

The Development of Learning Management Activities Using the Inquiry-Based Learning (5E) To Develop Analytical Thinking Skills in the Course Science and Technology for Students in Grade 3

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Abstract: This research aims to (1) Develop learning management activities using the 5E inquiry-based learning model. science and technology course of students in grade 3. (2) Develop the analytical thinking of grade 3 students to pass the criteria of 70%. (3) To study the satisfaction of grade 3 students towards learning management using the 5E inquiry-based learning model. Thus, the researchers developed our solar system learning activities. of6- plans and developing analytical thinking skills of grade 3 students of 31 people. The results showed That (1) Learning management using the 5E quest model Amount of 6 plans and passed the evaluation of suitability efficiency by 3-experts. (2) The results of the development of analytical thinking of grade 3 students. It was found that after receiving the learning management, inquiry-based learning style 5E with an average of 7.25 representing 72.74 percent (3) Satisfaction of grade 3 students towards the learning management of the 5E inquiry-based learning model. with a high level of satisfaction.

Keyword: inquiry-based learning management, analytical thinking, development of science learning activities

Introduction

Key skills in the 21st century. It plays an important role in developing realities in preparing students for life in the 21st century. It is an important aspect of the social transformation trend in the 21st century. affecting the way of life of the society thoroughly. Therefore, teachers Are prepared to manage to learn to prepare students to have skills for life in the 21st century. The 21st-century skill is high-level analytical thinking ¹. The PISA exam is assessed. Emphasis is placed on assessing learners' competency in applying knowledge and skills in real life rather than learning from a school curriculum. PISA Exam Assessment ². Conducting a survey of 15-year-old students from around the world every three years. Which emphasizes the importance of the assessment in three main areas. is reading mathematics and science. In addition, in PISA 2018, there is another innovation assessment. is the competence of living in a global society (Global competence). PISA will assess the level of the essential knowledge and skills needed to live today, for social and economic participation. Thailand is one of the countries that have the PISA test to measure various skills. is. As of 2018, Thailand is at the PISA level out of 79 countries worldwide for critical thinking skills. Ranked 66 th the region is 20th, And the ASEAN level is ranked 4th. By science score, which emphasizes analytical thinking skills, is equal to 426 points.

¹ C. P. Ormell, "Bloom's Taxonomy and the Objectives of Education," *Educational Research* (1974).

² OECD, *PISA 2018 Assessment and Analytical Framework*, OECD Publishing, 2019.

Learning management that is appropriate to the school context. It is linked to being successful in developing a learner's skill competency. While observing students at a school in Kalanin Province. It was found that the 5E knowledge-seeking learning management. Used did not have a positive effect on analytical thinking. When the researcher took the analytical thinking test to test the students. It was -found that students did not pass the critical thinking criteria at 70 percent set. From further studies, it was found that. Allowing students to learn by themselves is important in developing critical thinking skills.

5E quest style learning. It is a learning management that focuses on students. and allows learners to choose what they want to learn on their own. Problems are set as the starting point for learning and as a stimulus for students to develop analytical thinking skills. Synthetic. solve problems. The learning management process consists of 5 steps. The researcher develops the ability of analytical thinking of the students before testing the target group. (Institute for the Promotion of Teaching Science and Technology) (EST.), 2006).

The research results reflect That. 5E quest-based learning management. able to develop analytical thinking skills. by critical thinking skills. Relationship. Principle.

Previous Research

Prasart Nuangchalerm ³ Cognitive Development, Analytical Thinking and Learning Satisfaction of Second Grade Students Learned through Inquiry-based Learning Science teaching needs to be able students having knowledge and understanding. Also, students have to develop their thinking skills, it should help students meet real science through inquiry-based pedagogical process. This study aims to (i) investigate effective teaching criterion through inquiry-based teaching at 80/80, (ii) find out effectiveness index of inquiry-based teaching, (iii) compare analytical thinking between before and after students had learned by inquiry-based learning activities, and (iv) study learning satisfaction of second grade students after they had learned through inquiry method. Participants of the study were 10 second grade students, sampled by purposive sampling technique. Research instruments comprised of 8-lesson plan, 20-item achievement test, 20-item analytical thinking test, and 15-item questionnaire on learning satisfaction. Data were gathered and analyzed by Wilcoxon Matched Pairs Singed–Ranks Test. Results revealed that inquiry-based learning activities had effective criterion at 84.46/82.50; effectiveness index of inquiry-based learning activities was 0.5200; post test score of achievement test higher than those pretest score at .05 statistical significance level; and students had learning satisfaction on inquiry-based learning activities at highest level. It can be concluded that inquiry-based learning activities promoted students in terms of both cognitive, analytical thinking, and learning satisfaction. It should be suggested in for pedagogical preparation and incorporate it into science curriculum.

Patamaporn Thaiposria, Panita Wannapiroonb ⁴ Enhancing students' critical thinking

³ Prasart Nuangchalerm and Benjaporn Thammaseana, "Cognitive Development, Analytical Thinking, and Learning Satisfaction of Second Grade Students Learned through Inquiry-Based Learning," *Asian Social Science* 5, no. 10 (2009), <http://dx.doi.org/10.5539/ass.v5n10p82>.

⁴ Patamaporn Thaiposri and Panita Wannapiroon, "Enhancing Students' Critical Thinking Skills through Teaching and Learning by Inquiry-Based Learning Activities Using Social Network and Cloud Computing," *Procedia-Social and Behavioral Sciences* 174 (2015): 2137–2144.

skills through teaching and learning by inquiry-based learning activities using social network and cloud computing. The purposes of this research study were: 1) to design inquiry-based learning activities to enhance students' critical thinking skills through teaching and learning using social network and cloud computing and 2) to evaluate these learning activities. The research methodology is divided into two steps. The first step involved designing the learning activities and the second step involved evaluation. The study sample was purposively selected and consisted of ten experts in higher education instructional design, inquiry-based learning activity design, social network, cloud computing and enhancing critical thinking skills. This sample either held a doctoral degree or at least three years of experience in relevant fields. This research describes the learning activities and assesses appropriateness using an evaluation form. Data were analyzed using the mean (\bar{x}) and standard deviation. The research findings were as follows: the learning activities consisted of three main steps: 1) pre-teaching and learning preparation, 2) enhancing students' critical thinking skills through teaching and learning by inquiry-based learning activities using social network and cloud computing and 3) measurement and evaluation. The sample judged the learning activities as highly appropriate and applicable to real practice.

Suryanti, I S Z Arifin, and U Baginda T.⁵ the application of inquiry learning to train critical thinking skills on light material of primary school students. Critical thinking skills are seen as important skills for survival and have become one of Indonesia's educational goals. The results of initial observation of critical thinking skills in Kemangsen 2 primary school involving students of grade V, revealed that 95% students possessed score 2 (with the scale, ranging from 1 to 4). Therefore, critical thinking skills of students need to be improved by applying hands-based learning of Hands-on Science; one of which is through inquiry learning. The purpose of this study is to determine the effectiveness of inquiry learning model in trained critical thinking skills of elementary students ($n=22$). This research was conducted by One Group Pretest-Posttest Design. Data were analyzed using t-dependent tests for overall critical thinking skills and descriptive analysis for critical thinking skills for each indicator. The critical thinking skills trained in this study include evaluation, explanation, interpretation, and inference based on the results of data analysis. To sum up, inquiry learning is classified as effective in terms of training students' critical thinking skills. The critical thinking skills of students should be continuously trained on appropriate materials or topics.

Bantalem Derseh Wale and Kassie Shifere Bishaw⁶. The aim of this study was to examine the effects of using inquiry-based learning on students' critical thinking skills. A quasi-experimental design which employed time series design with single group participants was used. A total of 20 EFL undergraduate students who took advanced writing skills course were selected using comprehensive sampling method. Tests, focus group discussion, and student-reflective journal were used to gather data on the students' critical thinking skills. The participants were given a series of three argumentative essay writing pretests both before and after the intervention, inquiry-based argumentative essay writing instruction. While the quantitative data were analyzed using One-Way Repeated Measures ANOVA, the qualitative data were analyzed through narration. The findings

⁵ I S Z Arifin and U Baginda, "The Application of Inquiry Learning to Train Critical Thinking Skills on Light Material of Primary School Students," in *Journal of Physics: Conference Series*, vol. 1108 (IOP Publishing, 2018), 12128.

⁶ Bantalem Derseh Wale and Kassie Shifere Bishaw, "Effects of Using Inquiry-Based Learning on EFL Students' Critical Thinking Skills," *Asian-Pacific Journal of Second and Foreign Language Education* 5 (2020): 1–14.

of the study revealed that using inquiry-based argumentative writing instruction enhances students' critical thinking skills. Therefore, inquiry-based instruction is suggested as a means to improve students' critical thinking skills because the method enhances students' interpretation, analysis, evaluation, inference, explanation, and self-regulation skills which are the core critical thinking skills

A S Ramadani , Z A I Supardi , Tukiran, E Hariyono ⁷. Profile of Analytical Thinking Skills Through Inquiry-Based Learning in Science Subjects The 2013 curriculum aims to form students who are ready to face the 21st century so that the 2013 curriculum is not only taught about aspects of knowledge but also aspects of skills. Thinking skills are the skills used in the 2013 curriculum, where one of the thinking skills students need is expertise in analytical thinking. These skills are necessary for science learning. Analytical thinking skills can be improved if the teacher trains them correctly, both from the learning model and learning strategies. This study examines learning models and learning tools that can improve analytical thinking skills. Learning based on inquiry learning is expected to improve students' analytical thinking skills. The findings of this study, it is known that inquiry-based models and tools can improve analytical thinking skills because they start from a problem. The problems given are then discussed with the group to find information that fits the situation and find ways to solve the problem nicely by conducting experiments or observations, then summing up the results obtained and communicating them well. Analytical thinking skills are closely related to problem-solving. So, with analytical thinking skills, students will quickly identify and solve a problem.

Method

Research Methodology

This research is a developmental research model. (Developmental Research) Type I ⁸. Which focuses on design and innovation development, divided into 2 phases. namely Development Process and Evaluation Process. This research is in phase 2. by developing 5E science learning activities. Show details as follows.

Phase 1 Development Process

1. Study the current learning management problems and the need for science learning activities.
1. Development of 5E knowledge-seeking learning management activities.
2. Design learning management activities in the form of 5E knowledge seeking. Use the information obtained from the study of the problem of analytical thinking in learning. Let's create and develop a learning management plan. And tools used to collect data after that were examined by 3 experts.
3. Experiment with the 5E Inquiry Learning Management Plan. with the experimental group, Secondary 3/4 students. Semester 1, Academic Year 2022, 28 students. Acquired by selecting a specific number of 6 plans. Take a critical thinking skill test.

⁷ Alifia Suryatin Ramadani, Zainul Arifin Imam Supardi, and Eko Hariyono, "Profile of Analytical Thinking Skills Through Inquiry-Based Learning in Science Subjects," *Studies in Learning and Teaching* 2, no. 3 (2021): 45–60.

⁸ Rita C Richey and James D Klein, *Design and Development Research: Methods, Strategies, and Issues* (Routledge, 2014).

Phase 2 Assessment Process

Organize 5E knowledge-seeking learning activities. 6- plans with students in grades 3/5. after using the analytical thinking skills test for Grade 3 students. with the sample group of students. Including having the students complete the satisfaction assessment questionnaire for learning management using the 5E knowledge search method.

Sample group

Phase 1 The research samples were divided into 2- groups: Group of 3 experts. Including 1- content expert. Teaching 1-person. 1-expert in organizing and evaluating. And the group of students, namely, grade 3/4 students in the academic year 2022, totaling 28 people. Choose a specific mode.

Phase 2 The sample group of 31 grade 3/5 students in the academic year 2022 was 31 people. Choose a specific mode. Because the sample group did not pass the analytical thinking skill experiment at the criterion of 70 percent.

Research tools

The tools used in this experiment were. 1. Knowledge acquisition learning management plan 5E About our solar system, 6- plans namely

- 1.) Gravitational force between the Sun and its satellites 2.) Phenomena caused by the movement of the earth around the sun. 3.) Phenomena caused by the interaction between the Sun earth and the moon 4.) Space technology and its uses. In the total time spent on learning management is 17 hours. with an average of 4.28. The suitability is at a very reasonable level. The standard deviation is 0.12. The consistency index is between 0.5-1.00.
- 2.) Analytical thinking skill test, multiple choice 4- options. A total of 30 items passed the IOC reconciliation index ⁹. The difficulty, discrimination, and confidence. The first aspect, the important aspect, amounting to 10 items. The second aspect of the relationship, the number 10 items. The 3rd aspect, the principles of 10 items.
- 3.) Satisfaction questionnaire, 10- items. 5-level estimation scale. Which has an average of 4.69. There is a standard deviation of 0.22. Have the highest level of satisfaction.

Data Collection

In this research, the researcher has tried and collected data. The procedure for collecting information is as follows:

1. Use the analytical thinking skill test. for Grade 3 students and the sample group of students.
2. Organize learning management activities with the sample group of students. using the 5E quest model. Steps according to the learning management plan 1-6. Complete all 6- plans in 17- hours. ready to collect scores after studying and analyzing the data.
3. Organize learning activities with the target group of students. Using the 5E quest model. According to the learning management plan 1-6, complete all 6-plans in 17 hours. Ready to collect points after studying and answer the satisfaction questionnaire.

⁹ Richard J Rovinelli and Ronald K Hambleton, "On the Use of Content Specialists in the Assessment of Criterion-Referenced Test Item Validity." (1976).

Data analysis

1. The appropriateness of the learning management plan was analyzed using the mean (\bar{x}). Then the obtained mean was interpreted with the following level of fitness ¹⁰

- 4.51-5.00 is most appropriate. 3.51-4.50 is very appropriate.
 2.51-3.50 moderately appropriate 1.51-2.50 is less suitable.
 1.00-1.50 is the least suitable.

2. Analyze the data from the analytical thinking skills test. obtained from the test at the end of the learning activity by finding the mean (\bar{x}). Standard Deviation (S.D.) and Percentage. Students with a critical thinking score of 70 percent pass the criteria. If the analytical thinking score is lower than 70 percent, the criteria are not passed.

3. Student satisfaction scores were analyzed by mean (\bar{x}) and standard deviation (S.D.). Then, the obtained averages were used to interpret the results of the satisfaction towards the 5E knowledge-seeking learning management. Therefore, the five satisfaction levels are (Likert, R. (1932).

- 4.50 or more means the most satisfied. 3.50 - 4.49 means very satisfied
 2.50 – 3.49 means moderate satisfaction. 1.50 – 2.49 means less satisfaction.
 Below 1.50 means least satisfaction.

Results and Discussion

The Development of 5E learning management activities. Science and technology course for students in grade 3.

Table 1 presents the 5E inquiry-based learning management process. the design of the school.

teaching process	meaning of each step	teaching method	Instructor role
Step 1 Engagement	The teacher arouses the interest of the students by using questions to enter the lesson.	Before entering the lesson, teachers are encouraged by asking the children.	The teacher acts as a coach and facilitator.
Step 2 Exploration	Teachers teach students to study the contents learned in grade 3 Science and Technology books, Volume 1, IPST, or other learning resources such as information on the Internet.	The teacher had each student study a basic science textbook.	The teacher acts as a coach and facilitator.
Step 3 Explanation	At this stage, the teacher explains from the textbook and gives the children a worksheet.	After the teacher has finished teaching, the teacher will ask the students and explain further. When the students understand the	The teacher acts as a coach and facilitator.

¹⁰ John K Hemphill and Charles M Westie, "The Measurement of Group Dimensions," *The Journal of Psychology* 29, no. 2 (1950): 325–342, <http://dx.doi.org/10.1080/00223980.1950.9916035>.

		lesson, the teacher will give them love to study and make worksheets.	
Step 4 Elaboration	Teachers let students' study on their own. at home more	The teacher gave questions and asked the students to study more at home.	The teacher acts as a coach and facilitator.
Step 5 Evaluation	The teacher evaluates the students' worksheets.	After the students have completed the work, the teacher will evaluate each child's worksheet.	The teacher acts as a coach and facilitator.

Table 2 presents the 5E inquiry-based learning management process. designed by experts.

teaching process	meaning of each step	teaching method	Instructor role
Step 1 Engagemen t	Teachers generate student interest by asking questions. to enter the lesson	The teacher will be introduced into the lesson and will encourage the students by using questions to test the children's knowledge before entering the lesson.	The teacher acts as a coach and facilitator.
Step 2 Exploration	The teacher teaches the students together to study the contents learned in the textbook. and ask questions when students are unsure or do not understand so that teachers can provide answers.	The teacher had each student study the information about... in the basic science textbook and divide into groups to complete the activity in equal groups of men and women.	The teacher acts as a coach and facilitator.
Step 3 Explanatio n	The teacher explains and promotes the concepts to the students. so that students can understand more	The students analysed the data from their group work and asked each group to design their own experimental conclusions. such as "My Map Summary" or "Summarize the Speech"	The teacher acts as a coach and co-learner.
Step 4 Elaboration	The instructor will have more teaching materials to	In which the teacher will have teaching	The teacher acts as a coach and facilitator.

	explain more so that the students understand more.	materials to explain and expand knowledge for students to understand more, and Kahoot will be used to test students.	
Step 5 Evaluation	The teacher evaluates the students based on activities and quizzes.	The teacher evaluated the students based on activities and quizzes from Kahoot.	The teacher acts as a coach and facilitator.

3.2 Develop analytical thinking skills by using 5E knowledge-seeking learning management activities. For Grade 3 students pass the criteria of 70%.

Table 3 Data analysis results of analytical thinking abilities. of students in grade 3. by using the 5E inquiry-based learning activities. Show information as in the table.

the ability to think analytically	average rating	standard deviation	average rating (%)	70 percent criteria
aspect of importance	7.23	1.02	72.26	pass
relationship	7.35	1.08	73.55	pass
Principle	7.16	0.73	71.61	pass
average	7.25	0.10	72.74	pass average

from table 3 Students receiving 5E inquiry-based learning arrangements. have an ability score in analytical thinking average is 7.25 The standard deviation is 0.10. Representing 72.74 percent, all students passed the set criteria of 70 percent.

3.3 A study of satisfaction with learning management by using knowledge-seeking learning activities Grade 3 students received 5 E in science and technology subjects.

Table 4: The results of the satisfaction study of Grade 3 and 5 students with the 5E knowledge-seeking learning style.

List	average	standard deviation	level of satisfaction
1. Students are free to study, research, and exchange ideas.	4.71	0.58	Most satisfied
2. Teachers allow students to do activities independently.	4.90	0.39	Most satisfied
3. Students have the opportunity to practise	4.58	0.71	Most satisfied
4. Students participate in activities.	4.81	0.53	Most satisfied
5. Help students gain knowledge and understanding for themselves.	4.74	0.51	Most satisfied
6. Teacher's rate students for their actions.	5.00	0.00	Most satisfied

7. Teachers encourage students to exchange knowledge and ideas.	4.48	0.76	Very satisfied.
8. Students understand the content and can remember the content for a long time.	4.29	0.92	Very satisfied.
9. Happy students have fun with learning activities.	4.87	0.42	Most satisfied
10. Help students think more critically.	4.61	0.61	Most satisfied
average	4.69	0.22	Most satisfied

Table 4 shows that Grade 3/5 students who received knowledge-seeking learning management 5E performed well. The average level of satisfaction was 4.69, and the standard deviation was 0.22, which was the highest level of satisfaction.

Discussion

The development of learning management activities in the search for knowledge in 5E science subjects and technology of Grade 3 students through organizing Manage learning in the search for knowledge (5E) synthesized by the researcher. which the researcher used to create a learning management plan. The quest for knowledge, 5E There are six plans in total, each with five steps of learning activities: Step 1: Create interest. Step 2: Explore and find Step 3: Explain and draw conclusions. Step 4: Increase knowledge; Step 5: Evaluate

Development of analytical thinking skills about our solar system by using learning management activities in the search for knowledge (E for Grade), 3 students must meet a 70% pass rate based on the study's findings in order to develop analytical thinking skills. Science and technology subjects using analytical thinking skills in learning management activities It was found that the learning management model was a 5E knowledge-seeking model, from having passed the experts and taking the test to experimenting with the sample group. The sample did not pass the test according to the set criteria. Therefore, there were interviews with the students, and it was found that the students wanted to have a group with their friends and bring the media into teaching. The researcher therefore adjusted the learning management plan in accordance with the needs of the learners and made it possible to experiment with the target group. All target groups passed the 70 percent criteria set. This is due to the fact that the learning management plan, learning management style, and seeking knowledge (5E) emphasize that learners know how to do things and provide opportunities for them.

A study of Grade 3 students' satisfaction with learning management using knowledge seeking learning activities (5E) in science and technology subjects. 3 who received the learning management through the test by using the learning management activity model of seeking knowledge (5E) had an average satisfaction of 4.69 and a standard deviation of 0.22, which was a high level of satisfaction.

Conclusion

The development of analytical thinking skills of Grade 3 students by using an inquiry-based learning management system (5E) on our solar system To pass the criteria of 70 percent, there are 5 steps: Step 1. Create interest. Step 2. Explore and find out. Step 3: Explain and draw conclusions. Step 4: Expand your knowledge.

Step 5: Assessment of six plans and study of the satisfaction of Grade 3 students who received

learning management through the test using the 5E knowledge-seeking learning activity model. The average satisfaction was 4.69 and the standard deviation was 0.22, which was a high level of satisfaction.

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