Problems and Needs Assessment to Learning Management of Computational Thinking of Teachers at the Lower Secondary Level

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Abstract

The objective of the study was to investigate the problems and needs in the learning management of computational thinking among teachers at the lower secondary level in private schools in the province of Maha Sarakham, Thailand. This current study comprised 42 participants. The research tools were 1) questionnaires about problem situations in learning management for computational thinking and 2) recordings of group discussions. 1) The findings revealed that teachers had limited knowledge and understanding of learning management in computational thinking ($\bar{x}$ = 2.43, S.D. = 0.44). In this regard, teachers believe that computational thinking is regarded as knowledge in addition to literacy, and they recognize that computational thinking, together with reading, writing, and calculating, is the cornerstone of learning in the 21st century. The best way to foster and develop teachers in teaching and learning computational thinking skills is through training and collaboration with the technology that should be used in teaching and learning computational thinking (i.e., computers, computer programs, smartphones, and multimedia). 2) Teachers indicated a strong need for self-improvement in terms of learning management in computational thinking ($\bar{x}$ = 4, S.D. = 0.63). Through training, teachers want to improve their control of computational thinking. The development of learning management abilities that enhance computational thinking involves the following five steps: 1) Educating teachers; 2) Having a speaker or mentor instruct them in the creation of activities; 3) providing activities for teachers to practice together until proficiency is attained; 4) enabling each teacher to present the outcomes of the activities; and 5) teachers collectively summarizing the results of the activities.

Keywords: computational thinking, teacher development, lower secondary level, science and technology

1. Introduction

In addition to addressing the content and procedures of the basic education's core curriculum, the current learning arrangements must also facilitate the creation of 21st-century skills. Successful skills training can be achieved through hands-on learning in the form of learning by using Problem-Based Learning and Project-Based Learning (The Institute for the Promotion of Teaching Science and Technology, 2017). Problem-based learning and active learning result in students' learning to use thought processes and real-world practices; these two types of learning also train students to express their opinions, summarize their knowledge, and present their work, in addition to being able to apply acquired knowledge in everyday life (Office of the Education Council, 2021).

Learning management for learners to have knowledge and skills is important and crucial to people's lives in the 21st century because it helps prepare young people to be ready citizens in the digital economy. This has a significant impact on how the nation is developing. To keep up with the world, the development of computational thinking abilities is important for everyone. This fits with the manpower development plan, which wants to give people the skills and knowledge they need to meet the needs of the job market and the nation's economic and social growth. Research and development to drive the learning management of computational thinking, or coding, research and development to construct the body of knowledge and innovation impact productivity and the creation of economic value in order to adapt to change and respond to urgent government policies. Improving the cognitive abilities of Thai children and equipping secondary school teachers with the knowledge and skills is necessary to teach computational thinking skills, a concept relevant to all disciplines and considered a fundamental skill (Barr &

Stephenson, 2011; Conery et al., 2011a, 2011b; Furber, 2012; Lu & Fletcher, 2009; Wing, 2008; Wing, 2008). 2006).

Considered essential to computational thinking is the capacity of students to comprehend, analyze, and solve issues systematically. In this aspect, computational thinking is an essential skill for all individuals, not just computer scientists. This is a notion and technique that may be cultivated over time, and it is the capacity to solve problems. It consists of 4 parts: Decomposition, Pattern Recognition, Abstraction, and Algorithms. The information and communication technology curriculum has been transformed into a computational science curriculum by the Institute for the Promotion of Teaching Science and Technology (IPST), which places an emphasis on the development of critical thinking abilities, methodical problem-solving skills, and computational thinking skills. Consequently, students may apply these abilities in the real world and are prepared to become a vital asset in the nation's development (Suteera Prasertsan, 2016; Yuen Phuwarawan, 2018; Davis, 1996; McLoughlin, 2002; Wing, 2006).

According to the educational evaluation of basic education management of private schools in Maha Sarakham Province by the Office for National Education Standards and Quality Assessment (Public Organization) round three (2011-2015), it was found that the teaching and learning management of the majority of teachers was mainly in line with the curriculum, while they had the minimum use of media in their teaching. The teachers had a learning plan, but they did not comply with it. They organize learning activities in a variety of ways. The content and instructional activities lacked relevance to the real world. Learning management did not promote the growth of critical thinking abilities in the classroom. The way students learned to analyze, synthesize, and draw conclusions from what they learned was not good enough. Students lacked the ability to think critically, synthesize ideas, and solve problems methodically. Students were not taught how to research from a range of sources by teachers. As a result, students were not cultivating the abilities necessary for self-discovery. In the field of student-centered learning management, teachers should be helped to train, study, and come up with strategies for their teaching, as well as to monitor, evaluate, and keep getting better at how they teach. Teachers should organize learning activities that encourage students to think, practice, and learn on their own through projects, self-study, research, and seeking knowledge from technological media. Through speaking, writing, and summarizing activities, teachers should also get students to answer questions, write, and make connections between different things (Office for National Education Standards and Quality Assessment, Public Organization).

Researchers in the role of promoting, monitoring, and developing the quality of teaching management in schools under the Office of the Private Education Commission. Therefore, they want to study the current problems and needs in developing the management skills that promote computational thinking of teachers at the early secondary level in private schools in Maha Sarakham province in order to develop and promote the ability of teachers to manage learning by emphasizing hands-on practice, creating knowledge and problem-solving skills in themselves, according to the idea of problem-solving using computational thinking.

2. Objectives

1. To study the problems in the management of learning that promote computational thinking of teachers at the early secondary level.

2. To study the necessity of managing learning that promotes computational thinking of teachers at the early secondary level.

3. Research Scope

This research focuses on studying the problems and needs in managing learning that promotes the computational thinking of teachers in the early secondary level. The researchers have defined the population and sample groups for the research as follows:

1. The target group for the survey on opinions regarding the problems in managing learning and computational thinking is 42 teachers of the early secondary level in private schools under the Office of the Private Education Commission in Maha Sarakham province. Thailand.

2. The target group for the focus group discussion is science and technology teachers of the early secondary level in private schools under the Office of the Private Education Commission in Maha Sarakham province, a total of 14 teachers, Thailand was selected through purposive sampling.

4. Instruments

1. Opinion survey on the management of computational thinking learning, with a Likert scale of 5 levels, 10 items

2. Focus group discussion record to identify problems and needs in developing and designing activities that enhance computational thinking skills, with the following topics:

2.1 What are the steps and content involved in developing skills that promote computational thinking?

2.2 What knowledge or content should teachers have in order to develop skills that promote computational thinking?

2.3 How should activities be organized in the process of developing skills that promote computational thinking?

2.4 How should learning be conducted in order to promote good computational thinking skills?

2.5 How can computational thinking skills be measured and evaluated?

5. Research Methodology

This study aims to study the problems and needs in developing skills to manage learning among science and technology teachers, who are the target group for this current study, in order to provide conclusions and guidelines for developing and designing activities in the course that enhance computational thinking skills for early secondary school teachers. This research is tailored to the actual problems and needs as follows:

5.1 Evaluation Method

Knowledge and understanding survey on computational thinking, concepts, principles, management of computational thinking learning, and evaluation of computational thinking skills of early secondary school teachers. Results are used to determine the topics for group conversation.

Focus Group Discussion: Science and technology teachers to summarize the problems and needs in developing skills to manage to learn among teachers.

5.2 Data Analysis

The data is analyzed through qualitative analysis, analyzing the current situation and problems in teaching and learning management in private junior high schools under the jurisdiction of the Office of Education of Maha sarakham Province, Thailand. Using the data obtained from interviews and group discussions, a summary is created through content analysis of opinions that are consistent or have the same direction, and the results are used to determine the issues to be used as a framework for thinking in research and the components of the course to enhance the ability to manage learning that promotes computational thinking for junior high school teachers.

6. Results

The analysis of the problems in answering the questionnaire on the understanding of computational thinking of teachers at the junior high school level in private schools under the jurisdiction of the Office of Education of Maha sarakham Province, Thailand as shown in the table.

Table 1. The Level of Understanding in Managing Learning Computational Thinking

Summary of key points	Knowledge and Understanding		Level
	$\bar{x}$	S.D.	
1. Problem conditions	2.95	1.01	Moderate
1.1. Concept of "computational thinking"			
1.2. Experience in managing computational thinking learning	2.77	1.06	Moderate
1.3. Experience in participating in training on the topic of "computational thinking"	2.07	0.73	Low
1.4. Self-development	1.91	0.26	Low
1.5. Approach to learning activities	2.45	0.74	Low
Total Average	2.43	0.44	Low

Based on Table 1, it was found that teachers have a low level of understanding and comprehension of managing the teaching and learning of computational thinking overall ($\bar{x}$ = 2.43, S.D. = 0.44). In order of importance, the

following were found to be at a low level: self-development ($\bar{x}$ = 1.91, S.D. = 0.26), training experience on the topic of computational thinking ($\bar{x}$ = 2.07, S.D. = 0.73), methods for organizing learning activities ($\bar{x}$ = 2.45, S.D. = 0.74), and experience in managing the teaching and learning of computational thinking ($\bar{x}$ = 2.77, S.D. = 1.06). The concept of computational thinking was found to be at a moderate level ($\bar{x}$ = 2.95, S.D. = 1.01).

Table 2. The Necessity of Managing the Teaching and Learning of Computational Thinking

Summary of key points	Needs		Level
	$\bar{x}$	S.D.	
2. Needs/ Demands	4.21	0.42	High
2.1 Training to increase knowledge			
2.2 Designing of the management of learning calculation thinking	4.07	0.73	High
2.3 Designing a lesson plan for managing mathematical thinking	4.14	0.36	High
2.4 Developing learning media	3.57	0.75	High
2.5 Evaluating and assessing learning outcomes	4.00	0.67	High
Total average	4.00	0.63	High

Table 2 shows that the overall necessity of managing learning in computational thinking is high ($\bar{x}$=4.00, S.D.=0.63). The order of necessity is as follows: 1) training to increase knowledge, 2) planning for learning management, 3) designing learning, 4) assessment and evaluation, and 5) preparing learning materials.

The results of the group discussion found that:

1. the process of developing the ability to manage the learning that promotes computational thinking has 5 steps as follows: 1) teachers providing knowledge, 2) having a facilitator or mentor lead activities, 3) having activities that allow participants to practice together until they become proficient, 4) teachers presenting the results of their activities, and 5) teachers jointly summarizing the results of the activities.

2. The development of learning management skills that promote computational thinking should have content that is aligned with the elements of computational thinking, including 1) decomposing large problems into smaller problems, 2) finding patterns, 3) thinking abstractly, and 4) developing algorithms.

3. For teachers to learn how to manage learning in a way that improves their computational thinking skills, they should do learning activities that let students do hands-on problem solving, analysis, and practice in groups and on their own. Emphasize letting students find answers for themselves and summarizing their own knowledge.

4. To promote good computational thinking, it is important to stimulate students' interest and desire to learn. Teachers should use a variety of teaching techniques, using modern and appropriate media that align with the content. They should use real-life or near-life problem-solving scenarios and emphasize active learning, allowing students to practice thinking and doing. Practice presenting their own work should also be emphasized.

5. To measure and assess computational thinking, it is important to use a variety of methods and tools to measure and assess results. Emphasize measuring results based on real-life situations.

6.1 Additional Comments from the Group Discussion

Managing learning to enable students to read, write, and calculate is an important and necessary thing for teachers, especially when the national curriculum has been revised in B.E. 2550 (revised version B.E. 25602560). In the science learning group, which includes technology, it is necessary to accelerate teacher training to enable them to manage the teaching effectively." (teacher)

"I am feeling anxious because I don't have the skills to use computers and various computer programs and I am not sure if I will be able to teach students." (teacher)

"I want big school teachers who are ready and used to teaching this topic and have been trained to come and share their knowledge with small school teachers." (teachers)

"I'm looking for ready-made manuals to use in learning activities." (teachers)

Based on the preliminary study of the basic data, the researcher then used information on the problems in teaching and learning management and the needs of teachers to define a framework for training courses to enhance computational learning management competencies. thinking for junior high school teachers.

7. Discussion

1. According to a study of the problems and needs in teaching and learning computational

thinking for teachers at the lower secondary level, it was found that the majority of teachers had little knowledge and comprehension of teaching and learning computational thinking. Teachers have minimal professional experience and are unfamiliar with computational thinking principles. Several individuals have only once participated in training on the topic of "Computational Thinking". This may be because the Ministry of Education has the policy to improve the basic education core curriculum in the B.in 2008 in learning areas of science and technology to be congruent with the development of human resources specified in the 12th National Economic and Social Development Plan, the National Educati2017–2036017-2036, and the 20-year National Strategy (Bureau of Academic Affairs and Educational Standards, 2018; Ministry of Education, 2019). As the fourth subject in the learning areas of science and technology, they integrate a technological learning area with science. About half of the teachers, who have experience in learning management, are concerned about this since they lack that experience. They misunderstood that learning management must be incorporated with only technology and computer media. This is consistent with research that has studied computational thinking perception. It was found that a high percentage of teachers without awareness and fundamental knowledge of computational thinking including a misconception about this learning, thus require considerable technical effort and in-depth knowledge of computer science. Moreover, many teachers hold erroneous beliefs about how to develop computational thinking skills. This is a barrier to the development of the learners' skills (Knie, Standl, & Schwarzer, 2022; Reichert, Barone, & Kist, 2020; Rottenhofer, Sabitzer, & Rankin, 2021; Lye & Koh, 2014; Bower, Lister, Mason, Highfield, Kalelioglu et al., 2016).

2. Regarding the need for teachers' computational thinking and learning management, the overall results were averaged at a high level ($\bar{x}$=4.00, S.D.=0.63). Most teachers wanted to develop themselves through training. It may be because teachers are inexperienced in teaching computational thinking. and the teacher never attended to self-improvement. They, therefore, have concerns. They think that teaching cannot be managed in this learning area. As a result, they want to improve themselves by training. This is in line with Byars and Rue's training theories (1994). They claim that training improves operational efficiency by increasing or building people's knowledge, skills, abilities, and attitudes. Workshops are designed with the goal of preparing participants to be highly prepared and to raise their operational efficiency according to the workshop's subject matter, including use in practical settings. Teachers in the UK were surveyed by Sentance and Csizmadia (2017), who discovered that they lacked knowledge and comprehension of computational thinking ideas. Thus, these researchers provided a variety of seminars to introduce computational thinking concepts and enhance teachers' confidence in so doing. After the training, the teachers stated that Workshops help inspire and build confidence. Makes most teachers more confident in teaching. In this regard, some teachers also need training to increase their confidence and develop teaching skills. It is in line with the findings that teachers can incorporate computational thinking in STEM K–12 classes with the use of workshops and design participation. It was discovered that K–12 teachers frequently do not understand computational thinking if they have never received computer science training. Workshops are a great way for instructors to understand computational thinking and how to apply tools in the STEM classroom (Wu et al., 2020). The results also showed that incorporating analytical thinking into the course of study will affect how well students understand the basics of computational thinking as they study for tests. Rodríguez del Rey et al., (2021) investigated the level of computational concept expertise in 55 male teachers who taught in 42 public secondary schools in Riyadh, Saudi Arabia, and used the course education system (CS). They recognized CT as a basic skill for everyone, and 41 teachers received low scores. In conclusion, the majority of male teachers who teach computer science have a low level of CT proficiency in CT proficiency; most CS teachers (N = 36) still cannot properly define CT. They require professional training (Wu., et al., 2020). It is consistent with the study of the introduction to computational thinking of those who studied through distance learning in K-12, which found that after the course, participants had an increased attitude towards computer subjects. They understand CT and gain confidence in learning computers. (Oliveira, Bittencourt, & Trindade, 2019). This is echoed by a study by Wu et al. (2020), who studies computational thinking. After the course, teachers have a better understanding of computational thinking and are surer of how to use it in the classroom. They have a more positive attitude towards computer subjects. Overall, they understand CT and confidence in learning computer science. It also points to a high level of motivation among learners throughout the course. However, developing teachers' knowledge of computational thinking is also challenging. All teachers should raise their confidence in learning management with workshops to enhance their knowledge and the ability to have the ability to manage to learn. In this regard, they should put digital technology to good use to fully develop computational thinking skills by using digital devices such as computers, laptops, and mobile phones. Teachers should be aware of managing learning, and computational thinking which can be considered a fundamental skill for

everyone. Teachers should look for ways to teach that will help students learn how to think computationally. and how to assess the learner's cognitive abilities, etc.

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