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Science Learning Based on Deep Learning Approach Assisted by Educational Games to Improve Student Learning Outcomes at Parthome Santiwit Songkhla Technological College Thailand

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Abstract: The purpose of this study was to enhance fourth-grade science students' learning outcomes at Santiwit Elementary School, Songkhla Technological College, Thailand, by utilizing deep learning techniques in conjunction with educational games. While educational games were utilized as engaging and pertinent learning resources, the deep learning approach was utilized to promote deeper conceptual knowledge, active participation, and critical thinking abilities. The classroom action approach used in this study was carried out in phases, including preparation, execution, observation, and reflection. According to the study's findings, student learning outcomes—both in terms of cognitive abilities and involvement in the learning process—have significantly improved. Pupils grew more engaged, animated, and capable of relating scientific ideas to pertinent educational opportunities. It has also been demonstrated that using educational games can boost learning motivation and foster a joyful learning environment. Based on these results, it can be said that fourth-grade students' science learning achievement is enhanced by the deep learning approach aided by educational games.

Keywords: Deep learning; Educational games; Learning achievement; Science education

Introduction

Building pupils' conceptual comprehension, critical thinking abilities, and capacity to connect scientific ideas to real-world occurrences are all greatly aided by science education in elementary schools. Nonetheless, scientific education is still frequently traditional and teacher-centered in many classrooms, which leads to less than ideal student engagement in comprehending the material and reaching in-depth learning objectives. Lack of interest in studying and a lack of resources to encourage higher-order thinking are the main issues facing fourth graders at Santiwit Elementary School in Songkhla Technical College, Thailand problem solution for students in an entertaining and interesting manner.

Science education must adapt to the 21st century's changing educational landscape by emphasizing the development of higher-order thinking, creativity, teamwork, and problem-solving abilities (Ahyati, 2024). The application of learning strategies that motivate students to actively create information is just as important to learning success as the content of the course (Azizatunnisa et al., 2022). Participation of students in demanding and contextualized learning activities facilitates the development of a more thorough comprehension of scientific ideas as opposed to education that solely stresses memorization and passive activities (OECD, 2019). In education, the deep learning approach is viewed as a process of learning that stresses experience, a profound, introspective comprehension of information, and the capacity to apply ideas in practical

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contexts (Akmal et al., 2025). This method's application in primary school has demonstrated that instruction that integrates aspects of happy, meaningful, and mindful learning can enhance students' critical thinking abilities and increase their engagement with science content (Ramadhan, 2025).

According to Nabila et al. (2025), joyful learning is a process that makes students feel at ease and excited, which helps them concentrate better and devote more time to learning activities. According to Abdurrochim et al. (2024), mindful learning is a method of instruction that stresses complete focus and awareness at every level of the learning process. It is anticipated that the application of this strategy will enhance students' focus, engagement, and capacity for reflection on their educational experiences (Mufidah et al., 2025). When new information is linked to preexisting and pertinent concepts in an individual's cognitive structure, Ausubel argues that meaningful learning takes place, giving the learned material greater significance (Tarmidzi, 2019). According to Hafidzhoh et al. (2023), meaningful learning occurs when people are able to make connections between newly learned material and previously acquired knowledge. The connection between theories, facts, and novel scenarios that fit the student's cognitive framework demonstrates this meaningful learning (Hamida et al., 2022). Through exploratory activities and problem-solving in pertinent contexts, a deep learning method can dramatically improve kids' engagement and comprehension of science subjects, according to several elementary school studies (Khotimah & Abdan, 2025). In essence, the learning system relies heavily on media (Nurfadhillah et al., 2021). To provide an effective learning experience, learning tools are also essential (Nurmaya et al., 2021). According to Sunarti et al. (2025), media must be a harmonious and essential part of the entire learning process. Ensuring efficient use in educational activities that allow students to engage directly with the media is the main objective of media selection (Doyan et al., 2024; Titin et al., 2023). Facilities or equipment are required to accomplish educational goals in order to transmit knowledge or educational messages. As a result, the main supporting element that is required is educational tools (Sari et al., 2024). According to Silaban et al. (2024), educational tools are gadgets or media that are purposefully made and utilized to help the learning process proceed more smoothly and effectively while accomplishing learning objectives.

Interactive media called educational games are made to combine gaming features with the goals of teaching science so that... can increase motivation, improved comprehension of scientific ideas and active student participation (Munandar et al., 2024; Ningtyas, 2024). In comparison to traditional teaching techniques, empirical research indicates that the use of educational games in scientific instruction in elementary classrooms has the potential to enhance student learning outcomes, engagement, and a more meaningful and interesting learning experience (Sundahry & Yantoro, 2025).

Utilizing learning materials that are in line with the needs and characteristics of students is essential to guaranteeing the best possible implementation of the deep learning strategy in elementary schools (Kurniawati et al., 2025). Learning media can be used to promote meaningful learning interactions in addition to providing knowledge (Rahmawati, 2025). Interactive media can boost active learning, give students a more realistic and contextual learning experience, and help them understand abstract science concepts through explicit visuals (Mayer, 2021).

Teachers play a vital role in the educational process as facilitators, helping students reach their full potential in terms of their social, intellectual, creative, and other potentials (Zulfatunnisa, 2022). In addition to imparting knowledge, educators also create learning experiences and can establish a welcoming, inclusive, and intellectually stimulating learning environment (Syamsurdi et al., 2024). Teachers are expected to support students' active knowledge creation, critical thinking skills development, and sense of responsibility in learning through careful organization of lessons (Faradila, 2024). Additionally, the learning process can be tracked through teacher-student contact and communication (Afif & Fausiyeh, 2024; Doyan et al., 2024). Teachers can get feedback on students' comprehension levels, challenges faced, and emotional reactions to learning through two-way communication (Muslim et al., 2022). This enables educators to modify instructional tactics, techniques, and media to better fit the learning preferences and characteristics of their pupils (Nurharirah et al., 2025). Students' academic success is based on the teacher's delivery of the subject (Agusti & Aslam, 2022). Students' comprehension of the subject matter is reflected in their learning outcomes (Sandari, 2021). Students' deeper comprehension of concepts will be facilitated by material that is delivered methodically, contextually, and with the use of relevant learning media (Sukmadianto, 2025). Following that, learning outcomes show how well pupils have understood the subject matter (Sunarti & Novitasari, 2021). Innovative teaching techniques, interactive technology, and methods that prioritize active student participation can all help accomplish these goals (Kurniawan et al., 2024). According to Handayani et al. (2023), low learning outcomes suggest that pupils have not fully comprehended the teacher's explanations during the learning process. Teachers must thus put in their best effort when presenting the content in order for students to fully absorb and comprehend it (Ali, 2022).

As a foundation for accomplishing learning objectives in subsequent learning activities, learning outcomes are crucial to the learning process because they allow teachers to assess the degree of knowledge and experience that students have gained (Wulandari et al., 2019). According to Law Number 20 of 2003 regulating the National Education System, learning outcomes for students are skills that they must acquire after engaging in the educational process. Students' thought processes and actions demonstrate these abilities, which are a conglomeration of knowledge, skills, values, and attitudes (Hasibuan et al., 2021). Accordingly, the growth of students' attitudes and abilities is used to gauge learning achievement in addition to cognitive factors (Sandrika et al., 2025). To ensure that the educational process may genuinely mold students as a whole, teachers must implement a learning strategy that is comprehensive, significant, and applicable to students' lives (Ulun, 2025). These factors led to the design of this study, which aimed to enhance fourth-grade students' learning outcomes at Santiwit Elementary School, Songkhla Technical College, Thailand, by integrating educational gaming media into a deep learning approach to scientific instruction. It is intended that this approach will make learning more purposeful, foster higher-order thinking abilities, and give students an enjoyable and engaging educational experience. Additionally, this study aims to offer recommendations for creative teaching methods that teachers might use when instructing science in elementary schools.

Method

In order to improve the learning outcomes of fourth-grade students at Santiwit Elementary School, Songkhla Technical College, Thailand, a deep learning approach aided by educational games in science learning was applied. This was done using Kemmis and McTaggart's Classroom Action Research (CAR) design model, which consists of two cycles and includes the planning, implementation, observation, and reflection stages. This study uses a combination of methods, including a qualitative approach to describe the learning process, degree of activity, and student responses through questionnaires and observation, and a quantitative approach to measure improvements in student learning outcomes through tests (Salsabila & Mahmuddin, 2024). Fourth-grade kids served as the research subjects, and learning achievement assessments, observation sheets, questionnaires, and documentation were among the methods used to collect data. Average scores and learning completion percentages were calculated as part of the data analysis process, along with descriptions of how student motivation and learning activities had changed. Therefore, the concept and methodology of this study suggest that applying a deep learning approach to scientific teaching with the use of educational games can enhance learning results and the caliber of the learning process.

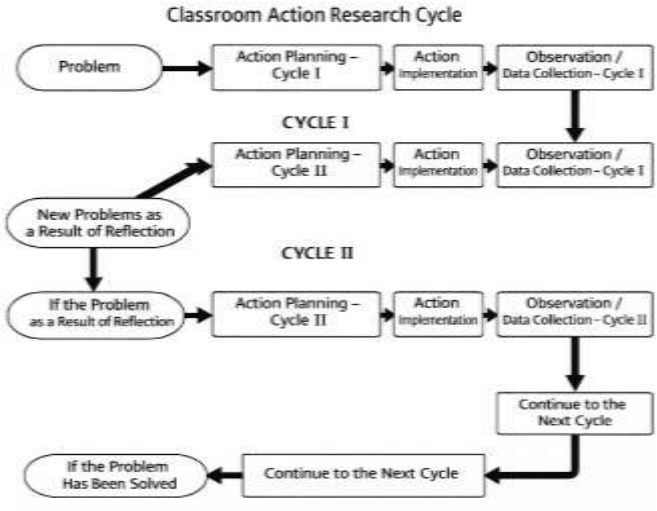

Figure 1. Research cycle diagram

Result and Discussion

With five students finishing the course and nine failing, the average result for Cycle I was 62.92. The classical completion percentage (PKK) was determined to be 35%, making it "Not Good".

With a traditional completion percentage of 35% and an average value of 62.92 for student learning outcomes, the activities implemented in cycle I fell into the poor qualifying category. According to these findings, most fourth-graders at Santiwit Songkhla Technological College Elementary School have failed to meet the required completion levels. This situation is consistent with the actual situation in the field, where students are still getting used to the deep learning approach with the help of educational games. Students are not yet used to learning activities that call for active participation, concept investigation, and autonomous problem solving because science instruction at the school has so far tended to be traditional and teacher-centered.

Cycle I observations revealed that while some students started to express interest in playing instructional games, their use was still subpar. Some students lacked the ability to make a strong connection between the gaming context and the science principles they were learning, tended to be quiet, and were reluctant to voice their opinions. The diverse classroom environment has an impact on this, both in terms of students' learning experiences and academic aptitude.

Additionally, the effectiveness of educational game-based learning in cycle I was also influenced by a lack of supporting facilities, such as learning equipment that needed to be utilized interchangeably.

The primary challenges were students' ignorance of the deep learning-based learning process and the lack of time for one-on-one student guidance, according to the findings of the Cycle I reflection. To make sure all students are actively participating and focused on the learning objectives, teachers still need to modify their classroom management techniques. Additionally, some students focused more on the gameplay than on comprehending science subjects since they did not fully understand the rules for playing educational games in Cycle I. To guarantee that the deep learning approach can function at its best, customized to the needs of the school and the characteristics of the students, changes must be made in the upcoming cycle, especially in the areas of giving clearer instructions, enhancing teacher mentoring, and putting in place more efficient classroom management.

With 10 students finishing the program and 4 failing, Cycle II had an average score of 76.28. According to the aforementioned computations, the PKK score was 71%, making it "Good".

Compared to cycle I, there was a notable rise in the actions implemented in cycle II. With a traditional completion rate of 71% and strong qualifications, the average value of student learning outcomes rose to 76.28. This growth suggests that the deep learning technique, aided by educational games, is beginning to function more efficiently and is in line with the needs of SD Santiwit Songkhla Technological College fourth grade pupils. Students are beginning to adjust to learning styles that call for active participation, discussion, and problem-solving through educational game activities, and they seem to be able to comprehend science subjects more thoroughly.

Cycle II observations revealed improvements in learning attitudes and student involvement. Pupils cooperated with their peers to complete instructional game-based assignments, voiced their ideas, and were more excited about taking part in the learning process. By enhancing classroom management techniques, giving more precise instructions, and connecting science content to gaming situations that were relevant to students' learning experiences, teachers were able to create more favorable learning environments. Additionally, study groups were set up to maximize the utilization of the limited school facilities available, giving every student an equal chance to engage in the learning process.

Even though cycle II results indicated significant progress, the reflection results still identified a number of issues that require addressed. A tiny percentage of students still had trouble fully grasping some ideas. autonomous and need more thorough instruction from educators. Learning speed is also impacted by student differences in academic aptitude. In finishing learning tasks that are based on deep learning. These challenges do not, however, lessen the learning process's overall efficacy. Rather, they function as assessment data for additional learning strategy improvement, allowing the educational game-assisted deep learning approach to be applied more ideally and sustainably in accordance with classroom settings and school infrastructure.

Student Learning Outcomes

The learning outcomes of the students received an average score in cycle I of 62.92 with a classical completion percentage (PKK) of 35%, according to the research test instrument results as reported in the research results sub-chapter above. In contrast, cycle II had a classical completion percentage (PKK) of 71% and an average score of 76.28. Therefore, there was a 36% increase from sufficient requirements to good criteria from cycle I to cycle II. Please refer to the diagram below for further information:

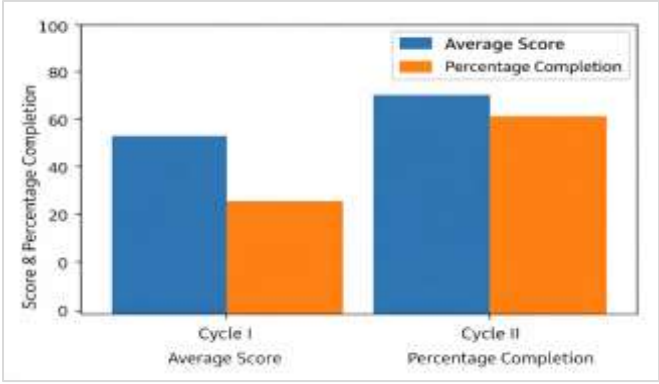

Figure 2. Percentage of student learning outcomes

According to the research findings, the average score increased from 62.92 to 76.28 and the number of students who completed classical coursework increased from 35% to 71%, indicating an improvement in student learning outcomes from cycle I to cycle II. This shift suggests that students' science learning results are improved when the deep learning approach is used with the help of educational games. The poor learning results in cycle I were a reflection of the students' ongoing adjustment to the new learning style, which calls for active participation, introspection, and a thorough comprehension of the material. In contrast, students were able to demonstrate greater understanding and attain superior learning outcomes in cycle II as they grew used to deep learning-based learning activities.

The deep learning methodology places a strong emphasis on meaningful learning, in which pupils not

only absorb knowledge but also connect it to the new information combined with previously learned notions and experiences. According to Ausubel's idea of meaningful learning, new information is better understood when it is linked to preexisting cognitive structures. Fourth-graders at Songkhla Technological College's Santiwit Elementary School started to make connections between the science principles they were studying and the context of educational games in cycle II, which made learning more relatable and understandable. This circumstance corroborates the conclusions of Ade Ramadhan (2025), who claimed that incorporating happy, meaningful, and mindful learning as the cornerstones of deep learning can improve learning outcomes and student engagement.

Changes in the classroom environment, which became more dynamic and engaging in cycle II, also had an impact on the improvement in learning outcomes in terms of real-world situations. Because they were used to traditional, teacher-centered learning, children initially tended to be passive. Nonetheless, the use of instructional games promoted group participation, discussion, and cooperation among the students. This supports the assertion made by Kurniawan et al. (2024) that engaging and active learning can boost student motivation and engagement, which in turn can affect learning results.

Learning outcomes are also influenced by school infrastructure and classroom settings. Even though SD Santiwit Songkhla Technological College currently has a limited quantity of learning resources, especially in terms of learning devices, teachers were able to make the most of them in cycle II by grouping students and improving classroom management. Meaningful learning experiences were nevertheless produced by the alternating usage of educational games. This corroborates the findings of Nurfadhillah et al. (2021) and Titin et al. (2023), who claimed that teachers' inventiveness in adapting media to classroom conditions and the fullness of facilities both influence how effective learning media are.

The enhancement of learning outcomes in cycle II further indicates that students can get deeper conceptual comprehension and critical thinking abilities by using the deep learning approach. Through investigation and problem-solving in educational games, students concentrate not only on the outcome but also on the process of comprehending scientific ideas. This result is consistent with the research findings of Khotimah et al. (2025) and Akmal et al. (2025), who found that the deep learning strategy is successful in enhancing students' higher-order thinking abilities and conceptual understanding through contextual and reflective learning experiences.

Overall, the comparison of learning outcomes between cycles I and II demonstrates that the quality of science learning processes and outcomes can be enhanced by the use of educational games in conjunction with a deep learning approach that is tailored to the needs of students, classrooms, and educational facilities. Learning became more active, purposeful, and pleasurable after it was first passive and teacher-centered. This demonstrates that the deep learning approach is a viable and successful implementation strategy for elementary schools, particularly in settings with limited resources and diverse classroom environments.

Conclusion

Based on the findings and discussion of the study, it can be said that using educational games to support a deep learning approach in science instruction in grade IV at Santiwit Elementary School, Songkhla Technical College, Thailand, has improved student learning outcomes. Through active participation in a purposeful and entertaining learning process, this method not only raises students' cognitive success but also fosters motivation, activity, and critical thinking abilities. Using educational games can help students make the connection between science concepts and real-world experiences while also fostering an engaged learning environment. In order to enhance the caliber of the science learning process and results in elementary schools, the deep learning approach backed by educational gaming media can be utilized as an alternate creative learning strategy.

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Conflicts of Interest
No conflict interest.

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