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Development of 7E Learning Packages on Units of Life and Plant Life Processes for Grade 7 Students

Juree Poonphanitauppathum[1*]
[1]Kannasootsuksalai Suphanburi School, Suphanburi, Thailand 72000
[*]Corresponding author email: juree@kannasoot.ac.th

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Abstract: The objectives of this research were as follows: 1) To develop a learning activity package on the topic of "Units of Life and Plant Life Processes" for Grade 7 students that meets the efficiency criteria of 80/80. 2) To compare the learning achievement of Grade 7 students on the topic of "Units of Life and Plant Life Processes" before and after using the learning package. 3) To compare the scientific mind of Grade 7 students before and after using the learning activity package. The sample group consisted of 40 Grade 7 students from Class 8 at Kannasootsuksalai School, Suphanburi Province, during the second semester of the 2024 academic year. The students were selected through cluster random sampling, with the classroom serving as the sampling unit. The research instruments used in the study included: 1) A learning activity package on the topic of "Units of Life and Plant Life Processes," consisting of 7 sets of activities. 2) A test to assess the learning achievement on the topic of "Units of Life and Plant Life Processes." 3) A scientific mind assessment scale. Data analysis was conducted using statistical methods, including the mean, standard deviation, E1/E2 values, and t-test for dependent samples. The results of the study revealed that. 1) The learning activity package on the topic of "Units of Life and Plant Life Processes" had an efficiency value of E1/E2 equal to 89.13/90.33. 2) The learning achievement of Grade 7 students on the topic of "Units of Life and Plant Life Processes" after using the learning activity package was significantly higher than before using the learning activity package, with a statistical significance level of .01. 3) The scientific mind of Grade 7 students after using the learning activity package were significantly higher than before using the learning activity package, with a statistical significance level of .01.

Keywords: Active learning, Learning packages, 7E learning cycle, Grade 7 Students

Introduction

The National Education Act B.E. 2542 (1999), as amended by the amendments B.E. 2545 (2002) and B.E. 2553 (2010), Section 6, sets the goal of education to develop Thai people into complete human beings, encompassing physical, mental, intellectual, knowledge, and morality, with ethics and culture for life, and the ability to live together in happiness. The guidelines for education are provided in Section 22, stating that all learners have the ability to learn and develop themselves, with the learner being considered the most important. The educational process must promote learners to develop naturally and reach their full potential. In the case of basic education, the Core Curriculum for Basic Education B.E. 2551 (2008) is used in accordance with Section 27, paragraph 1, and school-based curricula according to Section 27, paragraph 2, are used to guide education, ensuring that learners achieve the quality set by the standards (Royal Thai Government Gazette, 2010). Kannasootsuksalai School, Suphanburi Province, provides education at the secondary level from Grade 7 to Grade 12, using a school-based curriculum aligned with the Core Curriculum for Basic Education B.E. 2551 (2008) to develop learners in line with the educational objectives set by the National Education Act. The school organizes teaching and learning in 8 subject areas and student development activities that continuously meet the needs and interests of students. One of these 8 subject areas is Science, which focuses on developing learners' scientific knowledge, scientific process skills, scientific mind, and the ability to use science as a tool for knowledge acquisition and self-learning (Kannasootsuksalai School, Suphanburi, 2023).

From the implementation of the science teaching and learning unit "Units of Life and Plant Life Processes" for Grade 7 students at Kannasootsuksalai School, Suphanburi Province, in classrooms 3, 6, 8, 9, and 10 during the 2023 academic year, it was found that the average assessment score for the unit "Plant and Plant Life Processes" was 20.06 out of 30, which is 66.87%. This score is below the set benchmark of 80%. Additionally, the average score for scientific mind was 78.93 out of 135, which is 58.47%, also below the established standard (Kannasootsuksalai School, Suphanburi, 2023).

From the issues observed regarding the learning achievement on the topic "Plant and Plant Life Processes" and the scientific mind of students mentioned above, it is evident that if an effective innovation is implemented to address these issues, students would be more likely to succeed. Furthermore, upon reviewing various documents and research, it was found that learning activity packages are teaching tools used by teachers to facilitate student-centered learning. According to Good (1973), a learning activity package refers to a set of teaching programs that include teaching materials, learning tools, instructional guides, pre- and post-test manuals, and knowledge information, all aimed at defining specific learning objectives.

In addition, previous research studies have shown that several studies, such as those by Theeramok (2005), Nujoi (2006), Khota (2011), Sutawee (2011), and Maksup (2012), have used learning activity packages as tools for improving students' scientific learning achievements and scientific mind, and have been successful in developing students. Moreover, using the 7E learning cycle (Eisenkraft, 2003), which includes: Step 1 - Elicit (Assessing prior knowledge), Step 2 - Engage (Generating interest), Step 3 - Explore (Investigating), Step 4 - Explain (Clarifying), Step 5 - Elaborate (Extending knowledge), Step 6 - Evaluate (Assessing), and Step 7 - Extend (Applying knowledge), can further enhance learning achievements and scientific mind, as evidenced by the research of Klaythong (2011), Jaroenlertkijja (2011), Phanyula (2011), Nongkodlod (2011), and Kaewphikul (2011).

For this reason, the researcher developed a learning activity package on the topic " Plant and Plant Life Processes" based on the 7E learning cycle (7E) to enhance the learning achievement and scientific mind of Grade 7 students in this study. The research objectives are as follows: 1) To develop a learning activity package on the topic of " Plant and Plant Life Processes" for Grade 7 students that meets the efficiency criteria of 80/80. 2) To compare the learning achievement of Grade 7 students on the topic of " Plant and Plant Life Processes" before and after using the learning package. 3) To compare the scientific mind of Grade 7 students before and after using the learning activity package.

Research methodology

Population and Sample

The population consists of Grade 7 students from classrooms 1/3, 1/6, 1/8, 1/9, and 1/10 at Kannasootsuksalai School, Suphanburi Province, during the second semester of the 2024 academic year, with a total of 200 students. The students in each classroom have similar basic science skills.

The sample group consists of 40 Grade 7 students from classroom 1/8 at Kannasootsuksalai School, Suphanburi Province, during the second semester of the 2024

academic year. The students were selected using cluster random sampling, with classrooms being the unit of randomization.

Learning Activity Packages

The development of the learning activity package on the topic "Plant and Plant Life Processes" was carried out according to the following steps:

1. Analyze the main concepts of the topic "Units of Life and Plant Life Processes" in the curriculum of Kannasootsuksalai School, Suphanburi Province, in the Science learning area. The analysis revealed seven main topics, as follows: Cell Structure, Diffusion and Osmosis, Plant Transport Systems, Photosynthesis in Plants, Flower Structure, Plant Reproduction, Plant Responses to Stimuli. The researcher then used these topics to develop seven learning activity packages.

2. The main concept for the development of the learning activity package on the topic "Plant and Plant Life Processes" is to focus on enabling students to engage in hands-on activities from the learning activity package independently. The activities include answering thought-provoking questions, exchanging knowledge, and incorporating learning exchange opportunities in each learning activity package. Additionally, the development of the learning activity package on "Plant and Plant Life Processes" is based on the 7E learning cycle (Eisenkraft, 2003) as the core principle for designing the learning activities. For each step of the 7E learning cycle, the researcher follows the principles outlined below:

Step 1: Elicit (Checking Prior Knowledge). This step involves assessing the foundational knowledge or skills that are important and necessary for current learning. It provides information for teaching and learning in subsequent steps. The instructor can use various methods to check prior knowledge, tailored to the context of the learning process. The instructor can apply different techniques based on the learning context.

Step 2: Engage (Creating Interest). This step involves stimulating the students' interest and desire to learn, as well as motivating them for learning and preparing them for the learning process. The instructor can use various methods to achieve this.

Step 3: Explore (Investigating and Exploring). This step allows students to engage in learning activities that lead them to discover knowledge on their own through exploration, observation, hypothesis testing, identifying possible alternatives, hands-on practice, and data collection using various methods. The instructor can use a variety of learning activities in this state.

Step 4: Explain (Explaining). This step involves analyzing, interpreting, and summarizing the results of the exploration process, which includes various data collected. It allows students to acquire new knowledge through their own learning processes and present the knowledge in various appropriate formats.

Step 5: Elaborate (Elaborating). This step involves connecting the knowledge gained from the explanation phase with other knowledge, as well as ideas derived from further exploration. It also involves the concept of applying the acquired knowledge for practical benefit. Elaborating helps students gain new experiences and generates new questions that can lead to further learning and exploration.

Step 6: Evaluate (Evaluating). This step involves assessing students' learning regarding the learning process, learning skills, and learning outcomes using various methods according to the real context. The evaluation may be formal or informal, and the results are used to improve and further develop the students.

Step 7: Extend (Applying Knowledge). This step focuses on the transfer of learning, encouraging students to apply their knowledge for practical benefits in various aspects of daily life. In this phase, students are able to achieve a clearer and broader understanding through real-world application of what they have learned.

5. Preliminary Quality Check of the Learning activity package on "Plant and Plant Life Processes" The learning activity package on the "Plant and Plant Life Processes" was reviewed by five experts who have completed their studies in curriculum development and teaching or have at least 10 years of experience in teaching and assessing science learning outcomes. The experts evaluated the accuracy and feasibility of implementing the learning activity package using a 5-point rating scale (very high, high, moderate, low, and very low). The ratings were analyzed and interpreted based on Best's (1981) guidelines. The results of the evaluation by the experts revealed that all 7 learning activities in the set were deemed highly accurate and highly feasible for implementation.

6. Improvement of the Learning activity package on "Plant and Plant Life Processes" The learning activity package on the "Plant and Plant Life Processes" was revised based on the feedback and recommendations from all the experts. The revisions include: Refining the language used in the learning objectives to make them more concise. Adjusting the layout of graphical representations to make them larger and clearer. These improvements were made to the learning activity package in accordance with the experts' suggestions, prior to its trial implementation to assess its effectiveness against the 80/80 criteria.

Instruments

The tools used for data collection consist of: 1) Achievement test for each set of learning activities. 2) Achievement test on the topic of "Plant and Plant Life Processes" 3) Scientific mind measurement test. The details are as follows:

1. The achievement test for each set of learning activities is in the form of a multiple-choice test with 4 options. Each learning activity package has the following reliability values: Learning activity package 1 has a reliability of 0.81, Learning activity package 2 has a reliability of 0.82, Learning activity package 3 has a reliability of 0.81, Learning activity package 4 has a reliability of 0.85, Learning activity package 5 has a reliability of 0.83, Learning activity package 6 has a reliability of 0.80, Learning activity package 7 has a reliability of 0.79.

2. The achievement test on the topic of "Plant and Plant Life Processes" is in the form of a multiple-choice test with 4 options. The reliability value is 0.81.

Data collection

Step 1: One-on-One Trial

This step involves testing the learning activity package on the topic "Plant and Plant Life Processes" with three students in Grade 7/3 at Kannasootsuksalai School, Suphanburi Province. The students include one high-achieving student, one average student, and one low-achieving student. These students were selected using purposive sampling.

Step 2: Small Group Trial

This step involves testing the learning activity package on the topic "Plant and Plant Life Processes" with nine students in Grade 7/10 at Kannasootsuksalai School, Suphanburi Province. The students consist of three high-achieving students, three average

students, and three low-achieving students. These students were selected using purposive sampling.

Step 3: Large Group Trial (Field Trial)

This step involves testing the learning activity package on the topic "Plant and Plant Life Processes" with 40 students in Grade 7/6 at Kannasootsuksalai School, Suphanburi Province, according to the regular class schedule. The students were selected using cluster random sampling, with the classroom serving as the sampling unit.

Step 4: Testing with the sample group

In this step, the learning activity package was used with 40 students in Grade 7/8 at Kannasootsuksalai School, Suphanburi Province. These students were selected using cluster random sampling, with the classroom serving as the sampling unit. The experimental design used was the One-Group Pretest-Posttest Design (Campbell & Stanley, 1963).

Data analysis

The data analysis was conducted as follows:

Analysis of the effectiveness of the learning activity package on the topic "Plant and Plant Life Processes" based on the 80/80 criterion according to the Kannasootsuksalai School guideline: This involves analyzing the E1/E2 values to determine if the learning activity package meets the efficiency criterion of 80/80, which typically indicates both high effectiveness in enhancing student learning and satisfaction.

Analysis of the results of using the learning activity package with the sample students: This analysis involves examining how the learning activity package impacted the sample group in terms of their academic performance and other relevant outcomes.

Analysis of the mean and standard deviation of academic achievement on the topic "Plant and Plant Life Processes" before and after using the learning activity package: This step involves comparing students' performance before and after using the learning activity package, focusing on the mean scores and standard deviation to assess the level of improvement.

Analysis of the mean and standard deviation of scientific mind scores of Grade 7 students before and after using the learning activity package: The analysis will focus on how students' scientific mindset (psychological aspect) is affected by the learning activity package, comparing the scores before and after its implementation.

Comparison of the mean academic achievement on the topic "Plant and Plant Life Processes" of Grade 7 students before and after using the learning activity package: This involves comparing the mean scores of students' academic performance before and after the learning activity package was used, to evaluate the effectiveness of the intervention. Additionally, the comparison of the mean scores for the scientific mind scores (psychological measurement) before and after using the learning activity package will also be analyzed.

Research results

1. The result of one-on-one trial. From the evaluation of the effectiveness of the learning activity package on the topic "Plant and Plant Life Processes" in the one-on-one trial, it was found that the effectiveness values (E1/E2) were 79.59/78.90, which is below the established criterion. Therefore, the researcher made improvements in the following areas identified as

weaknesses in the learning activity package: 1) improved the clarity of the content explanation, including various illustrations. 2) Enhanced the clarity of the questions in each learning activity package and the post-test questions. After these improvements, the researcher proceeded to use the learning activity package in the small group trial.

2. The result of small group trial. From the evaluation of the effectiveness of the learning activity package on the topic "Plant and Plant Life Processes" in the small group trial, it was found that the effectiveness values (E1/E2) were 82.23/83.70, which meets the established criterion. Following this, the researcher improved the learning activity package by enhancing the size and clarity of the images, before proceeding to use it in the large group trial (field trial).

3. The result of large group trial (field trial). From the evaluation of the effectiveness of the learning activity package on the topic "Plant and Plant Life Processes" in the large group trial (field trial), where the set was tested with 40 students in Grade 7/6 at Kannasootsuksalai School, Suphanburi Province, consisting of students with varying levels of science achievement (high, average, and low), it was found that the effectiveness values (E1/E2) were 89.08/89.20, which meets the established criterion.

4. The result of testing with the sample group. From the evaluation of the effectiveness of the learning activity package on the topic “Plant and Plant Life Processes” with the Grade 1/8 sample group, the results of the evaluation are as follows

Table 1: Results of the effectiveness evaluation of the learning activity package on the topic "Plant and Plant Life Processes" with the sample group of Grade 1/8 students

Learning packages	n	Full score	Total score	M	SD	Percentage (%)
Formative test (E_1)	40	80	3,559	71.30	4.69	89.13
Post-test (E_2)	40	30	1,355	27.10	2.76	90.33

From Table 1, it can be seen that the effectiveness of the learning activity package on the topic "Plant and Plant Life Processes" has E1/E2 values of 89.13/90.33, which meets the established criterion.

5. Comparison of learning outcomes on the topic “Plant and Plant Life Processes” of Grade 7 students before and after using the learning activity package. The comparison of learning outcomes on the topic “Plant and Plant Life Processes” of Grade 7/8 students before and after using the learning activity package are as follow.

Table 2 : Comparison of learning outcomes on the topic “Plant and Plant Life Processes” of Grade 7/8 students before and after using the learning packages.

Learning achievement	n	Total score	M	SD	t
Pretest	40	30	16.82	1.66	24.94**
Post-test	40	30	27.10	2.76	

** Statistic significant at .01 level

Table 2 shows that Grade 1/8 students had an average learning outcome score of 16.82 with a standard deviation of 1.66 before using the learning activity package. After using the learning activity package, the average score increased to 27.10 with a standard deviation of 2.73. The students' learning outcomes in science on the topic "Plant and Plant Life Processes" after using the learning activity package were significantly higher than before, with a statistically significant difference at the .01 level.

6. Comparison of the scientific mind of Grade 7 students before and after using the learning activity package. The comparison of the scientific mind of Grade 7/8 students in the sample group before and after using the learning activity package are as follow.

Table 3: Comparison of the scientific mind of Grade 7/8 students before and after using the learning activity package

Learning achievement	n	Total score	M	SD	t
Pretest	40	135	92.06	4.32	44.42**
Post-test	40	135	125.36	2.99	

** Statistic significant at .01 level

Table 3 shows that Grade 7/8 students had an average scientific mind score of 92.06 with a standard deviation of 4.32 before using the learning activity package. After using the learning activity package, the average score increased to 125.36 with a standard deviation of 2.99. The scientific mind of Grade 7 students after using the learning activity package was significantly higher than before, with a statistically significant difference at the .01 level.

Discussion

For the first research objective, which was to develop a set of learning activities on the topic "Plant and Plant Life Processes" for Grade 7 students to meet the efficiency criterion of 80/80, and the first research hypothesis which stated that the developed learning activity set would achieve the 80/80 efficiency criterion — the study found that the learning activity set had an efficiency value (E1/E2) of 89.13/90.33, which met the established standard. This result is attributed to the fact that the researcher designed the learning activities in a systematic way, organizing the content from simple to complex. As a result, students could understand the relationships between different concepts, study the content, and effectively engage with each learning activity.

Furthermore, behaviorist theories were applied during the implementation of the learning activities by providing continuous reinforcement to the students. The activities were designed for students to actively participate in the learning process themselves. In terms of humanistic theory, the researcher allowed students to make their own learning decisions, created a warm and accepting classroom atmosphere, respected students as individuals, and acted as a facilitator who encouraged, supported, and assisted students according to their individual abilities. This approach promoted students' positive self-perception, positive discipline, and self-esteem.

These findings are consistent with the research of Bunyang, Sripanphat, & Singlop (2016), who developed a learning activity set on the topic of "Ecosystems" for Grade 9

students using the cooperative learning STAD technique. One of their research findings indicated that the learning activity set had an efficiency of 87.78/86.67, which exceeded the 80/80 standard. Similarly, the research of Kanyasakul (2016), who developed a learning activity set based on the 5E Inquiry-Based Learning Model for Grade 9 science students on the topic of "Ecosystems," showed that the six learning activity sets achieved an efficiency (E1/E2) of 83.78/83.54, also surpassing the established 80/80 criterion.

For the second research objective, which was to compare the learning achievement of Grade 7 students on the topic "Units of Living Things and Plant Life Processes" before and after using the developed learning activity set, the research hypothesis stated that students would have higher learning achievement after using the activity set. The study found that Grade 7 students showed significantly higher science achievement on the topic after using the learning activity set compared to before, at the .01 level of statistical significance. This supports the second research hypothesis. This result can be attributed to the researcher's use of Eisenkraft's (2003) 7E Learning Cycle in designing the learning activities, which included the following seven steps: Elicit – The researcher assessed students' prior knowledge or foundational skills essential for current learning. Various methods were used for this purpose, tailored to the learning context. Engage – The researcher stimulated students' interest, motivation, and readiness to learn through diverse engagement strategies. Explore – Students participated in hands-on learning activities that allowed them to discover knowledge on their own through investigation, hypothesis formulation, identifying alternatives, performing experiments, and collecting data using different methods. Explain – The researcher guided students to analyze, interpret, and conclude from the information obtained during exploration. This step helped students construct new knowledge and present it in appropriate formats. Elaborate – The new knowledge was connected to other existing knowledge or ideas obtained through further research. Students were encouraged to apply their knowledge, leading to new experiences and questions for continued learning. Evaluate – Students' learning processes, learning skills, and outcomes were assessed using both formal and informal assessment methods aligned with real-life contexts. The results were used to further support and develop individual students. Extend – Students applied their knowledge in various situations, promoting transfer and deeper learning. These findings are consistent with the research of Promkao, Suwanjinda, & Chaowakeratipong (2022), who investigated the effects of 7E inquiry-based learning combined with analytical questioning and mental model construction on Grade 7 students' learning achievement and ability to construct scientific explanations. The study found that students' post-learning achievement was significantly higher than pre-learning scores at the .05 level. Moreover, the findings align with the research of Noreen, Iqbal, & Hayat (2024) titled "Effect of the 7E Learning Cycle Model on Students' Achievement in the Subject of Science at the Elementary School Level," which found that students taught using the 7E instructional strategy scored higher on the post-test compared to the control group. Similarly, Uzezi & Oiuyemi (2024) in their study "Improving Secondary School Students' Academic Achievement in Chemistry Using 7E Constructivist Instructional Strategy" reported a statistically significant difference in mean achievement scores between students taught with the 7E strategy and those taught with conventional guided discovery methods.

For the third research objective, which aimed to compare the scientific mind of Grade 7 students before and after using the developed learning activity set, the hypothesis stated that students' scientific mind would be higher after using the learning activity set. The study found that students' scientific mind was significantly higher after the intervention than before, with statistical significance at the .01 level. This result supports the third research

hypothesis. This improvement is attributed to the researcher's use of the 7E Learning Cycle in developing a learning activity set that emphasized student-centered, hands-on learning. As students engaged in the 7E learning process and achieved success through their own efforts, they began to value scientific mind. These attitudes were expressed through behaviors such as curiosity, perseverance, carefulness, responsibility, honesty, frugality, willingness to express opinions and listen to others, reasoning ability, and constructive collaboration with peers (Laohapaiboon, 1999; Ministry of Education, 2008). In addition, the learning activities were designed to stimulate students' scientific mind following the guidelines of the Institute for the Promotion of Teaching Science and Technology (IPST, 2013), which include: Providing students with opportunities to gain scientific learning experiences by emphasizing scientific methods, which directly promote scientific mind. Encouraging observation, questioning, and creating engaging environments to stimulate students' development of scientific mind. Promoting student responsibility for learning activities, encouraging expression of opinions, and accepting differing views. Students are trained to change their perspectives when other ideas are reasonably supported. Fostering curiosity, a desire for knowledge, interest in scientific advancements, creative thinking, and the application of knowledge to problem-solving. Using questions or learning scenarios that stimulate students to engage in scientific processes. Incorporating real-life examples or community issues into lessons to encourage scientific inquiry and learning. These findings align with the research of Sonsawat (2011), who studied the effect of problem-based learning and science project-based learning on Grade 7 students' academic achievement and scientific problem-solving abilities. One of the findings showed that the experimental group, which experienced context-based learning, had significantly higher post-instruction scientific mind scores than their pre-instruction scores at the .01 level. Similarly, Wankhom (2011) studied the effects of brain-based learning on Grade 9 students' science achievement and scientific mind. Her research revealed that students who were taught using brain-based learning approaches had significantly higher scientific mind after learning, also at the .01 level. Gok (2014) investigated the influence of the 7E Learning Cycle on students' learning about the human body system, self-regulation behavior, scientific thinking, and science process skills among Grade 6 students. One of the key findings was that students taught through the 7E model demonstrated significantly better science process skills than those who were taught through traditional lecture and question-answer methods.

Recommendations for the Application of Research Findings: This study offers the following recommendations for the application of its findings are follow. 1) During students' engagement in the 7E Learning Cycle, teachers should provide continuous guidance, suggestions, and questions that stimulate students' higher-order thinking. Teachers should act as mentors or coaches to help students utilize learning processes and scientific process skills as tools for ongoing learning. Additionally, teachers should observe and assess whether students understand the content. If misconceptions or misunderstandings are detected, immediate assistance should be provided to correct them. 2) After completing each learning activity, teachers should evaluate students' learning outcomes and provide prompt feedback. This immediate reflection of assessment results plays a crucial role in motivating students, encouraging them to stay committed and put forth their best efforts in subsequent learning activities. 3) Enjoyment in learning is a key factor that encourages students to actively engage in learning activities. The teacher plays a vital role in creating this enjoyable learning environment. When students experience happiness in their learning process, they are more likely to fully engage in the activities, which positively influences their academic achievement, their ability to apply scientific methods, and the development of scientific

mind. Therefore, teachers who wish to implement the developed learning activity set must also focus on creating a positive and enjoyable classroom atmosphere. Therefore, teachers who intend to implement the developed learning activity set must also focus on creating a joyful and positive learning environment. A classroom atmosphere that fosters happiness in learning is essential for encouraging student engagement and maximizing the effectiveness of the learning activities. For future research, it is recommended to study and develop learning activity sets in other science topics for Grade 7 students. These should be based on experiential learning theories, the 7E Learning Cycle, and empowering, authentic assessment methods. Such an approach would contribute to a more diverse and effective range of learning activity sets, supporting deeper learning and broader educational development. Suggestions for applying the research results are that teachers should use the learning package as a learning medium for science in other topics and should continue to research and develop learning packages in other topics.

Conclusion

This research developed a science learning activity set using the 7 E Learning Cycle as a framework for instructional design. The results revealed that students' academic achievement and scientific mind were significantly higher after participating in the learning activities, with statistical significance. These findings suggest that the research outcomes can be applied to the design of science instruction in various classroom contexts to effectively enhance both students' academic performance and their scientific mind.

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