Needs Assessment for the 21st Century Teaching and Learning in STEM Education to Promote Students’ Problem Solving in Thailand

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Abstract. The purposes of this study were 1) to investigate the current issues and the needs for the 21st century teaching and learning management in science and technology based on STEM education to solve issues in schools under the Office of Khon Kaen Primary Education Area 4, 2) to study the human resource development methods to enhance technology knowledge and skills to apply in solving science learning issues in schools by adopting STEM education approach, and 3) to propose the guidelines to support information technology and educational management based on STEM education. The population used in this study was a total of 2,185 teachers and staff in educational institutes under the Office of Khon Kaen Primary Education Area 4 in the academic year 2018. The 445 samples were selected by using cluster purposive sampling technique. The research tools used in this study were semi-structured questionnaire with 5-Likert scale questions divided into 2 parts: general information of respondents in the first part and open-ended questions in the second part asking the respondents’ suggestions on future development of educational management. Data were analyzed by using descriptive statistics, percentage, mean, and standard deviation. The interpretation was also used in the content analysis. The findings in the study are as follows: 1) Behavioral abilities related to the technology adoption to solve science learning management issues were found in 5 aspects, including seeking, using, collecting, selecting, and writing information skills. From the overall behavioral assessment, the level of knowledge in technology and technology skills for communication was found at a high level \( \bar{X} = 4.52, \ S.D. = 0.66 \). (2) The human resources development methods to enhance and apply technology knowledge and skills in solving science learning issues in schools were effectively implemented by adopting STEM education approach. The technology used in science learning issues should be verifiable, adaptable, and up-to-date. 3) The guidelines developed the teachers’ and staff’s knowledge and skills of information technology, which in turn, supported educational management based on STEM education effectively in practice.

1. Introduction

The 20-year national strategy B.E. 2060 – 2579 (A.D. 2017 - 2036) has emerged in the relation to the 12th National Development Plan aiming to solve the country’s sluggish development. The several plans and strategies for the future of the nation are directly manipulated by the government as well as the budget allocation is strategically arranged in proportion under the vision: [1] “the country will become a developed country with prosperity and sustainability under the philosophy of sufficiency economy to bring happiness to Thai people.”

The schools under the Office of Khon Kaen Primary Education Area 4 are regarded as qualified educational institutes providing basic education in accordance with the nation’s educational standards. Schools pursue strong administration and management of education, abiding the principles of good governance and philosophy. The professional development of teachers are constantly highlighted to
sustain professional standards, ethics, and skills, especially in effectively adopting technology. In general, students in the educational service area are provided with basic education equally.

Although the use of science and technology in solving learning issues is prevalent, teachers and staff have limited skills in seeking information to design science teaching media for students. Moreover, the educational personnel’s skills in collecting, selecting, using, and writing information need to be developed due to the rising demand for information technology adoption in students’ science learning. In addition, teachers and staff were found with poor ability to write newsletters on website for communication purposes. Teaching is mainly based on theoretical method, instead of activity-based teaching approach. This results in the students’ lack of interest and motivation to learn. Students have different levels of learning abilities, consequently, they perceive and interpret the knowledge differently [3].

Thus, the objectives in this study aim to understand the current issues and needs for using technology in science education based on STEM education in schools under the Office of Primary Education Area Khon Kaen Area 4 to develop students’ learning skills with the 21st century requirements. The STEM education is further implemented to enhance knowledge and skills of educational human resources to adopt technology in solving students’ learning problems effectively.

2. Objectives

To investigate the current issues and the needs for the 21st century teaching and learning management in science and technology based on STEM education to solve issues in schools under the Office of Khon Kaen Primary Education Area 4,

To study the human resource development methods to enhance technology knowledge and skills to apply in solving science learning issues in schools by adopting STEM education approach, and

To propose the guidelines to support information technology, leading to the effectiveness of educational management based on STEM education.

3. Population and samples

The population used in this study was a total of 2,185 teachers and staff in educational institutes under the Office of Khon Kaen Primary Education Area 4 in the academic year 2018.

The 445 samples were teachers and staff in educational institutes under the Office of Khon Kaen Primary Education Area 4 in the academic year 2018. The samples were selected by using cluster purposing sampling technique [2].

4. Research tools

The research tools used in this study are list below.

4.1 Semi-structured questionnaire consisted of questions asking about 1) knowledge of science and technology, 2) techniques of presenting information and activities, 3) channels and methods of publishing online information, 4) science and technology skills for communication purposes on websites, and 5) technology skills for distance learning information technology (DLIT). The questions were designed with 5-Likert scales, ranging from 5 as highly effective performance, 4 as effective performance, 3 as moderate performance, 2 limited performance, and 1 very limited performance. The final part of the questionnaire was the open-ended questions asking the respondents’ suggestions on future development of educational management. The research tools were tested with the reliability of 0.87.
5. Data collection

The triangulation approach, survey, and feedbacks of the samples divided into groups of educational institutes were used to collect data from various resources. The respondents were those who had experience working in schools, attending the operational management meetings, brainstorming in discussion and sharing ideas for educational management.

6. Data analysis

Data were analyzed by using descriptive statistics, percentage, mean, and standard deviation. The interpretation was also used in the content analysis.

7. Results

7.1 the current issues and the needs for the 21st century teaching and learning management in science and technology based on STEM education to solve issues in schools under the Office of Khon Kaen Primary Education Area 4

The assessment of the use of technology to solve issues in teaching and learning science based on STEM education in school and the effectiveness of technology adoption are described below.

1. The findings showed the behavioral abilities related to the technology adoption to solve science learning management issues including seeking, using, collecting, selecting, and writing information skills. The overall assessment of teachers’ and staff’s abilities in 5 aspects was found at a high level (\(\overline{X} = 4.52, \text{ S.D.} = 0.66\)); consisting of knowledge of science and technology, science and technology skills for communication purposes on website, technology skills for distance learning information technology (DLIT), techniques of presenting information and activities, and channels and methods of publishing online information. Among the 5 aspects of teachers’ and staff’s abilities in adopting technology to solve issues in teaching and learning science, the first three aspects with highest level are presented as follows:

1) The science and technology skills for communication purposes on website was found at the highest level (\(\overline{X} = 4.67, \text{ S.D.} = 0.63\)). The use of communication technology on website for seeking information among relevant agencies and the use of communication technology on website for operating information were significantly implemented.

2) The techniques of presenting information and activities was found at high level (\(\overline{X} = 4.58, \text{ S.D.} = 0.67\)). The techniques of writing contents, newsletters with headlines, introduction, and content bodies with detailed description were clearly presented.

3) The technology skills for distance learning information technology (DLIT) was found at high level (\(\overline{X} = 4.54, \text{ S.D.} = 0.72\)). The evidence showed the presentation of activities on the website, presentation of information on educational management, and news for public relations in social media. Moreover, the knowledge of science and technology was found at a high level (\(\overline{X} = 4.45, \text{ S.D.} = 0.67\)). The channels and methods of publishing online information was also found at a high level (\(\overline{X} = 4.35, \text{ S.D.} = 0.74\)), respectively.
7.2 Guidelines for the human resource development methods to enhance and apply technology knowledge and skills in solving science learning issues in schools based on STEM education approach

1. Readiness at all time (Timeliness): the information must be available and accessible at all time; whenever and wherever.
2. Accuracy: the information must be correct, precise to the reality, and up-to-date.
3. Speediness: the information must be convenient and timely to transfer.
4. Completeness: the information must be complete and most currently updated.
5. Relevance: the information must be relevant to the users’ need as much as possible.
6. Verifiability: the information must be certified to ensure its accuracy and reliability.
7. Adaptability: the information must be adaptable to be up-to-date.

8. Discussion

The guidelines to promote science education based on STEM education in relation to information technology are effective in all aspects including behavior, skills, and practices of technology adoption in solving learning management issues. Teachers and staff were able to seek, collect, use, select, and write information effectively. They also had strong technology knowledge and skills to publish information online and use of web-based communication technology to acquire information among agencies. Moreover, they had skills in presenting information, activities and image and writing information e.g. contents, news, and articles that were accurate, fast, convenient to access, and beneficial for the users, which in turn, develop the effectiveness of science education management.

References

[1] Chester I B 1968 The Function of Executive (Cambridge, Harvard University Press)
[2] Lee J C 1977 Educational psychology (New York: Harcourt Brace Jevanoich. Inc)
[3] Phillip B and Susan G 1992 Electronic Book for Early Learners Educational and Training Technology International pp 281–290