, have reason, adhere to correct ideals, protect the environment, sufficiency, equality in society, social responsibility, accepting differences in society, spending reasonably, responsibility, patient in professional work, careful, thorough, can be a role model, good personality, good communication, systematic thinking, self-confidence, have a sense of aesthetics, have an artistic personality, have an imagination, be creative, love playing, love performing, administrative, logical thinking, entrepreneurial, digital literacy, media literacy, technology literacy, information literacy, visual literacy, communication literacy, and social literacy etc. (Finnish National Board of Education, 2016)

National Economic and Social Development Plan No. 13 Regulations Published in the Royal Gazette (2023 - 2027) The Higher Education Qualification Standards 2022 and the Phetchabun Rajabhat University's 5-year operational plan (2023–2027) provide details on learning outcomes. This information was announced in the Royal Gazette. The data generated from cross-disciplinary problem solving that occurs in teamwork reinforces social constructivism and sociocultural learning theories. Planning activities is related to the management of STEM education and phenomenon-based learning because it aims to inspire students to be passionate creators of their own knowledge. Having said that, knowledge establishes the social context along with cultural artifacts without requiring the creation of new ones. It is possible to improve and promote youth learning, which will help young people develop their methodical thinking skills, by combining current information and resources and via cultural transmission. This is a growth of current knowledge that will result in the creation of new products and inventions in order to tackle the problem fully and precisely. (Silander, 2015)

The teaching and learning management science course has revealed that student teachers still struggle with a variety of abilities, including inquiry skills, problem solving, entrepreneurship, critical thinking, reasoning, creativity, and learning as well as

communication and teamwork. These skills must be applied in order to provide professional instruction and prepare pupils for future work. In order to improve competency in learning management science for the student teaching practice, the researcher would like to suggest study on creating a learning management model with phenomenon as a basis in collaboration with STEM learning management. The goal is raising the bar on education standards so that they will meet the needs of society and students alike and be successful in the future. (Mattila & Silander, 2015)

Findings from a study of theoretical concepts, learning management using phenomena as a foundation in conjunction with learning management for STEM education, and learning management using fundamental data for developing a learning management model will be brought to bear in this research. Learn from experts in STEM education. This gave rise to the idea of using STEM learning management and phenomena as the foundation to create the most appropriate learning management system possible at the highest level. This is the outcome of reading up on the subject and consulting experts to figure out how to develop a learning management model that employs phenomena as a basis and integrates STEM learning management in a clear and practical manner. The results of creating and assessing a learning management system that uses STEM learning management, phenomenon- based learning management, expert evaluation, and a pilot project to gauge implementation feasibility. To the greatest extent possible, it is thus ensured that the learning management model developed may be used to accomplish the objectives in accordance with learning management, learning management, and user manual. As well as the results of the experiment to combine STEM learning management with the phenomenon- based learning management model to enhance learning management science capabilities for student teaching practice. (Valanne et al., 2017)

Objective

1. To study basic information in developing learning management model using phenomena as a base in conjunction with STEM learning management to enhance learning management science competencies for the student teaching practice.
2. To create and examine the quality of a learning management model using phenomena as a basis in conjunction with STEM learning management, in order to strengthen learning management science competencies for the student teaching practice.
3. To study the results of an experiment using a phenomenon- based learning management model in conjunction with STEM learning management, in order to strengthen learning management science competencies for the student teaching practice.

Research Framework

In this study, the researcher employed STEM learning management and a framework for learning management based on phenomena, which may be explained in more detail as follows; the goal of phenomenon- based learning is to investigate phenomena that go beyond the scope of the given course, the beginning of the teaching and learning process involves real-world occurrences. Focuses on students producing information on their own, and as knowledge is the outcome of solving problems, it provides students with a comprehensive viewpoint on the numerous phenomena being analyzed. In a classroom where phenomenon- based learning is practiced, the teacher's job is to guide the students toward their objectives rather than merely imparting knowledge to them. In addition to helping students learn how to ask questions, which opens up exciting and novel research opportunities, teachers must comprehend and investigate a variety of phenomena alongside their pupils. It is so difficult to execute a phenomenon-based learning strategy, even in developed nations, but because the advantages to students outweigh

this difficulty, it might be difficult for Thai instructors to encourage phenomenon- based learning, also known as PhenoBL, among Thai youngsters. (Daehler & Folsom, 2016)

When it comes to structuring STEM education, the researcher places an emphasis on integrated learning, which combines knowledge and abilities from several sciences through project- or activity-based learning that is appropriate for the kids' ages. Because thinking skills, technology use, problem solving, and communication are all crucial skills in the modern world, STEM education will assist students in developing these skills. In addition, students will acquire holistic knowledge that can be connected to or applied in everyday life. In light of this, STEM education refers to a teaching strategy that combines science, technology, and engineering. and mathematics begin to focus on resolving issues in everyday life. Also, to improve the experience Students that possess life skills are better prepared for careers in fields such as science, math, technology, and the arts. STEM education must be effectively integrated into classroom instruction if it is to foster future creativity. (Institute for the Promotion of Teaching Science and Technology, 2014)

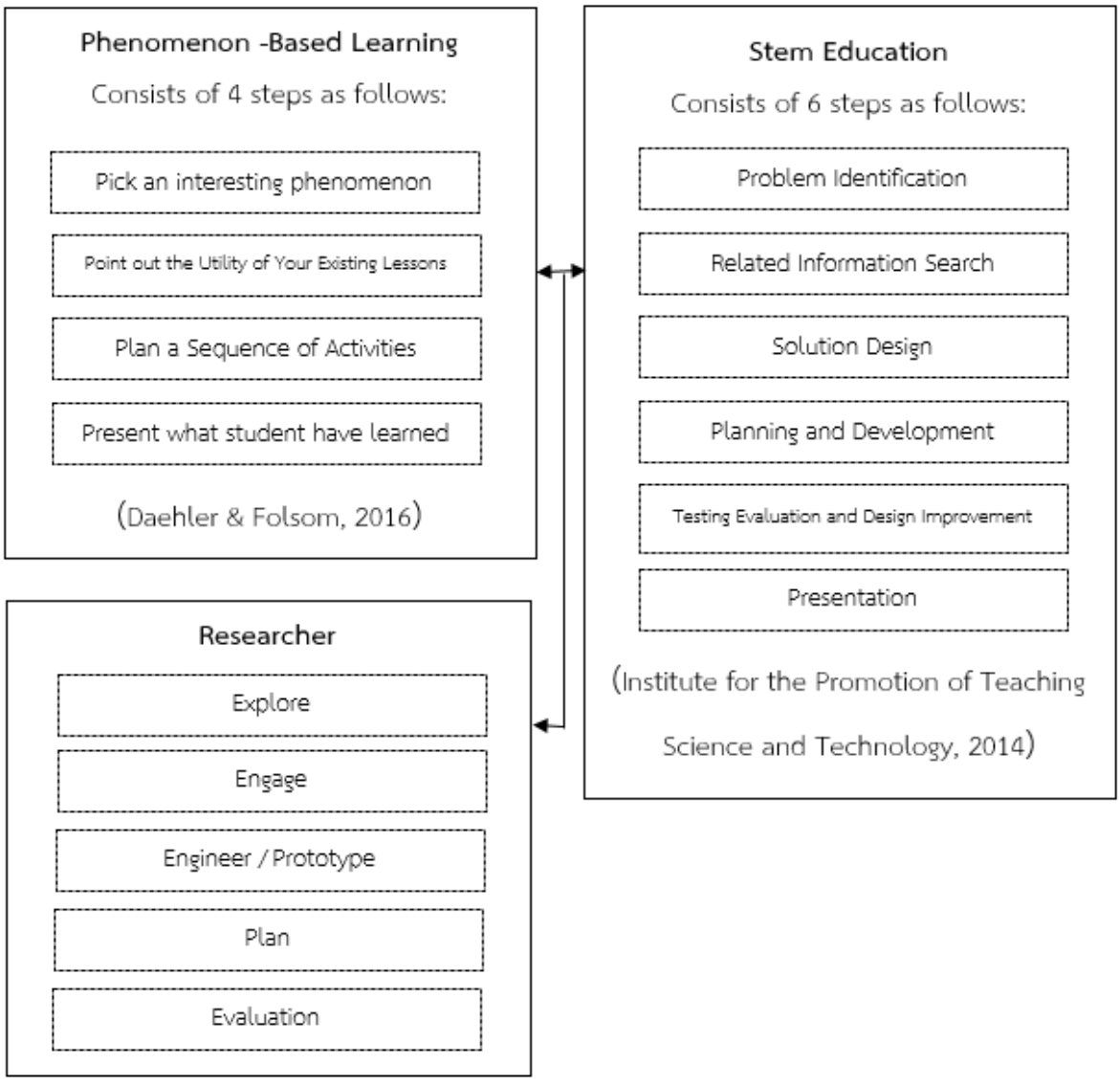

Figure 1 Research Framework

Methodology

In this study, there are three phases in the research and development process;

Step 1: Study basic information in developing learning management model using phenomena as a base in conjunction with STEM learning management to enhance learning management science competencies for the student teaching practice.

To improve learning management scientific abilities for the student teaching practice, examine and evaluate key foundational data pertaining to the creation of a phenomenon-based learning management model in conjunction with STEM learning management.

Information providers include: three specialists in learning management formats for the academic year 2023 who use phenomena as a foundation and STEM learning management to improve learning management science abilities for the student teaching practice.

The tools used in the research include: interview that is structured around the requirements for developing capabilities in learning design and the best practices for fostering such competencies during student teaching. The fundamental idea behind a structured interview is that all respondents should be given the same questions in the same order, and the questions themselves should be predetermined. As a result, the interviews for this study must follow a pre-planned interview format. This format will include a set of questions that will enable the interviewer to ask precise questions and avoid straying from the subject, such as ensuring that the limits are not exceeded and allowing for the comparison of the data collected. (Kaewthep, 2015) There are steps for creating and determining the quality of the tools as follows; 1) research the idea of competency in learning design for student teaching practice, the researcher has researched the idea of building competencies in learning management for student teaching practice in a number of fields from relevant organizations, including; (1) bachelor's degree qualification standards department of education and department of education (four year course) of the year 2019 on teaching strategies, (2) office of the teachers council committee (2013) regarding knowledge professional competencies and experiences of teaching professionals, and (3) office of the secretariat of the education council (2019) regarding guidelines for developing learner competency at the basic education level, (4) office of the national economic and social development office (2008) regarding the management of phenomenon-based learning in conjunction with the management of STEM education, 2) the created interview form was presented to 3 experts to check for content validity by calculating the index of consistency (IOC), which has a consistency value between 0.80-1.00, and 3) the interview form was edited, improved, and prepared as a complete interview form.

Data Collection

1. To obtain information about the need to develop competencies in learning design and instructions for developing them for the student teaching practice, conduct expert interviews.

2. Proceed with the development of a learning management model using phenomenon as a basis in conjunction with STEM learning management to enhance learning management's scientific capabilities for the student teaching practice.

Data Analysis

Analyze qualitative research data by analyzing content analysis in an inductive analysis.

Step 2 : Create and examine the quality of a learning management model using phenomena as a basis in conjunction with STEM learning management, in order to strengthen learning management science competencies for the student teaching practice.

The development of a learning management model that uses phenomena as a foundation in conjunction with STEM learning management to improve learning management scientific abilities for student teaching practice can be achieved through the review of pertinent literature, appropriate research, and expert consultation. Additionally, the effectiveness of learning management models that use phenomena as a foundation in conjunction with STEM learning management to improve learning management science abilities for the student teaching practice can be evaluated by testing it with thirty second-year students in the first semester of the 2023 academic year at the Faculty of Education, Phetchabun Rajabhat University, which is not a sample group, can be done to determine its efficacy.

Sample Groups

The sample group used in the research was 30 second-year teaching students, Faculty of Education, Phetchabun Rajabhat University, academic year 2023, which was obtained from simple random sampling using the lottery method.

Research Tools

1. An assessment is conducted on how well the elements of the phenomenon-based learning management model work together with STEM learning management to enhance learning management science competency for student teaching. including measuring and assessment procedures, learning management systems, content, goals, and philosophies. Three experts reviewed the 5-level rating scale assessment form to ensure content validity. The results of the consistency check, which was measured by computing the index of consistency (IOC), ranged from 0.80 to 1.00.

2. The objective is to evaluate the handbook's suitability for use with the phenomenon-based learning management model in conjunction with STEM learning management for student teaching practice, as well as the components of the manual and learning management plan. The content validity of the 5-level rating scale was assessed by three experts through the calculation of the Index of Conformity (IOC). The consistency check scores ranged from 0.80 to 1.00.

Collection of Information

1. To enhance learning management science competency for the student teaching practice, compile data from the evaluation of the phenomenon-based learning management model's component parts in conjunction with STEM learning management.

2. Gather data from the evaluation of the handbook's applicability to the phenomenon-based learning management model in combination with STEM education for the student teaching experience.

Data Analysis

1. Take into account if the components of the phenomenon-based learning management model are acceptable in conjunction with STEM education management to improve learning management science competency for the student teaching practice, by finding the average and standard deviation the interpretation criteria are as follows; (Wongratana, 2007)

An average of 4.50 – 5.00 means it is most appropriate
An average of 3.50 – 4.49 means it is very appropriate
An average of 2.50 – 3.49 means it is moderately appropriate
An average of 1.50 – 2.49 means it is less appropriate
An average of 1.00 – 1.49 means it is least appropriate

2. Take into account if the manual is adequate for implementing the phenomenon-based learning management model in tandem with STEM education for the student teaching practice, by finding the average and standard deviation the interpretation criteria are as follows; (Wongratana, 2007)

An average of 4.50 – 5.00 means it is most appropriate
An average of 3.50 – 4.49 means it is very appropriate
An average of 2.50 – 3.49 means it is moderately appropriate
An average of 1.50 – 2.49 means it is less appropriate
An average of 1.00 – 1.49 means it is least appropriate

3. Determine the values E1 and E2 to determine the effectiveness of the learning management model utilizing phenomenon as a basis in conjunction with STEM education for the student teaching practice in accordance with the stipulated criteria 80/80.

Step 3 : Study the results of an experiment using a phenomenon- based learning management model in conjunction with STEM learning management, in order to strengthen learning management science competencies for the student teaching practice.

Studying the outcomes of an experiment utilizing a phenomenon- based learning management model in conjunction with STEM learning management can help to improve the student teachers' ability to use learning management science, these include; 1) examine the differences between pre- and post- class knowledge and comprehension of learning management science, 2) compare the 80% criterion with the expertise in learning management design thinking, and 3) compare the competency in writing learning management plans with the 80 percent criteria with 25 third-year students, semester 1, academic year 2023, Faculty of Education, Phetchabun Rajabhat University, using an experimental design with a single group and only posttest-only design. (Kanchanawasi et al., 2004)

Population and Sample

The population used in the research is the student teaching practice who is studying in the 3rd year of the Faculty of Education, Phetchabun Rajabhat University, in the academic year 2023, totaling 250 people.

The sample group used in the research is the student teaching practice students studying in the 3rd year of the Faculty of Education, Phetchabun Rajabhat University in the academic year 2023, and a total of 25 people, which was obtained by simple random sampling by lottery method.

Instruments Used in the Experiment

1. One version of the test of knowledge and understanding of learning management science, which involves creating and determining the quality of the tool, which includes the steps for creating and finding the quality of the tool as follows; 1. 1) research learning management design-related materials, theories, and studies, 1.2) research learning management strategies and techniques for developing competence exams, 1. 3) design a knowledge exam paired with STEM learning management, knowledge of phenomenon- based learning management design, 1. 4) the created test was presented to 3 experts to check for content validity by calculating the index of consistency (IOC), which has a consistency value between 0.80-1.00, and 1.5) use a trial test on 30 students who are not part of the sample to examine the difficulty value and discriminating power in light of the predetermined criteria, which obtained a difficulty value (P) of 0.25 - 0.89 and a discriminatory power value (r) of 0.20 - 0.60 for 30 questions and found the confidence value, by finding Cronbach's Alpha Coefficient, which has a value equal to 0.89.

3. One copy of the competency assessment form for drafting learning management plans that contains the stages for developing and evaluating the quality of tools, as well as the competency assessment form itself; 1. 1) research learning management design- related materials, theories, and studies, 1. 2) research techniques for developing and accessing competences in the creation of learning management systems, 1. 3) in connection with STEM learning management, develop and assess abilities in designing learning management plans using phenomena as a basis, 1.4) present the created evaluation form to 3 experts to check for content validity by calculating the index of consistency (IOC), which has a consistency value between 0. 80- 1. 00, and 1. 5) use the evaluation form to test with 30 non- sample students, to analyze the confidence value, by finding Cronbach's Alpha Coefficient which is equal to 0.87.

Collection of Information

1. Conduct a pre- test with third- year teaching students, Faculty of Education, Phetchabun Rajabhat University, in the academic year 2023, a total of 25 people, and 30 questions.

2. To improve learning management scientific abilities for the student teaching practice, test a phenomenon- based learning management model in conjunction with STEM learning management.

3. When completed, a post-test was conducted with 3rd year teaching students, Faculty of Education, Phetchabun Rajabhat University, in the academic year 2023, a total of 25 people, and 30 questions.

4. Conduct a comparative evaluation of the learning management design thinking competencies of the phenomenon- based learning management model combined with STEM education teaching management to strengthen the learning management science competencies for the student teaching practice. , with 3rd year teaching students, Faculty of Education, Phetchabun Rajabhat University, in the academic year 2023, totaling 25 people.

5. Conduct a comparative assessment of the learning plan writing competencies of the student teaching practice, with the 80 percent criteria, with the 3rd year student teaching practice, Faculty of Education, Phetchabun Rajabhat University, in the academic year 2023, totaling 25 people.

Data Analysis

1. Compare knowledge and understanding of learning management science before and after learning with a phenomenon- based learning management model combined with STEM learning management, using a t-test for dependent, in order to improve competency in learning management science for the student teaching practice.

2. Compare the learning management design thinking abilities of the phenomenon-based learning management model with STEM education learning management using a t- test on a single sample to enhance learning management science abilities for student teaching practice with the percentage criterion of 80.

3. Utilizing a t- test for a single sample, examine how successfully creating learning management plans is executed utilizing the phenomenon-based learning management model in conjunction with STEM learning management to enhance learning management science skills for the student teaching practice.

Results

1) The results of the study of basic information in developing a learning management model using phenomena as a base in conjunction with STEM learning management to enhance competency in learning management science for the student teaching practice.

The tools used in the research include: interview that is structured around the requirements for developing capabilities in learning design and the best practices for fostering such competencies during student teaching, which can be summarized as follows;

1.1) the outcomes of the learning management design preparation for the student teaching practice can be summed up as follows; findings to get ready for the learning management system that will be used to evaluate the curriculum and determine the learning objectives of the students, and to improve students' impressions of the teaching profession during their student teaching experience. In addition, offer courses that support learning management design and delineate formats, strategies, and tactics for educators, this will enable students to apply knowledge design methodologies and critical thinking skills, as well as get ready to create teaching and learning strategies that will help students put what they've learned into practice.

1. 2) Results of activities in designing learning management of the student teaching practice, summarized as follows; (1) the 2008 Basic Education Core Curriculum, student curriculum, learning standards, indicators, core learning materials, and current learning management challenges should all be examined in order to improve effectiveness. Learning management is information-driven, (2) examine students, teaching professionals, in terms of their past knowledge, preparedness and abilities to learn, interests, aptitudes, personalities, and other attributes, (3) learning objectives that are specific, cover information, and promote learner growth are necessary for professional teaching students to increase learner learning in terms of knowledge, process skills, and attitudes, (4) students who work as teaching professionals select information that is correct and compliant with relevant learning objectives, indicators, and standards, (5) instruct students to carefully review the assignments they are given in accordance with the specified learning units, these assignments may include portfolios including evidence, speaking reports, diagram writing, and innovative projects, (6) provide a list of learning management activities and media, advise professional students to select learning activities in line with learning objectives and content, emphasize active learning management and have students apply it, and make use of a variety of learning management media, (7) students of teaching professionals determine measurement and evaluation in accordance with indicators, standards, and learning objectives covering knowledge, skills, processes, and attitudes. A variety of tools, such as behavioral assessments, performance evaluations, forms of observation, and testing, are used in these assessments, and (8) with the following components, teacher students build learning management plans: learning objectives, learning standards, learning indicators, and important points; learning content; learning management activities; learning media; and defining measurement techniques and evaluation criteria.

It is evident that incorporating real-world scenarios to learning makes sense when structuring learning around phenomena. The results demonstrate that a STEM education strategy, with an emphasis on integrating knowledge and abilities across topic areas, aids in the development of knowledge and skills relevant to the twenty-first century. Incorporating math, science, technology, engineering, and science to encourage the kind of practical problem-solving thinking that is crucial to 21st-century living. Nonetheless, studying STEM ideas and

learning utilizing phenomena as a foundation are comparable in that both emphasize problem solving that can be used in real life and the development of knowledge and skills.

2) The results of creating and inspecting the quality of a learning management model using phenomena as a base in conjunction with STEM learning management to strengthen learning management science competencies for the student teaching practice.

The following findings serve the purpose of creating and examining the quality of a learning management model using phenomena as a basis in conjunction with STEM learning management, in order to strengthen learning management science competencies for the student teaching practice. At this point, the results were gathered through data collection from the evaluation of the STEM learning management and phenomenon-based learning management model's component parts, which can be summarized as follows;

2. 1) The outcomes of developing a learning management model using phenomenon as a foundation and STEM learning management in combination to improve learning management science abilities for student teaching practice, including crucial components such as; 1) history of the model, 2) principles, 3) aims of the learning management model, 4) learning management activities, and 5) measurement and evaluation, via paying close attention to the five stages of the learning management model's workflow: explore, engage, engineer, plan, and evaluate. It is appropriate to combine STEM learning management with the phenomenon- based learning management paradigm. By specialists evaluating appropriateness, which is at the highest level with an overall suitability rating of $\overline{X} = 4.55$, S.D. = 0.55, regarding the handbook for implementing the phenomenon-based learning management model in tandem with STEM education management, it has an overall appropriateness rating of $\overline{X} = 4.54$, S.D. = 0.45 at the highest level.

2.2) The outcomes of evaluating the effectiveness of the learning management model utilizing phenomenon as a foundation and STEM learning management to strengthen learning management scientific abilities for the student teaching practice. In order to improve competency in learning management science, it was discovered that the average score achieved when studying using a phenomenon-based learning management model in conjunction with STEM education was 83. 20 percent, and the average academic accomplishment scores after using a phenomenon- based learning management model along with STEM learning management to improve competency in learning management science, which was assessed to be 85.60 percent. That is, a phenomenon-based learning management model paired with STEM learning management to improve learning management science competency has an efficiency of 82.16/84.83, which satisfies the required 80/80 efficiency requirement.

Based on the aforementioned research, it can be concluded that while the idea of STEM education and the concept of phenomenon-based learning management are similar, there is a distinction between the two concepts of organizing learning: using real conditions as the basis for learning and organizing learning based on phenomena. The study discovered that from the features of problem-based learning, which is how the idea of STEM education is structured, crucially, the user may decide which of the two ideas' advantages to combine to create a learning management guideline that supports the growth of students' superior applied thinking.

3) Results of an experiment using a phenomenon-based learning management model combined with STEM education to enhance competency in learning management science for the student teaching practice.

The aim of this study is to enhance learning management science abilities for student teaching practice by analyzing experiment results using a phenomenon- based learning management model in conjunction with STEM learning management. The following findings address this goal. This is the result of using the created learning management model to test with

teaching students studying the course learning management design (EDCI 201) in the first semester of the academic year 2023, totaling 25 people. The following findings were based on a single-group experimental design and only a post-test, which resulted in summary results as follows;

3.1) With statistical significance at the .05 level, students who received both STEM and phenomenon-based learning management to enhance their learning management science competency for the student teaching practice demonstrated increased knowledge and comprehension of learning management science following their studies.

Table 1 Presents the findings from comparing knowledge and comprehension scores in learning management science between baseline and post-study conditions

Test	**N**	**Full score**	$\bar{X}$	**S.D.**	$\bar{D}$	**t**	**p-value**
pre-test	25	30	14.92	1.07	10.04	68.31	.00
post-test	25	30	24.96	1.06			

*p<.05

From Table 1 it is found that the student teaching practice has knowledge and understanding of learning management science between before and after class using a phenomenon-based learning management model combined with STEM learning management with an average score of 14.92 points and 24.96 respectively, and when scores are compared before and after studying, it can be said with statistical significance at the .05 level that teaching students have a better comprehension of learning management science after studying than before studying.

3.2) After learning, students who got phenomenon-based learning management in addition to STEM learning management had learning design thinking abilities that were considerably above the predetermined 80% criterion at the .05 level.

Table 2 Shows the results of comparing competencies in learning design thinking, post-test scores with the 80 percent criteria

Test	**N**	**Full score**	$\bar{X}$	**S.D.**	**μo (80%)**	**t**	**p-value**
post-test	25	30	25.12	1.05	1.12	5.31	.00

*p<.05

From Table 2 teaching students have an average score of 25.12, which accounts for 83.83 percent of their proficiency in creating learning management systems. In addition, while contrasting the criteria and competency ratings for learning management design thinking. Therefore, it can be said that after studying using the established model above the 80% cutoff, with statistical significance at the .05 level, teaching students have the capacity to conceptualize and construct learning management.

3.3) Students who receive phenomenon-based learning management in addition to STEM learning management to strengthen learning management science competencies for the student teaching practicum have the capacity to produce learning management plans after studying above the 80% cutoff specified with statistical significance at the .05 level.

Table 3 Shows the results of comparing the competency in writing learning management plans, the scores after studying with the criteria of 80 percent

Test	N	Full score	$\bar{X}$	S.D.	μo (80%)	t	p-value
post-test	25	30	25.20	1.19	1.20	5.04	.00

*p<.05

From Table 3 it is found that teaching students' competency in writing learning management plans has an average score of 25.20, or 84.00 percent, and when comparing the criterion with the competence scores for writing learning plans, it can be said that teaching students' competency in writing learning plans after studying using the established format is much greater than the 80% requirement at the .05 level.

Discussions

In order to enhance learning management science competency for student teaching practice, a phenomenon-based learning management model should be developed in tandem with STEM learning management. This raises interesting questions that merit discussion, with the following details;

1) The results of a study of theoretical concepts, learning management using phenomena as a foundation in conjunction with learning management, and research of basic data for developing a learning management model for STEM education discover more about STEM education from experts. This gave rise to the idea of using STEM learning management and phenomena as the foundation to create the most appropriate learning management system possible at the highest level. This is the outcome of reading up on the subject and consulting experts to figure out how to develop a learning management model that employs phenomena as a basis and integrates STEM learning management in a clear and practical manner. According to Butkatanyu (2018), learning with phenomena as a base can help students become knowledge creators and innovators, keep them abreast of changes in the digital age, and foster a holistic view and access to the real world of learners. Therefore, learning with phenomena as a base can be one effective way to promote knowledge among students. It also aligns with the findings of Mahawijit (2019) study on the application of learning ideas to improve students' 21st-century learning skills by utilizing active learning in primary school courses and using phenomena as a basis for learning.

2) The results of creating and testing a learning management system that combines STEM learning management with phenomenon-based learning management, as well as expert advice and a pilot project to gauge implementation feasibility. Hence, it is ensured that, to the greatest extent possible, the learning management model developed may be used to accomplish the goals in accordance with learning management, learning management, and user manual. This is in line with the research of Wettong (2018) who developed a brain-based teaching model to promote Thai reading and spelling skills for first grade students, it was found that 21 students had reading and spelling skills in Thai that passed the criteria of 80 percent, accounting

for 87.50 percent of the total number of students, which is higher than the specified threshold of 80 percent or more. This is in line with the research of Phodong (2017) who developed a self-directed learning model to strengthen the learning design ability of student teachers at Rajabhat University, with statistical significance at the.05 level, it was discovered that student instructors had greater knowledge and comprehension of learning design than they had previously.

3) The experiment's results, which combined STEM learning management with the phenomenon-based learning management model to enhance learning management science capabilities for student teaching practice, with the following information;

3.1) With the learning management model and phenomena as a common foundation for STEM learning management, the results of comparing students' knowledge and understanding of learning management science before and after studying showed that, when scores are compared before and after studying, it can be said with statistical significance at the.05 level that teaching students have a better comprehension of learning management science after studying than before studying. Students' average scores for learning management science between before and after studying were 14.92 and 24.96 points, respectively. The reason for this is that learning management is designed with phenomena as the basis and combined with STEM learning management to improve learning management science competencies for students undergoing professional teaching experience. This is done in compliance with academic principles that align with learning management theories, concepts, and principles. As a result, after studying more than before, teaching students have a greater comprehension of learning management science. This is in line with the findings of Samahito (2019) study on the planning of educational experiences. Research has shown that utilizing STEM education in conjunction with phenomena as a basis for early childhood education is a suitable learning arrangement for this age group. Therefore, utilizing phenomenon-based learning experiences to organize learning activities is a learning management strategy that promotes children's development of life, career, and learning abilities, particularly critical thinking and problem solving, which are crucial components of learning management in the twenty-first century.

3.2) Outcomes of contrasting test scores with the 80 percent proficiency threshold for developing learning management systems. Teaching professional students demonstrated competency in learning management design thinking, with an average score of 25.12, or 83.83 percent, when the criteria were compared with the competence scores in that area. Thus, it can be concluded that teaching students possess the ability to conceive and create learning management after utilizing the developed model to study beyond the 80% cutoff with statistical significance at the .05 level. This is the final product of the process that was used to organize the teaching and learning activities for the model developed using the concepts of STEM and phenomenon-based learning management. Various processes were made available to students to aid in the development of their critical thinking and learning management skills. Consistent with the research of Phodong (2017) it was found that the data on learning design thinking ability was 88.10 percent, higher than the 80 percent criteria set at the statistical significance level .05. Furthermore, it aligns with the findings of Nuankham (2019) which examined the effects of utilizing a social media activity set grounded in a phenomenon-based concept in conjunction with an examination of primary school students' digital literacy practices, it was discovered that when students use the concept-based social media use activity, they create a variety of digital literacy behaviors, this phenomenon is based on common reflections.

3.3) According to research using the criterion score of 80 percent, the average score for teaching students' ability to write learning plans was found to be 25.20, or 84.00 percent. When the criterion is compared with the competence scores for writing learning plans, it can be concluded that teaching students' competency in writing learning plans after studying using the established format is much greater than the 80% requirement at the.05 level. This is done in order for students to become more adept at developing learning management plans as a result of their activity designs aligning with learning management science competencies. This is consistent with the research of Karimah & Kasetchai (2016) which found that the learning management plan using the 7-step learning cycle (7 Es) had an efficiency of 83.16/85.50. This is consistent with Phodong (2017) who found that the ability to write learning management plans of student teachers was 82.13%, higher than the 80% threshold specified at the statistical significance at the .05 level. This is due to the fact that the learning management model incorporates the royal science, which has been methodically established as previously indicated, and that the components of organizing learning activities follow the stages, enabling teaching professionals to produce more learning plans.

Conclusion and suggestions

The development of the phenomena- based learning model accompanied by STEM for enhancing students' competency in science learning management, which has the following recommendations;

1. Suggestions for using research results

1.1 Teachers should research effective teaching strategies for the subject matter before using the phenomenon-based learning management model and STEM education management, they should also use lesson plans to arrange teaching and learning in a way that achieves the desired goals.

1.2 The learning management model ought to be made public as a substitute for teachers who want to arrange classroom activities differently.

2. Suggestions for future research

2. 1 To determine whether other teaching techniques can implement the learning management created by the researcher in accordance with the same or different standard criteria, the phenomenon-based learning management model should be used in conjunction with the STEM learning management that the researcher created and tested with additional samples using the active learning management method.

2.2 To build the community of professional learning in educational institutions that society requires, the phenomenon- based learning management model should be merged with the STEM learning management that the researcher created and tested with other disciplines.

New knowledge and the effects on society and communities

Community-based education, or community-based education, has an understanding of the problems with education development in the Thai educational system. Since schools and other educational institutions are big production centers, they serve as a vehicle for the development of individuals as well as the nation's development to keep up with global trends. Education also helps Thai people become aware of other nations that are making progress, and Thai people value education highly in a competitive environment like this one. throughout life and using information as a tool to enhance life quality, being able to apply knowledge to better

govern oneself. Conversely, the educational model offered by educational institutions isolates individuals from their family, community, locality, temples, places of worship, nature, environment, and morality all of which serve as links that enable people to grow into fully realized human beings to the point where people nearly forget their origins, way of life, and identity.

Active learning management learning and interdisciplinary utilizing phenomena as a basis are the focus of teaching and learning using this approach. However, multidisciplinary ideas have not yet been effectively implemented in Thailand's active learning teaching methodology, despite its lengthy history. Therefore, if student teaching is to be used in Thailand, it must be prepared in phases, to achieve this one must first experience with teaching and learning in their own classroom before researching the positive aspects. The findings were subsequently made more widely available both nationally and at the school level (pilot). Instructors are already utilizing such learning management models in their classrooms to some level, but there are still not many of them. (Dhedchawanagon, 2023) These models are raising awareness and inspiring instructors to arrange learning with an emphasis on learners in Thailand right now. In which teachers continue to educate using an outdated method that is more closely related to the images they remember seeing in the classroom and is focused on subject matter rather than skill and process development.

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