Development of Computing Science for Primary School Students in the Age of Digital Disruption

T. Tannirat, N. Songkram, V. Dulyakorn and S. Upapong,

***Abstract*—** The primary purposes of the study were to analyze knowledge management of primary school teachers in Thailand and present computing science instruction in online and off-line platforms for primary school students. The population of primary school teachers was 1,214 and the research instruments were questionnaires and data were analyzed by mean and standard deviation (SD). The result of the study found that 1) the average opinion of primary school teachers of what was expected performed higher than what was in the actual practices in terms of dedication to the development of teaching and learning management mean=4.59 SD=0.57 and mean=4.48 SD=0.62 respectively and 2) Instructional activities for learning computational science for primary school students can be organized both online and offline and can be blended by focusing on active learning approaches.

***Keywords*—**computing science, primary school teacher, teaching and learning management, digital disruption

I. Introduction

From an endeavor to make significant contributions to design basic education core curriculums in Thailand and to prepare learners for future challenges, the educational institutions participated in designing a curriculum with clear concepts and principle and practice to promote a learner's holistic development including knowledge and skills that are essential for success in college and the workplace. (Thailand Basic Education Core Curriculum B.E. 2551). Computer Science (CS), Information Communication Technology (ICT) and Digital Literacy (DL) were introduced to be strong foundations for living in the age of digital disruption.

In addition to Computer Science (CS), Information Communication Technology (ICT) and Digital Literacy (DL) in basic education, core curriculums mainly focus on enabling students to think critically by providing disciplined approaches to analyzing problems and the ability to design creative solutions. Students will be able to find, assess, organize, analyze, synthesize and apply information to problem solving and apply knowledge to problem solving in real life. However, due to the lack of certified teachers who hold a degree in related sciences, schools hire substitute teachers from other fields to take responsibility in instructing these courses. Educational institutions attempt to provide short-term training courses to educate teachers online and offline platforms but the effective instruction remains unstable. [1] [2] Besides, textbooks and learning materials which are still relatively very few in availability which do not focus on students to practice specific skills as they should be. This is an intense challenge for teachers to encourage students to achieve learning objectives. Teaching online poses challenges for teachers trained primarily to work face to face. The Covid-19 pandemic and subsequent lockdown of schools have forced teachers to move online to ensure students continue their studies. This is not an easy transition and success depends on educators having the skills, knowledge, and competencies for online teaching. [9]. The Covid-19 situation has a major impact on changing education and teachers are driven to keep up with technology knowledge and specific skills than ever before due to knowledge as being dynamic and must be adapted to the routine practice in their teaching and learning. It is also important to share knowledge and exchange ideas with others in order to construct new knowledge and to improve teaching and learning processes in the classrooms and also create a learning environment of intuitions [3] [4] [5]. Technology is a major factor influencing education today but some areas are not ready due to lack of accessibility to technologies and internet especially in rural areas.

Therefore, teacher's knowledge management is important for the organizations where teachers are able to learn new knowledge and skills after applying it in their instructions then share their valuable experiences to their peers. So, this study focuses on data from teachers which were collected to analyze the knowledge management of teachers in primary schools and presents examples of computational learning activities both online and offline from primary school students in Thailand.

II. Research Objectives

The main purposes of this paper were 1) to analyze the knowledge management of primary school teachers in Thailand and 2) to

Manuscript received February 25, 2022. This work was supported in part by the Office of the Secretary of The Ministry Of Higher Education in Science Research and Innovation in the Kingdom of Thailand.

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present computing science instructions in online and off-line platforms for primary school students.

III. Samples

The population of this study was from 28,495 primary school teachers in Thailand in 2019. Samples were gathered by using a multistage sampling method. A total of 1,214 questionnaires from samples were returned, which was greater than the required minimum sample number and was gathered from all regions across the country.

IV. Instrument

The questionnaires were utilized to study the knowledge management of primary school teachers. The researchers generated questions and adjusted the questions from the local and international related research questions by using the validation of question processes. The instrument was inspected for internal consistency of reliability by computing Cronbach's Alfa coefficient (α – coefficient) which equals 0.901. The instrument was reviewed and adjusted before being distributed to primary school teachers across Thailand.

V. Data Collection

The data was collected by using questionnaires between December 2021 -January 2022 and after which 1,214 questionnaires were received.

VI. Data Analysis

The data were analyzed by mean and standard deviation (SD).

VII. Results

The results of the analysis of expected practices and actual knowledge management practices of primary school teachers in Thailand.

Items	Expectation		Actual practice	
	mean	SD	mean	SD
1. I applied the knowledge from various trainings into my instructions.	4.39	0.61	4.07	0.67
2. I always search for new knowledge to improve my teaching and learning activities.	4.47	0.61	4.20	0.65
3. I study teaching techniques and applied into my instruction to improve my students' learning skills	4.47	0.58	4.23	0.64
4. I have the confidence to educate my students and share knowledge to my fellow teachers.	4.50	0.58	4.32	0.64
5.I use available resources from school to benefit from my instructions and share with fellow teachers.	4.40	0.59	4.23	0.71
6. I search for information from researches to improve my instructions.	4.10	0.74	3.84	0.80
7. I develop my teaching by doing my own research.	4.06	0.79	3.80	0.88
8. I am encouraged to spread knowledge in teaching and learning.	4.14	0.76	3.92	0.84
9. I design lesson plans according to the school curriculum.	4.41	0.65	4.21	0.73
10. I have designed lesson plans to suit my students' learning styles.	4.49	0.59	4.32	0.68
11. I am fully dedicated to improve my teaching and learning management.	4.59	0.57	4.48	0.62
12. I test students' knowledge before the lesson in order to develop students to their full potential	4.38	0.65	4.19	0.72
13. I encourage students to use technology for their learning.	4.48	0.64	4.33	0.72
14. I am confident that the knowledge students gain will be able to apply in their real live.	4.50	0.61	4.35	0.67
15. I check students' works and give useful suggestions for their learning.	4.52	0.58	4.36	0.67
16. I formally share my teaching knowledge with fellow teachers, such as meetings.	4.28	0.68	4.04	0.79
17. I informally exchanged and shared knowledge about teaching with my fellow teachers.	4.33	0.67	4.18	0.72
18. I create learning materials and distribute them to my fellow teachers.	4.21	0.71	3.95	0.84
19. I am open to listening to students' problems in every way in order to lead to appropriate solutions	4.49	0.60	4.36	0.65
20. I publish my online and offline teaching and learning management so others can come and study.	4.18	0.77	3.94	0.87

The teacher organized a learning activity in computational science for elementary school students in Thailand: both online and offline. Exampled of computational science learning activities in an online system for a Thai school.

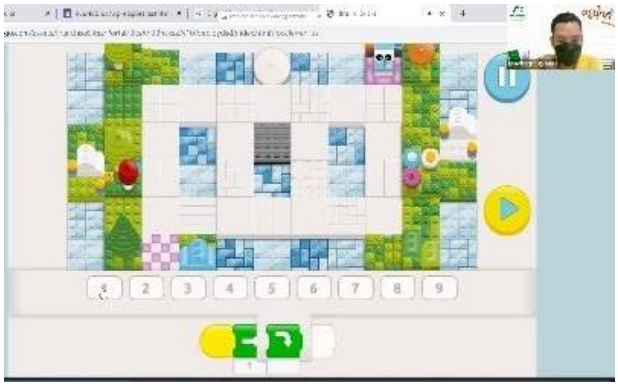

Fig.1. Learn basic coding skill, sequencing, loops, and debugging with Lego.com

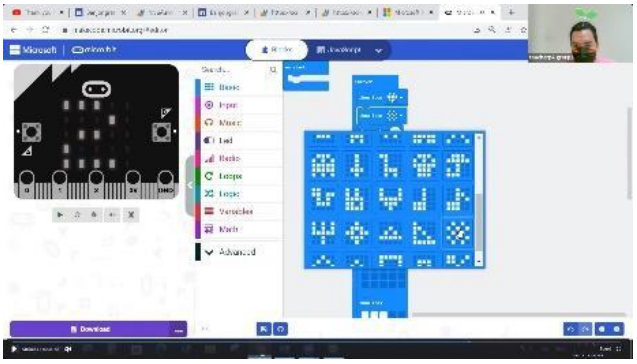

Fig.2. With LED light display Micro: bit board, student can program and physically interact with.

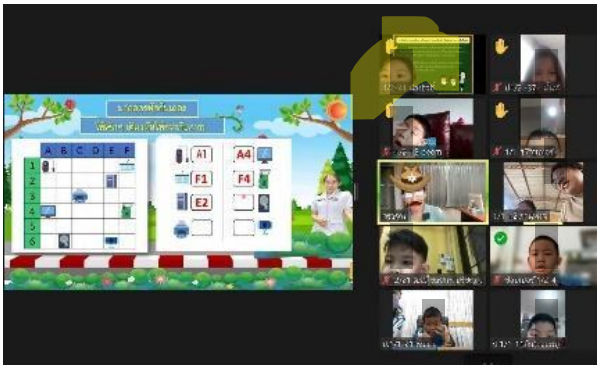

Fig.3. Online "Kids Can Code" activities for K1-3, matching the symbol with the right number

Fig.4. Hour of Code Activities from Code.org, learn the basic coding with drag and drop programming in a game-like tutorial. Students who complete all the levels will get e-certificate.

Examples of computational science learning activities in an offline system in a Thai School.

Fig.5. Unplugged lesson, where students break into groups to translate instructions into the symbols provided to accomplish specific tasks.

Fig.6. Students will program their classmates to step carefully from place to place until a goal is achieved. If problems arise in the program, students also need to work together to recognize bugs and build solutions.

VIII. Conclusion and Discussion

The analysis results for knowledge management among primary school teachers in Thailand found that 1) the average of what was expected to perform was higher than what was happening in actual practices. The average of the expectations and practices were the highest in item 11 which states "I am fully dedicated to improve my teaching and learning management" with the value of mean =4.59, SD=0.57 and mean =4.48, SD=0.62 respectively. On the other hand, for the least desired practices and actual practices, item 7 stated that "I develop my teaching by doing my own research." with the value of mean =4.06, SD=0.79 and mean =3.80, SD=0.88 respectively which corresponds to [3].

In addition, 2) Activities for computational science learning for primary school students can be organized in both online and offline platforms including blended learning by focusing on proactive learning approaches [7]. Creating entertaining activities for students to have opportunities to practice and experience in various environments can make their learning memorable. However, these practices are not common in some schools, hence, education policy makers need to develop proper innovation policies, better identify key agents of change and promote them and find more effective approaches to scaling and disseminating innovation [6] and [8].

Acknowledgment

Our thanks to the president of Bansomdejchaopraya Rajabhat University and teachers in Thailand.

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