Learning innovations in science and technology subjects by organizing learning in a cycle of inquiry with using games high school Chonburi province

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Abstract

In this class, the purpose of action research is to: 1. develop learning innovations in science and technology subjects. By combining the use of games with the cycle of inquiry (5 E) to organize learning 2. To compare academic achievement before and after studying using the learning arrangement using the cycle of inquiry (5 E). together with using games 3. To investigate students' satisfaction with the inquiry-based learning cycle (5E) combined with games. This is quantitative research. Target groups used in research: I am a fifth-grade student. Wat Thung Hiang School, Chonburi Province, Semester 1, academic year 2023, 1 classroom, 30 people, which are obtained through purposive sampling The research tools included: 1. an assessment form for consistency in the development of learning innovations in science and technology subjects. 2. Pre-study and post-study tests 3. A satisfaction assessment form. Statistics used in data analysis include percentage, mean, and standard deviation.

The research results found that organizing learning using the cycle of inquiry (5E) with the use of games. Grade 5 developed the water cycle with an efficiency of 84.29/85.57 results from using innovations. Academic achievement of students who study with the inquiry-based learning management model (5E) combined with games. The academic performance after studying was higher than before studying at 12.14 points, with a standard deviation of 0.28, indicating that students were more interested in learning. Able to use knowledge gained from study in gaming activities. Make the students answer the questions correctly. and had increased academic achievement in science subjects.

Keywords: learning innovation; Science and technology; cyclical learning management; knowledge inquiry

Origin and significance of the issue

The 2008 Basic Education Core Curriculum establishes clear learning standards and indicators as goals for developing students to achieve the specified results. Each year, the compulsory education level (Primary 1–Secondary 3) will set year indicators as goals for developing students. When learners pass the indicators, it will result in improved academic achievement. Academic achievement is a characteristic that is assessed in terms of knowledge. The ability of a person to change behavior in various aspects is derived from gaining experience as a result of learning. Furthermore, using media to support lessons is beneficial to learning. It helps students understand the relationships between the topics they study and promotes meaningful learning (Kanyanee Bainiam and Mayuso Guno 2015).

The results of a survey of classroom problems among secondary school students in five schools at Thung Hiang Temple found that students had many problems. However, the most important problem and impact on teaching and learning is that 20 students have low academic achievement, accounting for 76.92 percent of the total number of students. This is the number with the most problems to be resolved. The problem lies in the fact that students with problems are not yet ready to learn. I didn't study hard, didn't submit a lot of assigned work, and got low scores on exams. In terms of teaching media and formats, they are unable to attract students' attention to the learning process. Including content is quite challenging. Students want to learn with new technology and media, and I prefer to do activities rather than study ordinary content. They like to do activities more to have fun and be able to insert knowledge into the activities. This problem, if not resolved, will result in lower academic achievement in science.

A research study related to the development of learning innovations in science subjects. As a result, the researcher studied the knowledge inquiry cycle (5E) in conjunction with the use of games. It is a learning process that allows learners to create new knowledge for themselves through thought and practice. use the scientific process as a tool, and insert games into learning management to have fun. Learners are curious and determined to learn. Phongsri Kongsing's (2008) research will increase academic achievement in science subjects. As a result, the researcher developed a learning innovation in the subject of science and technology. By organizing learning in a cycle of inquiry (5 E) together with the use of games, To improve low academic achievement If this problem is not resolved, it will have an impact on teachers. Students with problems other students in the classroom had lower academic achievement at school, but when corrections were made Students who have problems will have more knowledge and understanding. A learning process occurs. Teachers receive guidelines for solving problems. Academic achievement in science subjects has increased. Including raising the school's academic achievement level.

Objectives

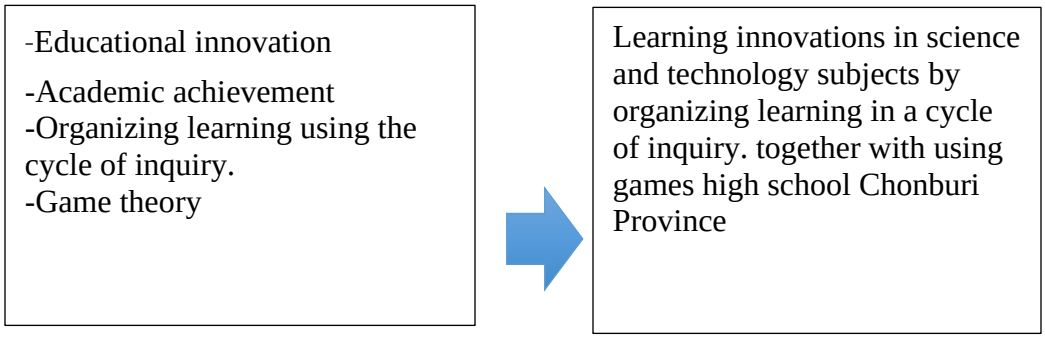
1. To create learning innovations in science and technology fields. By organizing learning in a cycle of inquiry (5 E) together with the use of games.
2. To compare academic achievement before and after learning by using the learning cycle of inquiry (5E) together with the use of games.
3. To investigate student satisfaction with the inquiry-based learning cycle (5E) combined with games.

Literature review

Developing learning innovations in science and technology subjects by organizing knowledge inquiry cycle learning (5E) together with the use of games. Wat Thung Hiang School, Chonburi Province In the content of the water cycle of 5th-grade students, the researcher has studied documents and related research, which has the following details:

1. Concepts and theories regarding educational innovation
2. Concepts and theories about academic achievement
3. Concepts and theories for learning management using the inquiry cycle (5E)
4. Concepts and theories about games

Conceptual framework



Methods

This research is quantitative (Mixed Methods) with research methods as follows:

Population and sample groups: In the research include: The target group for this research used the same population and sample group, namely administrators and 30 fifth-grade students at Wat Thung Hiang School, which were obtained through purposive sampling.

Research tools:1. Evaluation form for compliance with the development of learning innovations in science and technology subjects. 2. Pre-study - after - study test. 3. Satisfaction assessment form

Data collection. From the analysis of classroom problems of Grade 5 students in the science subject. Wat Thung Hiang School Chonburi Province The researcher, therefore, studied Learning innovations in science and technology subjects to solve the problem By collecting data from the specified sources and tools as follows:

1. From a research article research report That is consistent with the problem of developing learning innovations in science and technology subjects. There are the following steps.

1.1 Search for research articles and research reports related to the development of learning innovations in science and technology subjects. From various research databases

1.2 Select relevant research that is consistent with the development of learning innovations in science and technology subjects. Consider the grade level that is the same or close to it. Grade 5

1.3 Study the research selected by studying all 5 chapters of the research. Starting with Chapter 1 studying the objectives of the research, and Chapter 2 studying documents. Relevant principles: Chapter 3 studies operational methods, Chapter 4 studies data analysis, and Chapter 5 studies summarizing and discussing results.

1.4 Record the information in the research report form. Research articles that are consistent with the development of learning innovations in science and technology subjects.

2. From books, textbooks, and documents related to the development of learning innovations in science and technology subjects.

2.1 Search for books, textbooks, and documents related to the development of learning innovations in science and technology subjects.

2.2 Study information on the development of learning innovations in science and technology subjects.

2.3 Record information in records, books, textbooks, and related documents.

2.4 Analyze all data obtained from research reports, articles, books, textbooks, and related documents.

2.5 Specify innovations that will be used to solve problems in the development of learning innovations in science and technology subjects.

3. Innovation and Problem Consistency Assessment Form The method of operation is as follows:

3.1 Bring innovation to development So that the innovations used are consistent with the problem conditions. The steps are as follows: Step 1: Create interest Introduction to the lesson by stimulating students' interest by using pictures, videos, and asking questions about the water cycle, Grade 5. Step 2: Survey and Search Learners explore and search for knowledge by using technology. By scanning a QR code from a smartphone and recording the knowledge gained in a knowledge sheet on the water cycle, Grade 5. Step 3: Explain and conclude. The students explained their knowledge of the competitive game. Each team will use the knowledge they have found to play games to compete with each

other and summarize their knowledge while playing the game. Step 4: Expand knowledge Teachers provide new situations in which knowledge about the water cycle can be connected to real situations, and students can solve situations by doing work. Step 5: Evaluation: Knowledge assessment. whether students know the water cycle or not by using exercises and tests to measure learning achievement in the science subject about the water cycle

3.2 Find 3 experts with at least 3 years of experience teaching science subjects, administrators, and academic leaders.

3.3 Bring the created innovations to be used in solving problems. Developing learning innovations in science and technology subjects By organizing learning in a cycle of inquiry (5 E) together with the use of games about the water cycle for Grade 5 to be considered by experts by evaluating them according to the assessment form for the consistency of problem conditions with innovative solutions.

3.4 Take the data from the assessment form and analyze it to find the consistency value (IOC).

3.5. If there is a correction Carry out innovative solutions as advised by experts.

3.6. Using innovation to solve problems in the development of learning innovations in science and technology subjects. By organizing learning in a cycle of inquiry (5 E) together with the use of games on the water cycle, Grade 5, Wat Thung Hiang School. Chonburi Province By collecting data from the specified sources and tools as follows:

(1) Check the exercises that students complete and record their scores in the log.

(2) Gather scores during class for all 2 subjects. and recording scores during the study in a recording form

(3) Collect scores from pre-study and post-study tests. into the recording form

(4) Collect scores from satisfaction assessments.

Data analysis 1. Qualitative data analysis Changing the behavior of students in teaching and learning Students are better prepared to study and have better academic achievement.

Quantitative data analysis

1. Evaluating the consistency of the problem condition with Learning innovations in science and technology subjects By organizing learning in a cycle of inquiry. (5 E) in conjunction with the use of games Subject: Water Cycle, Grade 5, assessed and analyzed by experts to find a consistency value (IOC) of 0.5 or higher.

2. Number of points and percentage that students received from Do exercises during class and after class, averaging 80% or more, pass the criteria.

3. The number of points and percentage that students get from taking the achievement test with an average score of 80 percent or more passes the criteria.

4. Average of satisfied students

Results

Objective 1 : To develop learning innovations in science and technology subjects. By organizing learning in a cycle of inquiry (5 E) together with the use of games. The

results of the research found that innovation was developed by using learning management using the learning management model of the inquiry cycle (5 E) together with the use of games, as shown in diagram 2. It can be concluded that 1. Interest generation step 2. Survey and search step 3. Explanation and conclusion step 4. Knowledge expansion step and 5. Evaluation step. Results of checking the consistency of learning management using the cyclical learning management model. Inquiry (5 E's) combined with the use of games Results of inspection by experts assessing conformity (IOC) Developing learning innovations in science and technology subjects by learning through the cycle of inquiry. (5 E) together with using the game about the water cycle as shown in Table 3

Table 3 shows the results of the inspection by the Conformity Assessment Expert (IOC). Developing learning innovations in science and technology subjects by learning through the cycle of inquiry. (5 E) together with using the game about the water cycle

Teaching stage	Results of expert inspection			sum of points $\sum R$	$IOC = \frac{\sum R}{N}$	Results of consideration
	1st person	2nd person	3rd person			
1. Interestgeneration step (engagement)	+1	0	+1	2	0.67	available
2. Survey and search step (exploration)	+1	+1	+1	3	1	available
3. Explanation and conclusion (explanation)	0	+1	+1	2	0.67	available
4. Knowledge expansion step (elaboration)	+1	+1	+1	3	1	available
5.Evaluation stage (evaluation)	+1	+1	0	2	0.67	available
Average					0.67	available

Table 3 Results of inspection of consistency in the development of learning innovations in science and technology subjects. By organizing learning in a cycle of inquiry (5 E) together with the use of games. Wat Thung Hiang School Chonburi Province has the results of the inspection by the 3 experts had an average of 0.67 which can be considered and used.

Objective 2: To compare academic achievement before and after learning by using the inquiry-based learning cycle (5 E) together with the use of games. The research results

found that Scores from taking academic achievement tests in science subjects. of students in grade 5 Academic results after studying were higher than before studying, as shown in Table 6.

Table 6 Pre-test and post-test scores, average standard deviation, and development of students in Grade 5 at Wat Thung Hiang School Chonburi Province

data analysis	Full score 30 points				development	
	Score before studying	percentage	Score after studying	percentage	score	percentage
Total average	13.53	45.10	25.67	85.57	12.14	40.47
SD	1.51		1.23		0.28	

From Table 6, it can be concluded that Academic results in the science subject of students in Prathom 5 at Wat Thung Hiang School. Chonburi Province, total number of students is 26 people, using the inquiry-based learning management model. (5 E) in conjunction with the use of games. The pre-study mean was 13.53 points, 45.1 percent, standard deviation equal to 1.51 and the post-study mean was 25.67, 85.57 percent, with a standard deviation equal to 1.23, which shows that the Academic achievement of students who study with The learning management model is based on the inquiry cycle. (5 E) in conjunction with the use of games Academic performance after studying was 12.14 points higher than before studying, an increase equivalent to 40.47 percent, standard deviation of 0.28.

Objective 3: To study student satisfaction with the inquiry-based learning cycle (5 E) combined with games. The research results found that Student satisfaction with the inquiry-based learning cycle (5 E) combined with the use of games for students in Grade 5, Wat Thung Hiang School Chonburi Province, a total of 26 students were satisfied. is at the highest level, as shown in Table 7

Table 7 Student satisfaction with Learning management is based on the inquiry cycle (5 E's) combined with games. of students in Grade 5, Wat Thung Hiang School Chonburi Province

Comment element	Satisfaction		Interpret results
	$\bar{X}$	SD	
Content	4.67	0.04	the most
Instructional design	4.65	0.03	the most

Game side	4.56	0.03	the most
Benefits	4.69	0.04	the most
Total average	4.63	0.03	the most

From Table 7, it can be concluded that students' satisfaction with the inquiry-based learning cycle (5 E) combined with the use of games. of students in Grade 5, Wat Thung Hiang School Chonburi Province, the total number of students was 26. Content satisfaction had an average of 4. 67 in terms of instructional design. has an average of 4. 65, in the game aspect has an average of 4. 56, and in the benefits aspect The mean is 4.69, the total mean is 4.63, and the standard deviation is 0.03, which is at the highest level.

Developing and leading innovation by organizing learning using the inquiry cycle (5E) and games. To be used in teaching and learning with Grade 5 students in the 1st semester of the academic year 2023 for 2 weeks, totaling 6 lessons, resulting from the use of innovations. Students are interested in watching videos, looking at pictures, and being able to answer questions. Can explore and search for knowledge. Using technology and taking your own notes new knowledge arises. Students must apply the knowledge they seek. I used to play fun games. Score results from taking the academic achievement test in the science subject. of Grade 5 students, a total of 26 students, with an average score from the pre-test of 13.53 points, 45.10 percent, a standard deviation of 1.51, and an average score from the post-test of 25.67 percent. 85.57 standard deviation is 1.23, which shows that the academic achievement of students who study with the learning management model combines a cycle of inquiry (5E) with games. After studying, academic results are higher than before. There was an improvement of 12.14 points, 40.47 percent, and a standard deviation of 0.28, with a total of 26 students passing the specified evaluation criteria, accounting for 100 percent. Student satisfaction with the inquiry-based learning cycle (5 E) combined with the use of games by students in Grade 5 at Wat Thung Hiang School, Chonburi Province At the highest level, the total number of students was 26, with a mean of 4.63 and a standard deviation of 0.03.

Discussion

Results from the research following:

Objective 1 The results found that when innovations were taken to experts to evaluate the consistency of the innovations, The results of checking the consistency of learning management using the inquiry-based learning management model (5 E) together with the use of games are equal to 0.67. This is in line with the development of academic achievement in the science subject for Grade 5 students. This consideration can be used. This may be because learning management is based on the inquiry cycle (5E) combined with the use of games. It is an important focus for students. Train students to search for knowledge on their own. In the pursuit of knowledge, learners play the role of operators. To discover various knowledge messages to solve problems that arise. The teacher serves as a facilitator and assists the students. There are fun games and activities that make

students Want to play, study, and insert knowledge? The learner must know and then use that knowledge when playing the game. Competing with friends in class can make it easier for students to remember the things they study. This is consistent with the research of Phongsri Kongsing (2008: 156). When students learn in a fun way, it won't be boring and will have positive effects on them in every aspect. Students want to study, listen carefully, and do various activities. It can be made out. Well, this may be because the development of science games is used to enhance inquiry-based learning in science subjects. After studying, students have high academic achievement and average scores. Before studying, the score was higher than the average. And students' opinions on using science games to supplement overall learning were at the highest level of agreement.

Objective 2 The research results found that scores from taking academic achievement tests in science subjects. of Grade 5 students, a total of 26 students, had an average score from the pre-test of 13.53 points, 45.10 percent, a standard deviation of 1.51, and an average score from the post-test of 25.67 percent. 85.57 standard deviation is 1.23, which shows that the academic achievement of students who study with the learning management model combines a cycle of inquiry (5E) with games. After studying, academic results are higher than before. There was an improvement of 12.14 points, 40.47 percent, and a standard deviation of 0.28, with a total of 26 students passing the specified evaluation criteria, accounting for 100 percent, which is consistent with the research work of Wilai Wanna Jitsaweng (2009) found that the results of the study of learning achievement in science on the topic of the reproductive system of Mathayom Two students who used games to teach had a higher learning achievement score. The science subject after teaching was significantly higher than the science achievement score before teaching at the .01 level. The analysis of Mathayom 2 students' opinions towards learning science produced good results.

Objective 3 According to the research findings, 26 students in Grade 5 at Wat Thung Hiang School, Chonburi Province, were satisfied with the inquiry-based learning cycle (5 E) combined with the use of games. In terms of instructional design, content satisfaction had an average score of 4.67. has an average of 4.65; in the game aspect, it has an average of 4.56; and in the benefits aspect, The mean is 4.69, the total mean is 4.63, and the standard deviation is 0.03, which is at the highest level. This may be due to the learning management model combining the inquiry cycle (5E) with games. Learners are interested and able to analyze and answer questions. When students have doubts, they can plan to search for information, find answers, then analyze the knowledge gained from the search, discuss and summarize the results, and use the knowledge gained from their studies in gaming activities. Make the students answer the questions correctly. Have fun, and remember the information used in playing games. When given situations, learners can analyze and apply knowledge to solve problems and create beautiful pieces of work. The ability to perform exercises correctly Therefore, students are most satisfied. which corresponds to Research conducted by Rung Arun Kantuen (2010) found that the academic achievement of students who learned using science games About the relationship between

living things After studying, it was significantly higher than before studying at the.01 level. Students' attitudes after using science games. What about the relationship between living things? Students have an attitude at the level of 4.85, which is the highest average level of attitude. The attitude that students have the most is that students are happy with learning science. The side with the least attitude and the least not found.

Suggestions

From research and study of related information. The researcher has suggestions to make, as follows:

Suggestions for putting research results to good use

1.1 Results from research objective 1 revealed the development of learning innovations in science and technology subjects. By organizing learning in a cycle of inquiry (5 E) together with the use of games, It must be carried out by the lessons that can be turned into a game. Therefore, relevant agencies should take action. According to the steps, learning activities must be organized using media. The videos used must only be relevant to the content. There is a clear picture of movement. Questions must encourage students to think constantly. Teachers are the guides when students need help. Mainly focused on students.

1.2 Results from objective research 2 Compare academic achievement before and after studying. Tests must be taken and scores collected. many issues, and the results are summarized as an overall picture. To provide effective results to students and develop academic achievements in science and technology.

1.3 Results from the objective research Assess student satisfaction. To ensure that students are as satisfied as possible in order to have fun and be able to apply the knowledge gained, the games used must be competitive. Study it and use it for real. To expand knowledge, the scenarios used must be related to the content. and use questions to stimulate students. Including creating an environment in the classroom that is fun and not boring, so that students are always eager to learn.

Suggestions for future research

1. Research should be done using the model for developing learning innovations in science and technology subjects. By organizing learning in a cycle of inquiry (5 E) together with the use of games to develop academic achievement in science and other subjects.

2. Research should be done using the model for developing learning innovations in science and technology subjects. By organizing learning in a cycle of inquiry (5 E) together with the use of games, To develop academic achievement in science subjects to get better results, combine with other learning arrangements.

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