International Journal of STEM Education for Sustainibility, Vol.4, No.2, 2024, pp. 229-237
e-ISSN 2798-5091. DOI. 10.52889/ijses.v4i2.386

Development of STEM Learning Activities on the Water Cycle to Enhance the Achievement of Grade 5 Students

Submitted 4 March 2024 Revised 8 April 2024 Accepted 22 April 2024

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Abstract

This research aimed to 1) Develop STEM learning activities for Grade 5 students on the water cycle to be effective according to the 70/70 criteria. 2) Compare achievement before and after studying. After using STEM education activities About the water cycle. 3) Study student satisfaction with science learning activities. The sample for this research was 21 students in Grade 5 at a School at Chaturaphak Phiman District, Roi Et Province, Thailand obtained from random sampling, using the school as the random unit. The tools used include 1) 3 Lesson plans 2) an Achievement test for science subjects, Grade 5, Unit 4 The Water Cycle was a multiple choice test with 4 options, 30 questions. 3) an Assessment of student satisfaction with learning activities using STEM education using the evaluation scale has 5 levels and 12 items. Statistics used in data analysis include percentages, averages, and standard deviations and statistics test the value of t. The results of the research found that STEM learning activities on the water cycle to enhance the achievement of Grade 5 students were highly effective at criteria of 86/76.5. The academic achievement of Grade 5 students after studying was higher than before studying at a statistical significance at the .05 level and student satisfaction with organizing STEM learning activities on The Water Cycle to enhance the achievement of Grade 5 was at the highest level.

Keywords: STEM learning management, Academic achievement, Water cycle

INTRODUCTION

Science plays an extremely important role in today's and future world society because science is relevant to everyone in daily life and in various careers as well as technology tools and various products that humans have used to facilitate life and work. All of these are the result of scientific knowledge combined with creativity and other sciences. Science has helped humans develop ways of thinking. Both ideas are reasonable, think creatively, think analytically, be critical, have important skills in researching and acquiring knowledge, use knowledge and skills to solve problems or develop work through the engineering design process, having the ability to solve problems systematically. Including being able to search for data or information, evaluate information, and apply computational thinking skills and knowledge in computer science, digital media, information, and communications technology to creatively solve real-life problems. can decide Using a variety of information and verifiable testimony. Science is the culture of the modern world, which is a learning society (knowledge-based society). Therefore, everyone needs to develop to know science to have knowledge and understanding of nature and technology created by humans and be able to apply knowledge with reason, creativity, and morality by the Basic Education Core Curriculum, B.E. 2008 Singsuria et al. (2014). The Science subject group aims for students to learn science that emphasizes linking knowledge with processes and have important skills in researching and creating knowledge using a variety of processes for searching for knowledge and solving

problems and Involve students in every step of learning, there are hands-on activities (Ababa, 2017)

From the teaching of the researcher, it was seen that there were problems in learning science subjects that students regularly encountered. The students have no scientific skills and often forget the scientific skills they have learned, causing teaching to be inconsistent. It affects learning in other subjects and causes the academic achievement of students to be low. From the academic achievements, the average score has not yet passed the criteria. This is because the learning arrangements are not appropriate for the development of students. Therefore, teachers organize STEM activities to efficiently develop students to their highest potential. therefore Teachers play an important role in the implementation of STEM (McDonald, 2016). In science learning, STEM is an alternative learning model that can build a capable and skilled 21st-century generation (Permanasari, 2016) and also meet the challenges of Industry 4.0. In addition, teachers can use STEM education as a learning strategy, lear learning method, assessment, learning media, teaching materials, and textbooks (Farwati et al., 2021) ning approach,

Teaching according to STEM education is a holistic integration by integrating science, technology, engineering, and mathematics to have a unified relationship in teaching by adding the liberal arts. It will help to learn science to connect knowledge and understand the content (Yakman, 2008) to be able to develop creativity and train students to use reason to connect the relationship between the liberal arts (emphasizing creative thinking) and science (emphasizing academic thinking). This results in students being more durable in learning science. It encourages students to have freedom in their work because each student agrees to have different aptitudes and abilities. Therefore, it allows students to exchange knowledge and experiences together to gain knowledge understanding, and unity in work (Kim, 2018).

In developing science activities linking knowledge content suitable for solving problems in daily life and creating a good attitude towards learning science, there are many different learning management methods. STEM Education is an approach to learning that integrates science, technology, engineering, and mathematics. Organizing learning according to the STEM education approach must include integrating the desired behaviors or expected to happen to students with the content learned by these behaviors, including stimulating the interest in searching for knowledge, exploring and examining thinking logically, as well as skills of learning or working collaboratively. This is to focus on being able to apply knowledge, skills, and experiences from learning to use in solving problems in real life (Hilton & Pellegrino,

2012). and helps inspire students to learn science in a meaningful way and develop skills in the 21st century, which are necessary for livelihood and innovation development to create careers for youth in the future (Lekatarakorn & Sittisomboon 2020).

From studying related research with learning management according to STEM education guidelines, students who received learning according to the STEM approach had better academic achievement, problem-solving skills, and attitudes toward learning. The researcher therefore saw that with the integration of STEM education through learning in science subjects, students would be able to develop scientific process skills which could lead to creating innovations that make students enjoy and not be bored with studying. The study, the research results of Chuachan & Puangpronpitag (2018) who conducted a study on academic achievement of learning science about substances and their properties of Grade 4 students using management methods according to the concept of STEM Education. The results of the research found that Grade 4students who studied with a learning management method based on STEM concepts had academic achievement in knowledge and understanding scientific process skills significantly higher than before at. 05level and scientific attitude after organizing learning according to the STEM concept was at a very good level. Ranmeechai et al. (2017) conducted a study on comparison of the results of organizing learning activities in the form of STEM education on the subject of electrochemistry for Grade 5students. The results of the research found that students who received STEM instruction had higher academic achievement scores, higher than students receiving normal teaching statistically significant at the . 05level. In addition, the research results of Saengpromsri et al. (2015) who studied the comparison of academic achievement, skills, and integrated science processes and attitudes towards studying chemistry of Grade 5students who received STEM learning management versus the normal learning method. The results of the research found that students who received STEM learning management had academic achievement integrated with science process skills and intentions. The attitude towards studying chemistry was higher than the group of students who received normal learning arrangements statistically significant at a . 01level.

For the above reasons, the researcher was therefore interested in developing STEM learning activities on the water cycle for Grade 5 students using STEM education principles at at a School at Chaturaphak Phiman District, Roi Et Province, Thailand. So, the students could have academic achievement and be able to use STEM activities to develop themselves and apply in daily life with higher level studies.

Based on the background the study aims to find the efficiency of the STEM education activity plan for Grade 5 students on The Water Cycle to be effective according to the 70/70

criteria. Furthermore, to compare achievement before and after learning by using activities organized according to the concept of STEM education of Grade 5students on the topic of The Water Cycle. Additionally to find the satisfaction of Grade 5 who received STEM learning Overall it is at the highest level.

METHOD

Target Group

The populations were Grade 5 students from a network of 4 schools, 2nd semester of the academic year 2022. The sample group was 1 class of Grade 5 students, semester 2, academic year 2022, totaling 21 people, randomly selected in groups, using school as the unit for randomization. The result was at a School at Chaturaphak Phiman District, Roi Et Province, Thailand. Time spent on research, 2nd semester, academic year 2023 Content of the Science Learning Group 3.2 Grade 5/5 Learning Unit 1: Water Cycle The results of the data analysis of the research as can be seen in Table 1 and Table 2.

Table 1. Development of STEM learning activities on The Water Cycle for Grade 5students to be effective according to the 70/70criteria.

Efficiency	Student No.	Full score	X	S.D.	Percentage
Process efficiency (E1)	21	150	129	1.73	86
Outcome efficiency (E2)	21	30	22.95	3.49	76.5

Note: STEM education activity plan with efficiency according to criteria (E/1E (2equal to 5.76/86)

From Table 1, it was found that the efficiency of the STEM education activity plan for Grade 5 students had process efficiency (E(1, mean value of 129, standard deviation of 73.1, and 86percent efficiency in results (E(2, mean value of 95.22, standard deviation of 49.3and 5 .7 6 percent. It could be concluded that the STEM education activity plan was effective according to the 70/70 criteria.

Table 2 Results of the analysis of academic achievement of Grade 5students using learning management according to STEM concepts, before and after class

Student no.	N	Full Score	X	S.D.	t	df	Sig.
Before learning	21	30	14.76	1.73	8.508*	20	0.001
After learning	21	30	22.95	3.46			
			Total average				

*Statistically significant at . 05 level

From Table 2, it was found that the academic achievement of Grade 5 students using STEM learning management was higher than before learning, statistically significant at a . 05 level.

RESULTS AND DISCUSSION

Data analysis in this research, The researchers divided the data analysis into 3 types including, STEM learning management for Grade 5 students on the water cycle had an efficiency of 5.76/3.87, which was higher than the set criteria of .70/70. Additionally, the academic achievement of Grade 5 students who received STEM learning about the water cycle was significantly higher after learning than before learning at the . 05level, which was in line with the set assumptions. Furthermore, the Satisfaction of Grade 5 students who received STEM learning Overall, it is at the highest level.

Analysis of the efficiency of the STEM education activity plan for Grade 5 students on the water cycle, was effective according to the criteria of 70/70, which meant that the students received the average score from the analysis of the learning management for the science subject group, Grade 5, Semester 2, Academic Year 2023. Regarding scores during learning and after learning, it was found that the efficiency of the STEM education activity plan of Grade 5 students was effective in terms of process (E(1, the mean was equivalent to 129 deviations. The standard was 73.1 and 86 percent. The efficiency of results (E (2had a mean value of 95.22, a standard deviation of 49.3 and 5.76 percent. It could be concluded that the STEM education activity plan was effective according to the 70/70 criteria set. This might be because the researcher proceeded with teaching according to the learning management plan created by the researcher to strengthen the skills of students at Grade 5 of at a School at Chaturaphak Phiman District, Roi Et Province, Thailand. Data were collected from observation and testing, using tools to collect data, such as water filter and a post-learning academic achievement test. This might be because the researcher asked questions stimulating students' thinking. It was a link between previous knowledge and new things to be learned, consistent with the research of Spruel (2020) who conducted research on the results of learning management according to the concept of STEM Education on academic achievement in biology. Ability to solve problems and satisfaction with the learning arrangement of Grade 5 students who found that learning management according to the concept of STEM Education affected achievement in biology learning. Students had higher academic achievement in science and problem-solving ability after learning than before learning, statistically significant at . 01 level.

Results of analysis of the academic achievement of Grade 5students using learning management according to STEM concepts, before and after class, it was found that the

academic achievement of students by using learning management according to STEM education concepts, before learning, the mean was 76.14 and the standard deviation was .73.1Academic achievement after learning had a mean of 95.22and a standard deviation of .46.3It could be concluded that the student academic achievement after learning was higher than before learning, with statistical significance at a . 05level. This might be because students had higher abilities in activities. Learning management according to STEM education guidelines, it is a learning arrangement that brings together science, technology, and engineering. and mathematics integrated perfectly to enable students to use knowledge in solving problems or situations that are connected to daily life, and quest for research. Create knowledge, communicate, promote creativity, and develop various works to be better. Learners can work together as a team as well as use technology to acquire knowledge to develop their learning. It showed that organizing learning according to STEM education could develop students' creativity to a higher level. This was in line with Kitikanan & Supantana (2018) who studied the learning achievement in science subject on substances in the daily life of students in Grade (1 6Achievement in science subject: Substances in the daily life of Grade 6students receiving learning according to STEM education guidelines was at a good level or better for not less than 80percent of all students; an (2academic achievement in Science subject: Substances in the daily life of Grade 6 students after learning management according to STEM education guidelines, was higher than before learning with statistical significance at . 05level. It was found that 96.80percent of students had scores that passed the criteria at a better level.

Satisfaction of Grade 5 students who received learning according to STEM concepts Overall, it was at the highest level with a mean of 4.56 and a standard deviation of 0.096. It was found that item 12. Teachers used many teaching methods such as (group work, projects, pairing, etc.) with a mean of 4.81 and Standard deviation of 0.51, followed by item 7. Teachers give students opportunities to ask questions, with a mean of 4.67 and standard deviation of 0.66, and the least is item 4. Students know the learning objectives clearly, with a mean of 4.43. and a standard deviation of 0.67. This is because the researcher created a learning management plan based on principles and guidelines for creating learning management plans. There is a process for finding quality. The learning management plan has been checked by experts for accuracy and completeness. Provide an environment that is conducive to learning, including classroom conditions and media equipment, and organize learning activities according to the concept of STEM education. as a tool In learning, students have to practice each step, resulting in learning. Understanding arises because of teaching and learning that gives students more opportunities to participate in learning activities. Students get to practice the activities on their own. Study

and research by yourself. In addition, students have learning behaviors that It is different from traditional learning in that they are interested in situations and problems and are eager to study to find answers for themselves. There is a challenging atmosphere for learning. It makes students strive to find answers and take responsibility for their learning, having fun and being satisfied with doing various activities, which is by the concept Navikarn (2002)has stated that the theory of satisfaction that there are 2 types of concepts In performing work, administrators or teachers must consider organizing teaching and learning activities that will make learners or workers satisfied, that is, satisfaction leads to work performance. Responding to the needs of workers until they are satisfied will create higher motivation to increase their work efficiency than those who are not satisfied. The results of job performance lead to satisfaction. Good work results will Lead to appropriate returns which will eventually lead to a satisfying response. Performance will be responded to in the form of rewards or rewards. This is consistent with Maslow's theory Rouse (2004) who proposed the theory of needs in order by saying that humans have endless needs all the time. human needs will have characteristics in order from lowest to lowest Going for heights is according to Thorndike's idea who said that learners will learn well if the learning results make the learners satisfied because the learners respond to what they are satisfied with (Islam, 2015).

CONCLUSION

Analysis of the efficiency of the STEM education activity plan for Grade 5 students on the water cycle, was effective according to the criteria of 70/70, which meant that the students received the average score from the analysis of the learning management for the science subject group, Grade 5, Semester 2, Academic Year 2023.

Results of analysis of the academic achievement of Grade 5 students using learning management according to STEM concepts, before and after class, it was found that the academic achievement of students by using learning management according to STEM education concepts, before learning, the mean was 76.14 and the standard deviation was .73.1Academic achievement after learning had a mean of 95.22and a standard deviation of .46.3It could be concluded that the student academic achievement after learning was higher than before learning, with statistical significance at a . 05level.

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and the least is item 4. Students know the learning objectives clearly, with a mean of 4.43. and a standard deviation of 0.67.

SUGGESTIONS

From the results of this research, the researcher had suggestions to benefit learning management and future research are to organize STEM learning activities, the researcher found that Learning Plan 1: Students still did not perform learning activities as they should. This was because students still didn't quite understand the learning process. Therefore, the steps for doing activities were explained so that students could understand and adjust to become more familiar with and carry out learning activities better. Additionally, the STEM learning management activities should be organized appropriately and follow the problem situation and could be applied in everyday life. Furthermore, to organize STEM learning more effectively, teachers must plan to organize classroom conditions following learning and should have additional worksheets and documents for students to have more practice. Moreover, there should be research on organizing learning according to STEM education guidelines with other contents or other grade levels to see the difference or change.

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