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Active Learning Strategies and Students' Learning Outcomes in Science Towards A Proposed Action Plan

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Abstract

The study aimed to investigate the effect of an active learning strategy on the academic performance of science students at Vietnam Australia International School. The study employed a descriptive-quantitative research design, with self-created survey questionnaires and assessment test papers utilized for pre-test and post-test. The respondents to the research were sixth-grade students who assessed the impact of active learning teaching styles on their grade-level science achievement. Student performance improved dramatically with the implementation of active learning methodologies. Students agreed on using self-directed learning tools, classroom dynamics, and involvement. Students strongly preferred experiential learning, especially experiments and hands-on activities. They also recognized the importance of teamwork and exhibited an interest in the subject. Despite being the lowest-rated component of involvement, overall confidence in understanding was high, indicating potential for improvement. Active learning strategies significantly enhanced student performance. However, the use of active learning strategies did not have a significant impact on test performance. Finally, student learning will be addressed completely through research, the development of targeted interventions, and the use of data analysis to understand and reduce influential elements.

Keywords: *Active learning, self-directed learning, classroom dynamics, students' engagement*

Introduction

- Background and Rationale

Learners are naturally curious, which makes science an ideal subject for them to learn. Science allows students to explore their world and discover new things. It is also an active subject, containing activities such as hands-on labs and experiments. This makes science well-suited to active learners. Science is an important part of the foundation for education for all children. Integrating active learning methodologies into science education creates a more interesting, thorough, and useful learning experience, equipping students with the skills they need to perform well in both academic and real-world settings.

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Active learning, as described by Lombardi et al.(2021), is the construction of an understanding ecosystem. A key component of this is that learners should be active agents during instruction and that the social construction of meaning is vital for many learners, in addition to their cognitive production of knowledge. Active learning is an educational technique that focuses on student engagement and participation in the learning process. Instead of passively acquiring information from lectures or texts, students actively engage with the material through conversations, problem-solving, hands-on activities, and group learning. This strategy promotes critical thinking, information retention, and a more in-depth comprehension of the subject.

According to Nghiêm-Phú and Nguyễn (2022). The use of active learning strategies varied among four groups: "conservatives," "liberals," "junior conservatives," and "junior liberals." The lecturers' trust in and empowerment of students may have influenced the extent to which active learning methods were applied. Additionally, covert characteristics of lecturers, such as thinking, may have influenced the application of active methods. The lecturers' age, education, and experience may have influenced their use of active teaching methods. In Vietnam, various schools provide international education programs, such as the Cambridge programme, including Vietnam Australia International School, where the researcher teaches science. The curriculum provides students with a broad and deep understanding of the global landscape and the new trends that shape it, through a variety of practical and relevant subjects. The science curriculum is designed to pique students' curiosity about the natural world and foster a lifelong interest in science. It goes beyond wasteful data memorization to focus on the development of scientific thinking and inquiry skills. Students are encouraged to explore, question, and examine the world around them.

The curriculum emphasizes scientific thinking and problem solving, teaching students how to ask pertinent questions, design experiments, and analyze data. It also focuses on using models to better grasp complex scientific issues and principles. Thus, active learning tactics, which engage students in the learning process through activities, conversations, and hands-on experiences rather than passive listening, have been promoted as the best teaching strategy for teaching science.

Thus, the current study aimed to look into the impact of active learning strategies utilized as teaching approaches on students' learning outcomes in Science. The study's findings contributed to the development of an action plan that will focus on the inadequacies of integrating the strategy when teaching science.

- **Review of related literature**

This chapter presents a review of literature that has bearing on the present study. This chapter served to place the study within the larger body of knowledge. By evaluating relevant literature, the researcher was able to determine how the study compares to past studies and what gaps the research could fill. This section of the study was vital to placing the findings in the larger perspective of the field.

Active Learning

According to Khomsiah et al. (2024) also state that active learning methods significantly reduce student burnout and increase their motivation and involvement in the learning process. Whereas the study of Borda et al. (2020), which looked at the early adoption of active learning techniques in sizable, lecture-based STEM courses across several institutions, concluded that student learning results in beginning STEM courses were considerably enhanced by faculty development programs that emphasized inclusive, student-centered pedagogies.

Mayer et al. (2022) emphasize the need to employ active learning tactics such as peer education, inquiry-based activities, and collaborative problem-solving to promote deeper comprehension and knowledge retention. The authors underline that to maximize the impact of active learning activities, they must be well-planned and implemented. In addition, Borda et al. (2020) discovered that faculty development programs focusing on inclusive, student-centered

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pedagogies significantly improved student learning outcomes in starting STEM courses. To boost student engagement and comprehension, the study emphasized the need to assist teachers in implementing active learning practices. Martinez and Gomez (2025) also conducted a mini-review of research-based active learning strategies, including problem-based learning, collaborative projects, flipped classrooms, and think-pair-share.

Meanwhile, Minner et al. (2020) investigated how active learning approaches influence how well students do in science. After reviewing numerous studies, they concluded unequivocally that active learning helps kids learn more in STEM topics, such as science. They emphasized the importance of student involvement, collaboration, and the development of higher-order thinking skills. The survey also found that students are pleased about employing active learning practices.

The study of Garcia and Lee (2023) concluded that while certain active learning strategies showed promising results, the overall correlation between teacher-reported strategy utilization and standardized test scores was inconsistent and frequently non-significant. The authors stressed the necessity of fidelity in implementation and aligning active learning methodologies with specific learning objectives.

Students' Engagement

Cui & Wang (2024) stated that student engagement with pre-class activities is critical to their learning outcomes. The study highlights the collaborative annotation activities in promoting engagement and enhancing learning outcomes. Liu et al. (2024) found that learner engagement is a key mediating channel linking active learning pedagogy and learner curiosity. Active learning pedagogy is positively associated with learner engagement.

Aldhaen (2024). His study found a significant influence of teachers' digital competence on student engagement. Digital competence equally influences all three dimensions of student engagement. Borres & Paglinawan (2024) concluded that the students exhibited a high level of academic engagement in science. Students feel positive about their engagement in science activities that help connect a deeper understanding of scientific concepts. Moussa et al. (2024) uncovered students' high engagement level in classroom activities, and they perceived AI tools as useful and effortless, which promotes their engagement and attention inside classrooms.

Tufino et al. (2024) also investigated how learning outcomes and student engagement impacted high school physics lectures which uses internet resources through the Investigative Science Learning Environment (ISLE). To facilitate direct experimentation, the researchers built up a small lab with lab equipment. The findings shed light on the benefits and challenges of combining ISLE with digital data collection and analysis technologies in educational settings, demonstrating that doing so increased learning outcomes and student engagement.

On another point of view, Sánchez-López et al. (2025) discovered that ALCs, which allow for flexible classroom configurations that stimulate movement and engagement, benefit students' health as well as their learning. The authors emphasized how vital it is to include physical learning environments in schools so that children can actively engage and learn. Furthermore, Young et al. (2021) investigated how classroom design might encourage students to participate in active learning environments thus promoting classroom engagement. The study's findings revealed that well-designed spaces with flexible seating and easy access to collaborative tools can significantly enhance student involvement and motivation. The study demonstrates how crucial it is for schools to invest in building real-world environments that foster active learning approaches which will eventually promote classroom engagement.

Adler et al.'s (2025) study, which examines how teachers might use smart learning environments to promote self-regulated learning (SRL) in science classes, suggest that the effectiveness of educational tactics varies, with some teachers giving students more opportunities to participate in SRL processes. Kelly et al. (2021) also look into how teachers use free educational

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https://journals.aloysianpublications.com
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resources to help students study independently about science. It stresses ways for helping students to reflect, analyze themselves, and discover areas where they may develop. According to Garcia and Lee (2023), peer interaction and active engagement are critical for helping students understand complex scientific concepts. Rodriguez et al. (2022) investigated the usefulness of inquiry-based learning in a middle school science classroom. Their findings demonstrated that students' conceptual knowledge, classroom engagement and scientific reasoning abilities improved dramatically, highlighting the importance of practical exercises and student-led research. Furthermore, Chen and Wang's (2024) meta-analysis summarized the findings of various studies on active learning in STEM education, revealing that the strategies consistently improve student engagement and learning outcomes.

Similarly, Rodriguez et al. (2021) explored the function of student engagement as a moderator of active learning and learning outcomes. Their findings indicated that perceived teacher usage of active learning was only successful when combined with high levels of student engagement, meaning that just introducing methods without encouraging engagement may not produce substantial outcomes. As a result, student engagement in the application of the active learning approach must be treated seriously because the abilities and methods developed are lifelong learning skills that will be useful outside of the learning environment.

Activating Prior Knowledge

Activating prior knowledge enables students to find the connections between previous learning and new instruction, expands on what they already know, provides a framework for learners to better absorb new material, and gives instructors formative evaluation data to adapt training. Each student brings their background, experiences, and expertise to the classroom. This prior knowledge, also known as background knowledge or schema, forms the basis for learning new information. Activating prior knowledge consists of two steps: first, determining what students already know, and second, creating the underlying knowledge needed to access instructional information. This strategy is beneficial to all students. (The Continental Education Publisher 2023)

In the study of Hattan and Alexander (2021), they utilized relational reasoning prompts to activate knowledge. These prompts urged students to analyze how the material in the text was comparable, dissimilar, or altogether different from what they assumed they already knew or had experienced. The most common strategy was to enhance knowledge activation prior to reading, but motivating students' existing knowledge was beneficial both during and after reading. The amount, precision, and specificity of students' knowledge all contributed to the variability in the effectiveness of activation approaches. They discovered that prior knowledge activation should be structured in such a way that it activates both students' concrete, domain-specific knowledge and their more abstract, general world knowledge.

Rinnemaa and Lyngfelt (2025) imply that difficulties with civics texts may not be caused by a lack of prior knowledge but rather by the limited possibilities students have to activate their prior knowledge when engaging with civics texts. When confronted with linguistic and content issues in civics texts, students have difficulty activating their prior knowledge. This emphasizes the critical role of civics teachers in activating prior knowledge before, during, and after reading civics texts.

Enoch et al. (2024) confirmed that students are more likely to perform better in circle theorems if they have solid and better background knowledge. The study of Nemeth & Lipowsky (2024) confirmed that low-prior-knowledge students would beneft from interleaving rather than blocking as it guides them through the learning relevant comparison processes and it was found out that prior knowledge had a positive infuence on students’ development of adaptivity in the blocked but not in the interleaved condition.

Online ISSN: 3082-5121
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https://journals.aloysianpublications.com
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Latupono & Nikijuluw (2022) emphasized that, background knowledge impacts differentially on stronger and weaker readers. Readers with lower background knowledge appear to benefit more from text with high cohesion, while weaker readers were able to compensate somewhat for their relatively weak reading skills in the context of a high degree of background knowledge. The most prevalent method was to facilitate knowledge activation before reading, but prompting students' existing knowledge was also effective during and after reading. The amount, precision, and specificity of students' knowledge were all factors that contributed to the variability in the effectiveness of activation approaches.

Self-directed learning through inquiry-based learning as used in the classroom.

According to Hua et al. (2024), important connections were found between self-directed learning, course experience, deep learning, surface learning, and learning satisfaction. Whereas, Dmoshinskaia et al. (2021) state that inquiry learning is a strategy for teaching science that allows students to study a subject that simulates scientific inquiry. However, Pedaste et al. (2021) concluded that students' inquiry skills, encompassing question formulation, investigation development, and research execution, are closely intertwined with their analytical and planning proficiencies. Adler et al.'s (2025) study, which examines how teachers might use smart learning environments to promote self-regulated learning (SRL) in science classes, suggest that the effectiveness of educational tactics varies, with some teachers giving students more opportunities to participate in SRL processes. Kelly et al. (2021) also look into how teachers use free educational resources to help students study independently about science. It stresses ways for helping students to reflect, analyze themselves, and discover areas where they may develop.

Adler et al.'s (2025) study, which examines how teachers might use smart learning environments to promote self-regulated learning (SRL) in science classes, suggest that the effectiveness of educational tactics varies, with some teachers giving students more opportunities to participate in SRL processes. Kelly et al. (2021) also look into how teachers use free educational resources to help students study independently about science. It stresses ways for helping students to reflect, analyze themselves, and discover areas where they may develop. According to Wale and Bishaw (2020), inquiry-based instruction improves students' critical thinking skills by enhancing their interpretation, analysis, evaluation, inference, explanation, and self-regulation, all of which are core critical thinking skills. Inquiry-based science (IBS)" encompasses diverse pedagogical methods such as project-based and activity-based instruction, highlighting hands-on learning and discovery. Students actively conduct experiments within a guided framework, facilitating deeper comprehension. Martin-Hansen's framework delineates structured, guided, and open-ended inquiry approaches. The National Research Council updated the definition to include crucial support for inquiry. Open inquiry encourages independent exploration akin to scientific practice, while guided inquiry provides structured teacher guidance. Combining both promotes independent thinking and critical analysis. Coupled inquiry merges guided and open methods, while structured inquiry offers a more focused approach. "Inquiry-based science education (IBSE)" enables learners to construct knowledge through observation, experimentation, and teacher guidance, contrasting with traditional deductive methods. The growing demand for IBSE underscores the recognition that science thrives on questioning and personal engagement in inquiry. Alqawasmi, A., (2024) investigates the impact of inquiry-based learning (IBL) on the academic performance of third-grade students in science. Consequently, the study recommends providing in-service and pre-service training on IBL for science supervisors and teachers at the primary education level based on the observed benefits. Ali and Ulker's (2020) study delved into the potential of Inquiry-based Learning (IBL) to enhance reading and writing skills. The results unequivocally reveal that IBL significantly improves both reading and writing abilities to a noteworthy extent.

Inquiry-based instructional methods enhance research skills and foster scientific knowledge. When combined with effective teaching strategies, they model real-world concepts, improving science education accessibility. This study analyzes instructional models, subject areas, and developmental aspects used by secondary school science teachers. Continuous teacher training is advocated to deepen understanding and implement open inquiry effectively. The findings emphasize the significance of Inquiry-based Learning (IBL) in promoting innovative scientific inquiry.

Yeboah and Siaw's (2020) study investigated the impact of inquiry-based teaching methods on general chemistry concepts. The results demonstrated that the inquiry-based method was more effective in enhancing students' performance compared to traditional lecture-based methods. Furthermore, while there was no significant difference in performance based on gender in the experimental group taught with inquiry-based methods, male students in the control group taught via lectures outperformed their female counterparts significantly. The study suggests the adoption of inquiry-based methods in teaching general chemistry at Colleges of Education to provide student-teachers with problem-solving opportunities and enhance their performance in chemistry and related subjects.

Inquiry-based learning aims to cultivate critical thinking, questioning skills, and familiarity with laboratory procedures among students. Kaya and Avan (2020) designed an inquiry activity focusing on fish respiratory systems, involving 28 seventh-grade students from Kastamonu, Turkey. Students worked in groups of four over a two-hour session, beginning with guided questions to stimulate critical thinking and discussion. They then designed models using balloons, straws, and bottles to explore concepts of buoyancy. Following model testing, students engaged in reflective discussions and were interviewed to gauge their perspectives on the process. Results indicated a strong grasp of the subject matter among students, demonstrated through their model designs and problem-solving abilities. Overall, Kaya and Avan (2020) considered the activity successful in fostering both student engagement and learning, suggesting similar approaches to enhance collaborative learning experiences.

Inquiry-based learning transcends mere information sharing by fostering critical thinking skills crucial for navigating contemporary, often contentious, issues. Qamariyah et al. (2021) investigated the impact of inquiry-based learning on students' development of higher-order thinking skills, specifically in the context of socioscientific issues. Statistical analysis confirmed significant improvement in the experimental group, attributing this to regular practice of higher-order thinking compared to the control group's emphasis on rote learning. Qamariyah et al. (2021) concluded that inquiry-based learning effectively enhances students' ability to critically analyze sociocentric issues.

Wale and Bishaw (2020) investigate the impact of inquiry-based learning on the critical thinking skills of students. The study revealed that employing inquiry-based instruction for argumentative writing enhances students' critical thinking skills. As such, inquiry-based instruction is recommended as an effective approach for improving critical thinking skills. This method enhances students' abilities in interpretation, analysis, evaluation, inference, explanation, and self-regulation—core components of critical thinking. The instructional method employed by educators can profoundly impact students' level of engagement and ultimately affect their learning outcomes.

The study of Edeh (2020) investigates the influence of inquiry-based teaching on Computer Science education. The results of the post-test revealed significant positive effects of inquiry-based teaching on students' learning interests and academic achievements. The experimental group exhibited higher post-test mean scores compared to the control group, indicating an improvement in both learning engagement and academic performance following the intervention. This study underscores the transformative potential of inquiry-based teaching, offering students more opportunities for self-directed learning, exploration, and problem-solving, thereby presenting a promising alternative to traditional didactic methods.

According to Issaka (2020), students taught using the inquiry-based method demonstrated greater retention capacity compared to those exposed to traditional teaching methods. Additionally, there was a slight gender disparity observed in both achievement and retention capacity among male and female students instructed in integrated science using the inquiry-based method, with a preference towards males. However, it's important to note that the inquiry-based method proved to be highly beneficial for both genders in terms of achievement and retention, indicating its effectiveness regardless of gender.

Salazar (2020) investigated the effectiveness of inquiry-based approaches in teaching Science and their impact on the performance of Grade 10 learners. The findings unveiled significant disparities between the assessments of teachers and learners regarding the utilization of inquiry-based approaches in teaching Science.

In the study of Santos and Boyon (2020), inquiry-based lesson exemplars were developed to enhance Grade 11 STEM students' competencies in Limits and Continuity. Results indicated a positive enhancement in students' mastery of Limits and Continuity concepts, suggesting that inquiry-based approaches could be beneficial for improving student performance in mathematics education. These findings advocate for the adoption or development of inquiry-based learning materials by high school mathematics educators to enhance student learning outcomes.

Classroom dynamics and creation of a student-centered environment

Kumari (2024) pointed out the importance of student-centered teaching which contributed to classroom dynamics in shaping future scientific leaders by providing a more balanced, dynamic, and inclusive learning environment for graduate students in science education. As education continues to evolve, blending traditional methods with student-centered approaches will be key to creating engaging and empowering educational experiences that meet the demands of both students and the ever-advancing fields of science and technology. The statement of Cui and Wang supports Abdigapbarova & Zhiyenbayeva's (2023) findings which state that changes in interactive education are driven by the need to transform student-centered learning and its organizational and methodological support. Seeing it as the primary component of classroom setup encourages interaction among us students which characterize classroom dynamics.

Also, Zhao et al. (2022) found out that in promoting classroom environment to strengthen classroom dynamics through the use of current information technology in education, particularly multimedia network technology, has resulted in significant changes in the content and methods of instruction. It has replaced the traditional teacher-centered, textbook-centered, and classroom-centered teaching environments with a student-centered, information technology-based learning environment that incorporates a vast network of multimedia learning resources and virtual reality. Through the interaction among students, students can acquire information by observation, understanding, and cognition to grasp the essence of things, as well as through interactions with the learning environment. It is an effective cognitive tool that allows students to freely explore and visualize different knowledge and skills which promotes positive classroom dynamics.

According to Woods & Copur-Gencturk (2024), regardless of pedagogical method, engaged teachers gained a broad range of teaching expertise, teachers who used student-centered teaching reported greater pedagogical content knowledge improvements for themselves and promotes favorable classroom dynamics than teachers who used direct instruction.

Khairunnisa, F. P. (2025) added that the student-centered learning (SCL) method is more successful. The key concepts of SCL - active participation, personalized learning, reflection, and feedback - can help to boost motivation, critical thinking capacity, classroom dynamics and support for lifelong learning. However, using this strategy offers challenges such as class size, student preparedness, and resource availability.

On the study of Dada et al. (2023), he stressed that implementing student-centered learning in some higher education systems remains challenging because some educators have not fully

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adopted this approach and are unaware of the value and benefits of promoting the importance of classroom dynamics and favorable learning environment. Improving learners' engagement depends exclusively on the approach and implementation of student-centered learning. Establishing a positive educator-learner relationship enhances learner engagement with their level of achievement. One goal of education is to help students acquire an immersed understanding through learning rather than cramming. As a result, student engagement in the application of the active learning approach must be treated seriously because the abilities and methods developed are lifelong learning skills that will be useful outside of the learning environment.

Self-directed learning with the aid of 21st century skills

According to Hua et al. (2024). Important connections were found between self-directed learning, course experience, deep learning, surface learning, and learning satisfaction. In addition, Wahyudi et al., (2025) the ability of prospective science and technology teachers to engage in Self-Directed Learning (S-DL) is essential for their professional growth in an evolving educational landscape developed S-DL instrument is an effective tool for measuring students' readiness for self-directed learning. However developing a self-directed learning instrument requires not only mere digital knowledge but advanced digital skills.

Yusay et al. (2024) states that, training is vital for developing teachers' 21st-century competencies to aid educators with inculcating self-directed learning among students. Strakova et al. (2024) emphasized that by incorporating 21st-century abilities, teacher training would enable pre-service teachers to be not just specialists in their subjects but also competent at supporting their students' autonomous, critical, and reflective thinking. According to Khalid et al. (2022), pre-service teachers should be given a thorough understanding of global citizenship and ways to cultivate it to effectively encourage it among secondary school students.

Jones, P. A. (2024), a balanced approach that integrates both knowledge and skills is critical for developing adaptable, competent learners capable of meeting the demands of the twenty-first century. As a result, Budiarto et al. (2024) believe that e-learning contributes to the improvement of learning outcomes in psychomotor and cognitive aspects. Foundation for vocational school teachers to confidently include e-learning into their teaching activities should be provided to strengthen self-directed learning.

Higgins, J. (2024) takes another perspective and emphasizes the potential of virtual exchange programs for promoting cultural understanding and language development in tertiary education which will enable the self-directed learning among students. Furthermore, Cantas et al. (2024) stressed the necessity of developing 21st-century abilities for lifetime and self-directed learning and proposed that AI concerns may not have a substantial impact on students' skill acquisition or learning behaviors. Gao and Huber (2024) argue that digital literacy should be included as the fifth attribution cluster in the citizen scholar framework to enable self-directed learning experiences among students

The study of Rahimi, A. R. (2024) shows that instructors' access to computers for instruction (CI) in the classroom enhanced their ability to assess, navigate, and evaluate language learners' problems with them. In terms of their elements, instructors' technological pedagogical content knowledge (TPACK), information access (IA), and perception of the benefits of ICTs were the most important factors in their development as creative problem solvers. As a result, shifting away from content-based learning and toward self-learning the 21st-century skills in learning is critical in developing future-ready thinking. A blueprint for building minds that are adaptive, innovative, and prepared for tomorrow's challenges through practical case studies, insights from educational psychology, and technological integration has to be provided. Digital literacy should be included as the fifth attribution cluster in the citizen scholar paradigm. A realistic implementation mechanism for fostering self-directed learning on the 21st-century graduate

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https://journals.aloysianpublications.com
Volume 1 Issue 7 (2025)

competencies will serve to better engage citizen scholars in pedagogical initiatives, empowering learning at scale (Raza et al.2024).

Hulyadi et al., (2024) emphasized the improvement in the students' 21st-century skills, such as autonomy, collaboration, environmental sensitivity, communication, problem-solving, creativity, responsibility, and IT literacy should be augmented. This may strengthen the self – directed learning ability of students.

In addition, Hassan et al., (2025) found out, digital technologies and multimedia tools augment the accessibility and engagement of classic literature about modern learners. Thus, technology has emerged as a catalyst for innovation in education, enabling educators to adopt student-centric pedagogies that cater to diverse learning styles and abilities. Digital tools, multimedia resources, and interactive platforms have fundamentally revolutionized the learning process, promoting student participation, critical thinking, and problem-solving skills. The internet has broadened learning options beyond the classroom, fostering self-directed study and cultivating a lifelong thirst for knowledge. Academic accomplishment, as well as the use of technology in education, play an important part in developing crucial 21st-century skills. (Kaliyani 2024).

Lin (2024) investigates the possibility of ChatGPT as a virtual instructor to promote self-directed learning in adult learners. ChatGPT, by leveraging AI, can assist adult learners in setting learning goals, locating available resources, designing personalized learning plans, monitoring their performance, and reflecting on their learning experiences, ultimately leading to the successful completion of self-directed learning. In addition, Li et al. (2024) reconceptualized self-directed learning in the age of generative AI and learning technology transactions. The study underlines Chat GPT's potential as a tool for facilitating self-directed language learning (SDLL), with implications for learning technology development and AI-facilitated self-directed learning research.

However, Sain and Z.H. (2024) discovered flaws in the current educational system, intending to guide students in learning advanced abilities. It briefly discusses the notion of AIEd in connection to promoting 21st-century competencies. The author highlights the existing applications and promise of AI learning technologies, emphasizing their benefits in promoting student skill development. Therefore, there are some limits connected with these learning systems.

Synthesis

The key points of the sources mentioned above were grouped in a way that defined parallel ideas while also examining some ideas that contradicted one other. Active learning is a teaching method that actively incorporates students in the learning process by encouraging them to engage with the subject, participate in conversations, collaborate with peers, and think critically. This strategy contrasts with typical lecture-based instruction, which frequently results in passive learning. The impact of active learning on student involvement can be deep and diverse. Activating prior knowledge plays an important part in effective learning and critical thinking when integrating active learning strategy, allowing learners to use their experiences to grasp and deal with unfamiliar concepts and difficulties. However, when presented with linguistic and content challenges in civics texts, students struggle to apply their prior knowledge. This underlines the need for civics teachers to activate prior knowledge before, during, and after reading civics texts. Self-directed learning through active learning is an educational strategy that encourages active participation and a greater understanding of subjects. Improved critical thinking skills, as well as increased engagement and motivation. By incorporating self-directed learning through active learning-based methods, educators can create dynamic learning environments that prepare students not only for academic success but also for active, informed citizenship in a complex world. Classroom dynamics, or the interpersonal connections, behaviors, and interactions that occur inside a classroom setting, are critical for fostering a happy and successful learning environment. But, implementing this

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Volume 1 Issue 7 (2025)

technique has several problems, including class size, student preparation, and resource availability. In higher education systems is hard because some educators have not fully adopted this strategy and are ignorant of the significance and benefits of emphasizing classroom dynamics. On the other hand, by establishing the abilities and mindset required for self-directed learning, students may show their educational paths employing 21st-century abilities and adapt to new obstacles throughout their lives.

- **Statement of the problem**

The study sought to determine the impact of active learning practices on academic performance in science among students in grade six at Vietnam Australia International School. The study's findings provide input for the formulation of an action plan that focuses on the shortcomings of the teaching technique as well as the areas where students' academic outcomes were determined to be weak.
Specifically, it sought to answer the following questions:
1. What are the mean scores of the respondents' learning outcomes as revealed by the pretest and posttest?
2. What is the respondents' assessment of the utilization of active learning strategy as used by teachers in teaching science in terms of :
   2.1 Students' Engagement,
   2.2 Classroom dynamics
   2.3 Self-directed learning
3. Is there a significant difference between the pretest and posttest scores of the students before and after the utilization of an active learning strategy in teaching science?
4. Is there a significant relationship between the assessment of respondents on the utilization of active learning strategy and the learning outcome as revealed by the posttest scores of students?
5. Based on the findings of the study, what action plan may be proposed?

Hypotheses

- There is no significant difference between the pre-test and post-test of Grade 6 students.
- There is no significant relationship between the level of effectiveness of the active learning teaching strategy and the learning outcome as revealed by the posttest scores.

Materials and Methods

- **Research Design:** Descriptive-quantitative research design
- **Respondents:** Centered on 3 sections of grade 6 students from Vietnam Australia International School. A total of 42 students were invited to participate in the study.
- **Instruments:** A questionnaire developed by Ali and Ulker (2020) was adapted and utilized as the primary data collection instrument in this study. Some items were modified, as well as scales that assessed the effectiveness of teaching strategies under an active learning strategy in teaching science.
- **Procedure:** Gathered primary data by reading papers and other relevant publications. Secondary data comes from the students' viewpoints, which were acquired using a survey questionnaire. Permission to perform a study was requested from the school director where the study would take place. The researcher administered a pre-test assessment tool with the agreement of the school's higher authority, and a thorough classroom lesson plan for teaching science to grade 6 students was created, modeling the active learning technique. Along with the lesson plan, a pre-test, post-test, and survey questionnaire were crafted and validated by experts in the field. Following the teaching processes involving the use of an active learning technique, a post-test was administered as a form of assessment. A survey questionnaire was used to collect responses from the study's respondents

on their assessment of the success of the teachers' intervention teaching technique by asking them specific questions.

- **Data Analysis:** The acquired data was then processed, analyzed, and interpreted using the descriptive statistical procedures.

Results

Table 1 shows the mean scores of the respondents who took the pre-test and post-test.

Table 1 Mean Scores of the respondents in the pre-test and post-test

	Mean	N	Std. Deviation	Std. Error Mean
Pre-Test	6.08	40.00	4.17	0.66
Post-Test	20.50	40.00	2.82	0.45

The data imply that active learning practices can be an effective tool for science teachers looking to improve student learning outcomes. The results strongly support implementing these strategies in the classroom. In addition, it suggests that students may benefit from instructional approaches that go beyond standard passive methods. Learning methods and actively involve them in the learning process. This motivates teachers to experiment with and adopt a wide range of active learning strategies. Furthermore, the study provides practical proof for the efficacy of active learning practices in this environment, which can be used to guide the creation of programs and instructional design in scientific instruction. It also proposes that teachers should have access to professional development opportunities to become proficient in implementing these strategies.

Table 2. Utilization of active learning strategy as used by teachers in teaching Science in terms of Students' engagement

	Mean	Std. Deviation	Verbal Interpretation
1. I find the topics we study in science class interesting and engaging.	3.48	0.51	Agree
2. I actively participate in discussions and activities during science lessons	3.33	0.62	Agree
3. I enjoy asking questions and exploring new ideas in Science	3.23	0.73	Agree
4. I can see how the concepts we learn in Science apply to real-world situations.	3.48	0.64	Agree
5. I enjoy working with my classmates on science projects and experiments.	3.48	0.72	Agree
6. I am confident in my ability to understand and explain scientific concepts.	3.20	0.65	Agree

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Aloysian Interdisciplinary Journal of Social Sciences, Education, and Allied Fields
https://journals.aloysianpublications.com
Volume 1 Issue 7 (2025)

7. I appreciate the feedback I receive on my work in Science and use it to improve.	3.48	0.60	Agree
8. Hands-on experiments or activities capture my attention and motivate me to learn	3.50	0.60	Strongly Agree
STUDENTS' ENGAGEMENT	3.39	0.40	Agree

4 3.50 - 4.00 Strongly Agree 3 2.50 - 3.49 Agree 2 1.50 - 2.49 Disagree 1 1.00 - 1.49 Strongly Disagree

Result implies that science teachers' use of active learning techniques generally results in better student engagement. The high level of agreement with hands-on activities suggests that these approaches are especially successful at attracting students' attention and inspiring them to learn. This emphasizes how crucial it is to include more practical, inquiry-based activities in science classes. Students may want more assistance to get a deeper comprehension of scientific concepts, as indicated by the lower but still positive agreement with feeling confident in understanding. Teachers might concentrate on techniques that help students develop conceptual understanding, like giving them more chances to describe ideas in their own words, relating what they have learned to what they already know, and giving them focused feedback. The overall positive engagement scores provide a strong basis for improving science learning outcomes.

Table 3: Utilization of active learning strategy as used by teachers in teaching Science in terms of Classroom dynamics

	Mean	Std. Deviation	Verbal Interpretation
1. There is a positive atmosphere in the classroom that fosters open discussion.	3.35	0.77	Agree
2. All of us in the classroom are respectful and supportive of each other's contributions to group work	3.13	0.82	Agree
3. We show enthusiasm and interest in science lessons and activities.	3.33	0.62	Agree
4. We listen to each other's perspectives and respond thoughtfully during conversations.	3.28	0.64	Agree
5. The classroom setup encourages interaction among us students.	3.10	0.72	Agree
6. The diversity of students' backgrounds and perspectives is valued in my science class.	3.30	0.56	Agree

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Volume 1 Issue 7 (2025)

7. I view challenges in Science as opportunities for my growth and learning.	3.43	0.59	Agree
CLASSROOM DYNAMICS	3.28	0.51	Agree

4 3.50 - 4.00 Strongly Agree 3 2.50 - 3.49 Agree 2 1.50 - 2.49 Disagree 1 1.00 - 1.49 Strongly Disagree

The positive perception of classroom dynamics implies that well-applied active learning techniques support a good learning environment. This can affect student motivation, involvement, and, finally, learning results. The statistics support the need for professional development targeted at establishing and preserving such surroundings as well as on teacher preparation. It emphasizes the requirement of teachers to have tools to not only present interesting material but also foster in their classroom a culture of respect, honest communication, and common scientific passion. The somewhat lower score for classroom configuration suggests that teachers and educational organizations should give the physical learning environment and optimization of it top importance in support of active learning. One could consider elements such as flexible seating configurations, resource access, and chances for group projects.

Table 4 Utilization of active learning strategy as used by teachers in teaching Science in terms of Self-directed learning

	Mean	Std. Deviation	Verbal Interpretation
1. I set specific learning goals for myself in my science studies.	3.30	0.61	Agree
2. I regularly assess my progress toward achieving my science learning goals.	3.30	0.52	Agree
3. I know how to find additional resources (books, articles, videos) to support my learning in Science.	3.43	0.68	Agree
4. I am skilled at using online platforms to enhance my understanding of scientific topics.	3.33	0.69	Agree
5. I take time to reflect on what I have learned after completing a science project or experiment.	3.15	0.67	Agree
6. I regularly evaluate my strengths and weaknesses in my understanding of Science.	3.28	0.60	Agree
7. I often review my work in Science to identify areas for improvement.	3.13	0.79	Agree
8. I persevere through difficult scientific topics until I understand them fully.	3.58	0.55	Strongly Agree
SELF-DIRECTED LEARNING	3.31	0.43	Agree

4 3.50 - 4.00 Strongly Agree 3 2.50 - 3.49 Agree 2 1.50 - 2.49 Disagree 1 1.00 - 1.49 Strongly Disagree

Based on the data gathered, students have the skills they need to learn Science on their own, since the mean scores for self-directed learning are quite impressive. This is a good sign because being able to learn on your own is important for becoming a lifelong student. However, the areas where students did somewhat harder show that teachers can do more to help them develop these skills. In particular, teachers could include tasks that help students think about themselves, evaluate themselves, and find ways to improve. The data also shows that teachers are already making it easier for students to access tools, which is an important part of self-directed learning. Building on this, teachers can help students figure out how to judge the reliability and usefulness of online tools, giving them the skills they need to find what they need in the enormous amount of information.

Table 5: Composite table of the Respondents' Assessment on the Utilization of the active learning strategy as used by teachers in teaching science

	Mean	Std. Deviation	Verbal Interpretation
STUDENTS' ENGAGEMENT	3.39	0.40	Agree
CLASSROOM DYNAMICS	3.28	0.51	Agree
SELF-DIRECTED LEARNING	3.31	0.43	Agree
Assessment of the Utilization of Active Learning Strategy	3.33	0.42	Agree

4 3.50 - 4.00 Strongly Agree 3 2.50 - 3.49 Agree 2 1.50 - 2.49 Disagree 1 1.00 - 1.49 Strongly Disagree

The educators are trying to use these techniques in their scientific classes. This is encouraging because active learning is widely acknowledged to be essential for fostering critical thinking and deeper comprehension. The apparent improvements in classroom dynamics, student engagement, and self-directed learning further support the benefits of these tactics. Though favourable, the mean scores are not very high. This implies that the implementation and efficacy of active learning techniques still need to be improved. To get the most out of these strategies, teachers may need more support and professional development. It might also be helpful to investigate particular active learning techniques that enhance science education the most and deal with implementation issues.

Table 6: Test of significant difference between the pre-test and post-test scores of the students before and after the Utilization of active learning strategy in teaching science

	T	df	Sig. (2-tailed)	Decision	Remark
Pre-Test - Post-Test	-22.849	39	0.000	Reject	Significant

The results show strong evidence that active learning techniques can improve science learning outcomes for students. This suggests that science instruction should give priority to these tactics. Teachers and curriculum designers prefer to think about incorporating more active learning strategies into their lesson plans and instructional resources. This could entail adding exercises like peer teaching, group discussions, problem-solving assignments, and practical experiments. The significance and application of active learning techniques should be emphasized in teacher preparation programs. Teachers must possess the abilities and know-how necessary to plan and lead these activities successfully.

Table 7 Correlation between the assessment of respondents on the Utilization of active learning strategy and the learning outcome as revealed by the post-test scores of students

		Assessment of the Utilization of Active Learning Strategy
Post-Test	Pearson Correlation	-0.115
	Sig. (2-tailed)	0.480
	N	40

It implies that the perceived Utilization of active learning strategies does not predict or explain students' learning outcomes as measured by post-test scores. This does not mean that active learning strategies are ineffective, but it does mean that, in this study, other variables may have had a stronger influence on post-test scores.

The finding is supported by the study of Garcia and Lee (2023), which examined the impact of diverse active learning techniques on science achievement in secondary classrooms. They found that while some active learning methods showed positive trends, the overall Correlation between teacher-reported strategy use and standardized test scores was inconsistent and often non-significant. Garcia and Lee (2023) emphasized the importance of considering the fidelity of implementation and the alignment of active learning strategies with specific learning objectives

Proposed Action Plan based on the findings of the study

Specific Objectives:

1. Conduct training sessions to enhance teaching skills on the implementation of an active learning strategy in science classrooms.
2. Conduct a focus–group discussion on the design of an active learning plan.
3. Review existing learning resources and develop supplemental learning materials aligned with the active learning strategy.

Area of Concern	**Activities**	**Time-frame**	**Persons involved**	**Budget Allocation**	**Expected output**
Enhancing teaching skills in the implementation of active learning	Professional development	5 days	School leaders Subject leader Science teachers	30,000 VND	100% attendance Reflection Journal
Lesson study	FGD Focus Group discussion	2-5 days	Science teachers	10,000 VND	Lesson plan embedding an Active learning strategy
	Classroom observation			-	Observation notes focusing on active

					learning strategy implementation
Review of existing learning resources	Inventory of competencies and learning resources	5 days	Science teachers Curriculum supervisor	10,000 VND	Accomplished curriculum inventory form data
Development of supplementary materials	Write shop	5-10 days	Science teachers Curriculum supervisor	50,000 VND	Supplementary materials Activity sheets Online learning resources

4. Discussion

The statistical analysis indicated a significant difference in student performance between the pretest and posttest. The difference was noticeable in that it enabled us to exclude the possibility of no significant improvement in scores. The findings indicate that the application of active learning methodologies in science classrooms resulted in a significant enhancement of student learning outcomes. The data demonstrates that active learning tactics effectively improved student performance.

The study revealed that there is almost no link between how teachers think they use active learning techniques and how well their students do on science tests. The relationship that was seen was so weak that it did not exist, and it is possible that any connection that was seen was just a coincidence. The data shows that students' stated use of active learning strategies did not have a big effect on how well they did on tests

Conclusion

Active learning strategies enhance student scientific learning outcomes, supporting their broader adoption over passive methods, greatly increasing students' interest in science. This necessitates changing lesson planning and instructional materials to include more active learning approaches, including peer teaching, group discussions, problem-solving, and practical experiments. The significance and real-world implementation of these strategies must also be emphasized in teacher preparation programs, giving teachers the tools they need to plan and lead active learning activities successfully.

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