

The Influence of the Level of Exposure to Artificial Intelligence-Based Tools on Grade 8 Students' Conceptual Understanding in Science 8

Guia S. Azur; Marjorie M. Guevarra; Monica Luz C. Moncada

Tanauan Institute, Incorporated

DOI: <https://doi.org/10.47772/IJRISS.2026.1026EDU0321>

Received: 23 May 2026; Accepted: 28 May 2026; Published: 12 June 2026

ABSTRACT

This study examined the relationship between the use of Artificial Intelligence (AI)-based tools and the conceptual understanding of Grade 8 learners in Science 8 at Pantay Integrated High School. It focused on students' exposure to AI-based tools in terms of type of tool used, duration of usage, and level of interactivity, as well as their conceptual understanding in terms of knowledge of scientific concepts, ability to explain scientific principles, application of concepts in problem-solving, and reduction of misconceptions. The study used a quantitative correlational research design and involved 111 Grade 8 students selected through the Raosoft formula and stratified random sampling technique. Data were gathered using survey questionnaires administered to the respondents. The results showed that students had a low level of exposure to AI-based tools, while their conceptual understanding in Science was high. Findings further revealed that only the level of interactivity of AI-based tools had a significant relationship with students' conceptual understanding. Based on the findings, the study recommends that Science teachers may integrate more interactive AI-based tools and that the school provide support and training to ensure the effective and responsible use of AI tools in Science 8 instruction.

Keywords: artificial intelligence-based tools, conceptual understanding, science 8, interactivity, critical thinking, problem-solving skills

INTRODUCTION

The integration of technology in education has significantly transformed teaching and learning processes in the 21st century, particularly through the emergence of artificial intelligence (Luckin et al., 2016) AI-based tools, including intelligent tutoring systems, adaptive learning platforms, and virtual simulations, are increasingly utilized to enhance instructional delivery and student engagement (Holmes et al., 2019). These tools provide personalized learning experiences, immediate feedback, and interactive content, which are essential in promoting deeper understanding, especially in science education, where conceptual comprehension is fundamental. Despite these advancements, many students continue to demonstrate inadequate conceptual understanding in science 8, particularly at the Grade 8 level (Department of Education, 2022). Learners often rely on rote memorization rather than meaningful understanding, resulting in poor retention and limited ability to apply scientific concepts in real-life situations (Chi & Wylie, 2014; National Research Council, 2012). This persistent issue highlights the need to explore innovative instructional strategies that can effectively address these learning gaps (UNESCO, 2021). Hence, this study examines the effect of AI-based tools on the conceptual understanding of Grade 8 students in science 8. From an international perspective, educational organizations emphasize the integration of AI and digital technologies to improve the quality and inclusivity of education (UNESCO, 2021). At the national level, the Republic Act 10533, also known as the Enhanced Basic Education Act of 2013, supports the adoption of modern and innovative teaching approaches to enhance learning outcomes (Republic Act No. 10533, 2013). Furthermore, the Department of Education promotes the integration of technology within the K-12 curriculum to ensure that learners are equipped with 21st-century skills (Department of Education, 2020). These policies provide a strong legal and institutional foundation for the conduct of this study.

One of the most pressing issues in science education is the low level of students' conceptual understanding (OECD, 2019). Many Grade 8 learners struggle to grasp essential scientific concepts such as force, motion, energy, and systems (Driver et al., 2014). The dominance of traditional teaching methods, which often emphasize

memorization over comprehension, contributes to this problem (Taber, 2018). As a result, students experience difficulty in applying knowledge, which negatively affects their academic performance and critical thinking skills (OECD, 2019). This unsatisfactory condition not only impacts students but also poses challenges to teachers and the overall quality of education. The researcher selected this topic due to the increasing relevance of AI in education and the ongoing challenges in effectively teaching science concepts (Luckin et al., 2016; Holmes et al., 2019). Understanding how AI-based tools influence students' learning is essential in improving instructional practices and student outcomes (UNESCO, 2021). In science education, it's important for students to understand concepts because it helps them learn how to think critically, reason, and solve problems. (National Research Council, 2012). This study, therefore, seeks to contribute meaningful insights that can enhance both teaching strategies and student learning experiences. Although numerous studies have examined technology integration in education (Holmes et al., 2019), limited research focuses on the impact of AI-based tools on conceptual understanding in science 8. There is limited research focusing specifically on the impact of AI-based tools on conceptual understanding in Science at the Grade 8 level (UNESCO, 2021). Existing studies often emphasize academic performance rather than a deep understanding of concepts (OECD, 2019). Moreover, there is a lack of localized research within the Philippine context, particularly in public secondary schools (Department of Education, 2022). These gaps underscore the necessity of conducting a more focused and context-specific investigation.

The purpose of this study is to present actual data regarding the connection between students' conceptual knowledge in science 8 and AI-based tools. Although AI technologies have been acknowledged for their potential to improve student engagement and facilitate deeper learning of complex concepts (Holmes et al., 2019; UNESCO, 2021), there is currently little local data on how these tools affect junior high school students' comprehension of particular science topics. Therefore, by investigating how AI-based technologies could enhance students' conceptual comprehension in science 8, this study aims to close this gap. The findings of this study are expected to assist teachers, school administrators, and curriculum developers in designing more effective instructional strategies. The ultimate goal of this research is to improve students' conceptual knowledge and foster the growth of critical thinking and problem-solving abilities, which are necessary for practical applications.

RESEARCH METHODS

The study utilizes a descriptive-correlational research design. The choice of the method was appropriate to know the design to examine the influence of artificial intelligence-based tools on grade 8 students' conceptual understanding in science 8, S.Y 2025-2026. In the present study, descriptive-correlational research design is relevant because it helps the researchers describe how Grade 8 students use AI-based tools and determine their influence on students' conceptual understanding in science. Through this design, the researchers can collect data regarding students' experiences, perceptions, and learning outcomes when using AI-based tools. This approach is appropriate because it provides a clear picture of the existing influence of AI-based tools on science 8 learning during the academic year 2025–2026.

RESULTS AND DISCUSSION

This chapter presents the analysis and interpretation of the data about the problems addressed in this study.

The Level of Exposure of Grade 8 Students to Artificial Intelligence Based Tools in terms of:

1.1 Type of AI Based Tool used

Table 1.1: Level of Exposure of Grade 8 Students to Artificial Intelligence Based Tools in terms of Type of AI Based Tool used

Indicators	Mean	SD	Verbal Interpretation
1. I can use ChatGPT for answering science-related questions.	2.48	0.79	Moderate
2. I use ChatGPT for my Science subjects.	2.35	0.77	Moderate

3. I use QuillBot for Science-related tasks.	1.93	0.76	Moderate
4. I use Meta AI for understanding Science lessons.	2.56	0.89	High
5. I use Gemini AI for answering Science questions.	1.96	0.86	Moderate
6. I use AI tools to help me understand difficult Science concepts.	2.86	0.78	High
7. I use AI tools to summarize Science lessons.	2.60	0.76	High
8. I use AI tools to solve Science problems.	2.42	0.78	Moderate
9. I use more than one AI tool for my science tasks.	2.22	0.88	Moderate
10. I choose different AI tools depending on the type of science activity.	2.13	0.86	Moderate
Overall results	2.35	0.81	Moderate

Legend: Strongly Agree/Very High 3.26-4.00; Agree/High 2.51-3.25; Disagree/Moderate 1.76-2.50; Strongly Disagree/Low 1.00-1.75

Firstly, respondents demonstrated a low level of exposure to Artificial Intelligence (AI)-based tools in terms of the type of AI tool used. An overall weighted mean of 2.35, with a verbal interpretation of Disagree, indicates that Grade 8 students generally have limited exposure to various AI-based tools in Science learning. Despite this, the indicator “I use AI tools to help me understand difficult Science concepts” obtained the highest weighted mean of 2.86 and was interpreted as Agree. This suggests that students commonly utilize AI tools as learning support when encountering challenging Science lessons, particularly for clarification and explanation of difficult concepts.

According to Rose Luckin et al. (2016), AI systems provide intelligent assistance that helps explain complex concepts and support learning beyond classroom instruction. Similarly, Wayne Holmes et al. (2019) stated that AI tools enhance learning by offering personalized support and immediate explanations that improve students’ understanding of academic content.

Additionally, the indicator “I use QuillBot for Science-related tasks” obtained the lowest weighted mean of 1.93 and was interpreted as Disagree. This indicates that students rarely use QuillBot in their Science activities. One possible reason is that students are more familiar with AI-based tools such as OpenAI’s ChatGPT and Meta Meta AI, which provide direct explanations and instructional assistance, rather than paraphrasing-focused tools like QuillBot.

This finding is supported by Olaf Zawacki-Richter et al. (2019), who explained that students tend to prefer AI tools that provide tutoring, feedback, and instructional support rather than those mainly focused on paraphrasing or rewriting tasks.

1.2 Duration of Usage

Table 1.2: Level of Exposure of Grade 8 Students to Artificial Intelligence Based Tools in terms of Duration of Usage

Indicators	Weighted Mean	SD	Verbal Interpretation
1. I have been using AI tools for school-related tasks for a long time.	2.40	0.77	Moderate
1. I have been using AI tools for science subjects for several months.	2.24	0.69	Moderate
2. I use AI tools frequently when doing Science assignments.	2.44	0.77	Moderate
3. I use AI tools every week for science activities.	2.02	0.75	Moderate

4. I spend a considerable amount of time using AI tools for science tasks.	2.17	0.81	Moderate
5. I use AI tools more during exam periods.	1.42	0.65	Low
6. I regularly use AI tools during normal class days.	1.92	0.82	Moderate
7. My use of AI tools has increased over time.	1.93	0.75	Moderate
8. I use AI tools consistently whenever I have Science tasks.	2.12	0.75	Moderate
9. I continue using AI tools even after completing assignments to review lessons.	2.38	0.84	Moderate
Overall results	2.11	0.76	Moderate

Legend: Strongly Agree/Very High 3.26-4.00; Agree/High (2.51-3.25); Disagree/Moderate 1.76-2.50; Strongly Disagree/Low 1.00-1.75

Table 1.2 presents the level of exposure of Grade 8 students to Artificial Intelligence (AI)-based tools in terms of duration of usage, with an overall weighted mean of 2.11 and a verbal interpretation of Disagree. This indicates that Grade 8 students generally have limited exposure to AI-based tools in terms of how often and how long they use them for Science learning. The findings suggest that AI-based tools are not yet fully integrated into the students’ daily learning routines and are only used occasionally or when necessary. This further implies that many students still rely more on conventional learning resources and classroom instruction rather than AI-assisted learning platforms.

Additionally, the indicator “I use AI tools frequently when doing Science assignments” obtained the highest weighted mean of 2.44 and was interpreted as Disagree. Although still under the Disagree category, this suggests that students are more likely to use AI tools when completing Science assignments compared to other learning activities.

This implies that AI tools are mainly utilized as support for academic tasks and school requirements. It also indicates that students may perceive AI tools as helpful in completing assignments, understanding instructions, and clarifying difficult scientific concepts. However, the limited frequency of usage may be influenced by factors such as lack of internet access, limited familiarity with AI tools, or insufficient encouragement from teachers to regularly integrate such technologies into learning activities.

According to Khan et al. (2021), students are more likely to use AI platforms when completing tasks that require guidance, clarification, and structured support, suggesting that AI tools are commonly used for academic purposes rather than as part of regular learning routines.

On the other hand, the indicator “I use AI tools more during exam periods” obtained the lowest weighted mean of 1.42 and was interpreted as Strongly Disagree. This indicates that students rarely use AI tools during examinations or review periods. One possible reason is that students may rely more on traditional study methods such as personal notes, textbooks, or teacher-provided review materials.

The result may also suggest that students are cautious about using AI tools during assessments because of concerns related to academic honesty, accuracy of information, or school policies regarding the use of technology during examinations. Additionally, students may prefer direct review strategies such as memorization, note-taking, and teacher-led discussions when preparing for tests.

This finding is supported by Enkelejda Kasneci et al. (2023), who emphasized that although AI tools can support learning, their use during assessment periods may remain limited due to concerns regarding academic dishonesty and students’ preference for traditional review materials.

1.3 Level of Interactivity

Table 1.3: Level of Exposure of Grade 8 Students to Artificial Intelligence Based Tools in terms of Interactivity

Indicators	Mean	SD	Verbal Interpretation
1. I can ask follow-up questions when using AI tools.	2.63	0.74	High
2. Step-by-step explanations are provided by AI tools.	2.67	0.76	High
3. Confusing science ideas are clarified through AI responses.	2.54	0.72	High
4. Examples generated by AI help improve understanding.	2.67	0.84	High
5. Responses from AI tools are received quickly.	2.54	0.85	High
6. Explanations change depending on the question asked.	2.61	0.84	High
7. Engagement in learning science increases when using AI tools.	2.45	0.81	Moderate
8. AI interaction stimulates curiosity about science topics.	2.48	0.82	Moderate
9. Conversations with AI tools feel natural.	2.23	0.87	Moderate
10. Feedback is received after providing answers to AI platforms.	2.50	0.87	High
Overall results	2.53	0.81	High

Legend: Strongly Agree/Very High 3.26-4.00; Agree/High 2.51-3.25; Disagree/Moderate 1.76-2.50; Strongly Disagree/Low 1.00-1.75

Table 1.3 presents the level of exposure of Grade 8 students to Artificial Intelligence (AI)-based tools in terms of level of interactivity, with an overall weighted mean of 2.53 and a verbal interpretation of Agree. This indicates that students generally experience interactive features when using AI-based tools for Science learning. The findings suggest that AI tools provide engaging learning support that helps students better understand lessons through interaction, explanations, and guided responses.

Additionally, the indicators “Step-by-step explanations are provided by AI tools” and “Examples generated by AI help improve understanding” obtained the highest weighted mean of 2.67 and were both interpreted as Agree. This suggests that students find AI tools helpful because they provide structured explanations and relevant examples that make Science concepts easier to understand. These interactive features support learners in grasping difficult topics more effectively and encourage deeper understanding of scientific lessons.

According to Gwo-Jen Hwang and Shu-Chen Chien (2022), interactive learning technologies promote active learning by providing immediate feedback, guided explanations, and structured instructional support. Similarly, Christian Okonkwo and Abejide Ade-Ibijola (2021) noted that AI chatbots and tutoring systems enhance understanding by delivering instant explanations and academic guidance, which strengthens students’ comprehension of complex lessons.

On the other hand, the indicator “Conversations with AI tools feel natural” obtained the lowest weighted mean of 2.23 and was verbally interpreted as Moderate. This suggests that although students use AI tools for learning, some still feel that interactions are not fully natural or human-like. This may be due to limited familiarity with AI platforms or difficulty in formulating questions clearly when interacting with AI systems.

This finding is supported by Sara Borsci et al. (2021), who explained that users often experience difficulty interacting naturally with AI chatbots due to limitations in conversational flow, usability issues, and challenges

in understanding user intent. The study noted that users may feel less comfortable or satisfied when chatbot interactions do not fully resemble human communication, especially among individuals with limited familiarity with AI systems.

2. The Level of Student’s Conceptual Understanding in Science in terms of:

2.1 Knowledge of Scientific Concepts

Table 2.1: Level of Student’s Conceptual Understanding in Science in terms of Knowledge of Scientific Concepts

Indicators	Weighted Mean	SD	Verbal Interpretation
1. I can recall important scientific terms discussed in class.	2.70	0.75	High
2. I understand the basic concepts taught in my science lessons.	2.85	0.69	High
3. I can identify key ideas when studying science topics.	2.76	0.81	High
4. I remember scientific facts that I learned in previous lessons.	2.67	0.72	High
5. I can recognize scientific terms when they appear in quizzes or activities.	2.78	0.86	High
6. I understand the meaning of common scientific vocabulary.	2.70	0.83	High
7. I can describe basic scientific concepts in my own words.	2.63	0.87	High
8. I can easily remember the main ideas from science discussions.	2.92	0.78	High
9. I understand the relationships between different science concepts.	2.77	0.84	High
10. I feel confident about my knowledge of science concepts.	2.68	0.84	High
Overall results	2.75	0.80	High

Legend: Strongly Agree/Very High 3.26-4.00; Agree/High 2.51-3.25; Disagree/Moderate 1.76-2.50; Strongly Disagree/Low 1.00-1.75

Table 2.1 presents the level of students’ conceptual understanding in Science in terms of knowledge of scientific concepts, with an overall weighted mean of 2.75 and a standard deviation of 0.80, verbally interpreted as Agree/High. This indicates that students generally possess a high level of knowledge and understanding of scientific concepts, suggesting that they are capable of recalling, recognizing, and comprehending important Science ideas discussed in class.

This finding is supported by the National Academies of Sciences, Engineering, and Medicine (2018), which emphasized that Science learning should develop conceptual understanding by strengthening learners’ ability to recall and comprehend scientific ideas. This supports the interpretation that students generally have a good foundation of scientific knowledge.

Additionally, the indicator “I can easily remember the main ideas from Science discussions” obtained the highest weighted mean of 2.92 and was interpreted as High. This implies that students are able to retain essential information and key points from classroom discussions, reflecting strong comprehension and memory of Science lessons. It also suggests that the teaching strategies and learning activities may be effective in helping students retain important scientific ideas.

According to John Hattie (2023), effective learning occurs when instructional strategies promote comprehension and long-term retention through meaningful engagement. Likewise, the National Academies of Sciences, Engineering, and Medicine (2018) emphasized that Science learning strengthens conceptual understanding when learners are able to recall and comprehend scientific ideas, reinforcing the interpretation of strong foundational knowledge among students.

On the other hand, the indicator “I can describe basic scientific concepts in my own words” obtained the lowest weighted mean of 2.63, although it was still interpreted as High. This suggests that some students may experience slight difficulty in expressing scientific concepts using their own explanations. It may imply that while students understand the concepts, they still need more practice in articulating and communicating their understanding clearly.

This finding is supported by Keith Taber (2018), who explained that conceptual understanding requires learners to construct accurate mental models and clearly express scientific ideas. He emphasized that even when learners remember concepts, they may still struggle to explain them due to incomplete conceptual development or limited ability to verbalize understanding. This supports the interpretation that students may need further support in developing scientific communication skills.

2.2 Ability to Explain Scientific principles

Table 2.2: Level of Student’s Conceptual Understanding in Science in terms of Ability to Explain Scientific principles

Indicators	Mean	SD	Verbal Interpretation
1. I can explain science concepts using my own words.	2.76	0.762	High
2. I can describe how scientific processes happen.	2.57	0.769	High
3. I can explain the reason behind scientific events or phenomena.	2.39	0.80	Moderate
4. I can explain science ideas clearly to my classmates.	2.68	0.75	High
5. I can describe how different science concepts are connected.	2.63	0.69	High
6. I can explain scientific principles when answering questions in class.	2.77	0.70	High
7. I can give examples when explaining science concepts.	2.68	0.78	High
8. I can explain science topics even without looking at my notes.	2.54	0.80	High
9. I can clearly describe the steps in a scientific process.	2.63	0.77	High
10. I can explain why certain scientific results happen.	2.66	0.80	High
Overall results	2.63	0.76	High

Legend: Strongly Agree/Very High 3.26-4.00; Agree/High 2.51-3.25; Disagree/Moderate 1.76-2.50; Strongly Disagree/Low 1.00-1.75

Table 2.2 presents the level of students’ conceptual understanding in Science in terms of their ability to explain scientific principles, with an overall weighted mean of 2.63 and a standard deviation of 0.76, verbally interpreted as Agree/High. This indicates that students generally have a high ability to explain scientific principles, suggesting that they can express scientific ideas, describe processes, and provide explanations related to Science lessons.

Additionally, the indicator “I can explain scientific principles when answering questions in class” obtained the

highest weighted mean of 2.77 and was interpreted as High. This implies that students are confident in explaining scientific principles during classroom interactions and are able to apply what they have learned when responding to questions. Another indicator with a similarly high result is “I can explain Science concepts using my own words,” which obtained a weighted mean of 2.76 and was also interpreted as High. This suggests that students are capable of communicating scientific ideas in a way that reflects understanding and comprehension of the lessons discussed in class.

This finding is supported by Matthew Bond et al. (2020), who explained that student engagement and active participation strengthen learning outcomes. When students actively participate in classroom discussions, they become more confident in expressing scientific ideas, which enhances their conceptual thinking and communication skills. On the other hand, the indicator “I can explain the reason behind scientific events or phenomena” obtained the lowest weighted mean of 2.39. Although this is the lowest among the indicators, it still suggests that some students may experience slight difficulty in providing deeper explanations or reasoning behind scientific phenomena. This implies that while students can explain scientific concepts, they may still need further support in developing higher-order reasoning skills and a deeper understanding of cause-and-effect relationships in Science.

This finding is supported by Keith Taber (2018), who emphasized that students often struggle with deeper scientific reasoning because misconceptions can interfere with their understanding of cause-and-effect relationships. Likewise, the National Academies of Sciences, Engineering, and Medicine (2018) stressed that deeper scientific explanation requires reasoning and application skills, which are considered higher-order competencies compared to simple recall and basic explanation. This supports the interpretation that students may need additional support in developing stronger analytical and reasoning skills in Science.

2.3 Application of Concepts in Problem Solving

Table 2.3: Level of Student’s Conceptual Understanding in Science in terms of Application of Concepts in Problem Solving

Indicators	Mean	SD	Verbal Interpretation
1. I can apply science concepts to solve problems.	2.98	0.68	High
2. I can use my science knowledge to answer difficult questions.	2.78	0.77	High
3. I can apply what I learned in science to real-life situations.	2.91	0.78	High
4. I can use science concepts when solving experiment-related questions.	2.78	0.73	High
5. I can analyze science problems and find possible solutions.	2.81	0.66	High
6. I can use scientific ideas to explain everyday situations.	2.70	0.74	High
7. I can apply science concepts during quizzes and exams.	2.83	0.75	High
8. I can solve science problems by using what I learned in class.	3.00	0.73	High
9. I can identify which scientific concept is needed to solve a problem.	2.90	0.73	High
10. I can use science knowledge to make decisions in real-life situations.	2.92	0.82	High
Overall result	2.86	0.74	High

Legend: Strongly Agree/Very High 3.26-4.00; Agree/High 2.51-3.25; Disagree/Moderate 1.76-2.50; Strongly Disagree/Low 1.00-1.75

Table 2.3 presents the level of students’ conceptual understanding in Science in terms of application of concepts in problem-solving, with an overall weighted mean of 2.86 and a standard deviation of 0.74, verbally interpreted as Agree/High. This indicates that students generally demonstrate a high ability to apply scientific concepts in solving problems, suggesting that they can use their Science knowledge effectively during activities, assessments, and real-life situations.

Additionally, the indicator “I can solve Science problems by using what I learned in class” obtained the highest weighted mean of 3.00 and was interpreted as High. This implies that students are able to transfer what they have learned from classroom discussions into solving Science-related problems. Another indicator with a similarly high result is “I can apply Science concepts to solve problems,” which obtained a weighted mean of 2.98 and was also interpreted as High. This suggests that students are confident in using their conceptual understanding when facing problem-solving tasks and academic activities.

This finding is supported by the Organisation for Economic Co-operation and Development (2019), which highlighted that scientific literacy is demonstrated when learners can apply scientific knowledge to solve real-world and academic problems. This supports the interpretation that students who are able to transfer classroom learning into problem-solving tasks have developed stronger conceptual mastery.

On the other hand, the indicator “I can use scientific ideas to explain everyday situations” obtained the lowest weighted mean of 2.70, although it was still interpreted as High. This suggests that students may slightly struggle in explaining real-life situations using scientific reasoning, even though they can still apply concepts in problem-solving activities. It implies that while students possess strong conceptual understanding, they may still need additional support in applying scientific reasoning beyond classroom-based tasks.

This finding is supported by Keith Taber (2018), who explained that many students may perform well in structured academic problem-solving tasks but still find it difficult to connect scientific concepts to everyday situations because doing so requires higher-order reasoning and real-world transfer of knowledge. This supports the interpretation that students may benefit from further opportunities to apply scientific concepts in authentic and practical contexts.

2.4 Reduction of Misconceptions

Table 2.4: Level of Student’s Conceptual Understanding in Science in terms of Reduction of Misconceptions

Indicator	Mean	SD	Verbal Interpretation
1. I can recognize when my understanding of a science concept is incorrect.	2.85	0.82	High
2. I try to correct my mistakes when I misunderstand a science lesson.	2.99	0.70	High
3. I ask questions when I am confused about a science concept.	3.00	0.82	High
4. I change my understanding when I learn the correct scientific explanation.	3.00	0.71	High
5. I review lessons to make sure I understand the correct science concepts.	2.91	0.81	High
6. I compare my answers with the correct explanation in class.	2.93	0.70	High
7. I try to find the correct explanation when I realize I made a mistake.	2.99	0.73	High
8. I improve my understanding after receiving feedback from my teacher.	3.01	0.82	High
9. I reflect on my mistakes in science activities.	2.81	0.84	High

10. I work on correcting misunderstandings in science topics.	2.87	0.86	High
Overall result	2.94	0.78	High

Legend: Strongly Agree/Very High 3.26-4.00; Agree/High 2.51-3.25; Disagree/Moderate 1.76-2.50; Strongly Disagree/Low 1.00-1.75

Table 2.4 presents the level of students’ conceptual understanding in Science in terms of reduction of misconceptions, with an overall weighted mean of 2.94 and a standard deviation of 0.78, verbally interpreted as Agree/High. This indicates that students generally demonstrate a high ability to reduce misconceptions, suggesting that they are aware of their mistakes and are willing to correct misunderstandings in Science lessons.

Additionally, the indicator “I improve my understanding after receiving feedback from my teacher” obtained the highest weighted mean of 3.01 and was interpreted as High. This implies that students highly value teacher feedback and use it effectively to strengthen their understanding of scientific concepts. Furthermore, the indicators “I ask questions when I am confused about a Science concept” and “I change my understanding when I learn the correct scientific explanation,” both obtained a weighted mean of 3.00 and were also interpreted as High. These findings suggest that students are open to learning, willing to clarify confusion, and capable of adjusting their understanding when provided with correct scientific explanations.

This finding is supported by John Hattie (2023), who identified feedback as one of the strongest influences on student learning. Hattie emphasized that feedback helps learners recognize errors, correct misconceptions, and improve conceptual understanding, supporting the interpretation that teacher feedback plays a major role in reducing misconceptions and strengthening learning.

Furthermore, conceptual change theories explain that misconceptions are reduced when learners actively reconstruct their understanding through feedback, inquiry, and reflection. This suggests that students become more capable of replacing incorrect prior knowledge with scientifically accurate explanations when they are actively engaged in the learning process.

On the other hand, the indicator “I reflect on my mistakes in Science activities” obtained the lowest weighted mean of 2.81, although it was still interpreted as High. This suggests that while students do reflect on their mistakes, this behavior is slightly less evident compared to other actions such as asking questions and correcting misunderstandings. It implies that students may need more opportunities and structured activities that encourage deeper reflection to further strengthen their learning process. This finding is supported by the National Academies of Sciences, Engineering, and Medicine (2018), which emphasized that reflective thinking is an advanced skill that develops gradually over time. The organization noted that while feedback can help correct misconceptions, deeper self-reflection requires intentional and structured learning experiences such as journaling, error analysis, and inquiry-based activities.

3.1 Relationship between the Level of Exposure of Junior High School Students to Artificial Intelligence Based Tools and the Level of Student’s Conceptual Thinking in Science

Table 3.1: Level of Exposure of Grade 8 Students to Artificial Intelligence Based Tools and Knowledge of Scientific Concepts

Level of Exposure to AI-based Tools	Level of Conceptual Understanding in Science	r -value	Sig. (2-tailed)	Interpretation
Type of AI Based Tool Use	Knowledge of Scientific Concepts	0.197	0.039	Reject Ho, Significant
Duration of Use		0.158	0.097	Accept Ho, Not Significant
Level of Interactivity		0.454	0.000	Reject Ho, Significant

The table presents the results of statistical analyses examining the relationship between the level of exposure of Grade 8 students to AI-based tools and their knowledge of scientific concepts. The Pearson correlation coefficients (r-values) indicate that two indicators of AI exposure demonstrate significant positive relationships with students' knowledge of scientific concepts, while one indicator does not show a significant relationship.

The correlation between Type of AI-Based Tool Use and knowledge of scientific concepts demonstrates an r-value of 0.197 and a p-value of 0.039, which reflects a significant but weak positive correlation. This signifies that the different AI tools used by students may slightly contribute to improving their understanding of scientific concepts. However, the relationship remains minimal, suggesting that the type of AI tool alone has only a limited influence on conceptual understanding.

On the other hand, the correlation between Duration of Use and knowledge of scientific concepts demonstrates an r-value of 0.158 and a p-value of 0.097, which indicates no significant correlation. This signifies that the length of time students use AI-based tools does not necessarily improve their conceptual understanding in Science. This implies that prolonged use of AI tools alone is insufficient in enhancing students' scientific knowledge. This finding is supported by Enkelejda Kasneci et al. (2023), who explained that the effectiveness of AI tools depends more on the quality of student interaction rather than the duration of use. The study emphasized that prolonged use does not automatically result in improved learning when students engage only in surface-level interactions such as seeking quick answers instead of meaningful learning experiences.

Lastly, the correlation between Level of Interactivity and knowledge of scientific concepts demonstrates an r-value of 0.454 and a p-value of 0.000, which reflects a significant moderate positive correlation. This signifies that students who experience more interactive AI-based learning, such as receiving explanations, asking follow-up questions, and engaging in guided responses, tend to have better understanding of scientific concepts.

This finding is strongly supported by Wayne Holmes et al. (2019), who stated that interactive AI systems improve learning through immediate feedback, adaptive instruction, and personalized learning pathways. Likewise, Chen et al. (2020) emphasized that AI-driven interactive environments strengthen comprehension through intelligent dialogue and guided explanations, highlighting that interactivity plays a more meaningful role in learning than mere exposure or usage duration.

Table 3.2: Level of Exposure of Grade 8 Students to Artificial Intelligence Based Tools and Ability to Explain Scientific Concepts

Level of Exposure to AI-based Tools	Level of Conceptual Understanding in Science	r -value	Sig. (2-tailed)	Interpretation
Type of AI Based Tool Use	Ability to Explain Scientific Concepts	-0.013	0.889	Accept Ho, not Significant
Duration of Use		0.022	0.818	Accept Ho, not Significant
Level of Interactivity		0.309	0.001	Reject Ho, Significant

The table presents the results of statistical analyses examining the relationship between the level of exposure of Grade 8 students to AI-based tools and their ability to explain scientific concepts. The Pearson correlation coefficients (r-values) indicate that among the three indicators of AI exposure, only the level of interactivity demonstrates a significant relationship with students' ability to explain scientific concepts, while the type of AI tool used and duration of use do not show significant relationships.

The correlation between Type of AI-Based Tool Use and students' ability to explain scientific concepts demonstrates an r-value of -0.013 and a p-value of 0.889, which reflects no significant correlation. The very low negative r-value signifies an almost negligible inverse relationship, meaning that the type of AI tool used has virtually no effect on students' explanation skills in Science.

This finding is supported by Scherer et al. (2020), who emphasized that AI tools become effective only when integrated into meaningful instructional strategies. This implies that the effectiveness of AI in improving explanation skills depends more on how the technology is used in learning rather than on the specific type of AI tool.

Similarly, the correlation between Duration of Use and students’ ability to explain scientific concepts demonstrates an r-value of 0.022 and a p-value of 0.818, which also reflects no significant correlation. This signifies that the amount of time students spend using AI tools does not necessarily improve their ability to explain scientific concepts. It suggests that prolonged exposure to AI tools alone is insufficient in enhancing students’ explanation skills in Science.

This finding is supported by Leo Lo (2023), who stated that AI tools may provide learning assistance, but extended use does not guarantee improved learning outcomes if students remain passive and fail to engage in deep cognitive processing. This implies that explanation skills depend more on meaningful engagement than on duration of use.

On the other hand, the correlation between Level of Interactivity and students’ ability to explain scientific concepts demonstrates an r-value of 0.309 and a p-value of 0.001, which reflects a significant moderate positive correlation. This signifies that students who experience higher levels of interaction with AI tools, such as receiving explanations, asking follow-up questions, and obtaining immediate responses, are more likely to improve their ability to explain scientific ideas.

This finding is supported by Gwo-Jen Hwang and Shu-Chen Chien (2022), who explained that interactive learning technologies enhance students’ ability to communicate scientific concepts through real-time feedback and guided instruction. Likewise, Christian Okonkwo and Abejide Ade-Ibijola (2021) found that AI chatbots support learning by encouraging questioning, clarification, and explanation practice, which strengthens students’ conceptual explanation skills.

Table 3.3: Level of Exposure of Grade 8 Students to Artificial Intelligence Based Tools and Application of Concepts in Problem-Solving

Level of Exposure to AI-based Tools	Level of Conceptual Understanding in Science	r -value	Sig. (2-tailed)	Interpretation
Type of AI Based Tool Use	Application of Concepts in Problem Solving	0.092	0.337	Accept Ho, not Significant
Duration of Use		-0.097	0.310	Accept Ho, not Significant
Level of Interactivity		0.267	0.005	Reject Ho, Significant

The table presents the results of statistical analyses examining the relationship between the level of exposure of Grade 8 students to AI-based tools and their ability to apply Science concepts in problem-solving. The Pearson correlation coefficients (r-values) indicate that among the three indicators of AI exposure, only the level of interactivity demonstrates a significant relationship with students’ ability to apply scientific concepts in problem-solving, while the type of AI tool used and duration of use do not show significant relationships.

The correlation between Type of AI-Based Tool Use and students’ ability to apply scientific concepts in problem-solving demonstrates an r-value of 0.092 and a p-value of 0.337, which reflects no significant correlation. The very weak positive correlation signifies that the influence of the type of AI tool on students’ problem-solving ability is minimal.

This finding is supported by Wayne Holmes et al. (2019), who emphasized that the effectiveness of AI in learning depends not on the specific tool used, but on how it is integrated into the learning process. This implies that without structured and meaningful use, different AI tools may not significantly affect students’ problem-solving

skills.

Likewise, the correlation between Duration of Use and students’ ability to apply scientific concepts in problem-solving demonstrates an r-value of -0.097 and a p-value of 0.310, which also reflects no significant correlation. The very weak negative correlation signifies that the length of time students spend using AI tools does not have a meaningful influence on their performance in applying scientific concepts during problem-solving activities.

This finding is supported by Enkelejda Kasneci et al. (2023), who explained that students may use AI tools for convenience rather than for deep learning, and longer exposure does not necessarily lead to improved skill development. This suggests that problem-solving ability depends more on how AI tools are utilized rather than on how long they are used.

In contrast, the correlation between Level of Interactivity and students’ ability to apply scientific concepts in problem-solving demonstrates an r-value of 0.267 and a p-value of 0.005, which reflects a significant weak to moderate positive correlation. This signifies that students who engage more interactively with AI tools, such as asking questions, receiving feedback, and accessing explanations, tend to perform better in solving Science-related problems.

This finding is supported by Chen et al. (2020), who stated that interactive AI systems enhance learning outcomes by engaging students in guided instruction, problem-solving activities, and immediate feedback. Similarly, Tang et al. (2021) found that AI-supported adaptive learning systems improve student performance by adjusting learning content based on learner responses. These findings support the conclusion that interactive AI engagement plays a key role in strengthening students’ problem-solving abilities in Science.

Table 3.4: Level of Exposure of Grade 8 Students to Artificial Intelligence Based Tools and reduction of Misconceptions

Level of Exposure to AI-based Tools	Level of Conceptual Understanding in Science	r -value	Sig. (2-tailed)	Interpretation
Type of AI Based Tool Use	Reduction of Misconceptions	0.078	0.414	Accept Ho, not Significant
Duration of Use		-0.060	0.534	Accept Ho, not Significant
Level of Interactivity		0.304	0.001	Reject Ho, Significant

The table presents the results of statistical analyses examining the relationship between the level of exposure of Grade 8 students to AI-based tools and their reduction of misconceptions in Science. The Pearson correlation coefficients (r-values) indicate that among the three indicators of AI exposure, only the level of interactivity demonstrates a significant relationship with students’ ability to reduce misconceptions, while the type of AI tool used and duration of use do not show significant relationships.

The correlation between Type of AI-Based Tool Use and students’ reduction of misconceptions demonstrates an r-value of 0.078 and a p-value of 0.414, which reflects no significant correlation. The very weak positive correlation signifies that the relationship between the type of AI tool used and reduction of misconceptions is minimal and not meaningful.

This finding is supported by Olaf Zawacki-Richter et al. (2019), who emphasized that although AI tools differ in function, misconceptions are not corrected simply through exposure to these technologies. The study explained that reducing misconceptions requires meaningful cognitive engagement and effective feedback. This suggests that the specific type of AI tool alone is insufficient in correcting students’ misunderstandings in Science.

Similarly, the correlation between Duration of Use and students' reduction of misconceptions demonstrates an r -value of -0.060 and a p -value of 0.534 , which also reflects no significant correlation. The very weak negative correlation signifies that the amount of time students spend using AI tools does not have a meaningful influence on correcting misconceptions and misunderstandings in Science. This finding is supported by UNESCO (2021), which emphasized that while AI tools can support learning, their effectiveness depends on proper implementation, guided use, and learner readiness.

This suggests that even if students spend more time using AI tools, misconceptions may still persist when the technologies are not used meaningfully or when learning lacks proper guidance. On the other hand, the correlation between Level of Interactivity and students' reduction of misconceptions demonstrates a significant moderate positive relationship, with an r -value of 0.304 and a p -value of 0.001 .

This signifies that students who engage more interactively with AI tools, such as through simulations, guided explanations, and inquiry-based learning platforms, are more likely to correct misunderstandings and improve their scientific understanding.

This finding is supported by Wayne Holmes et al. (2019), who stated that AI-based learning systems enhance understanding through immediate corrective feedback and interactive explanations. Likewise, Keith Taber (2018) emphasized that misconceptions are reduced when learners actively confront incorrect ideas and replace them with scientifically accurate explanations. These findings support the conclusion that interactivity plays a crucial role in helping students identify and correct misconceptions in Science.

SUMMARY OF FINDINGS

The salient findings of the study are summarized as follows:

1. Grade 8 students in science showed a moderate level of exposure to AI-based tools in science, with an overall mean of 2.35 Disagree/Moderate. AI tools are mainly used for basic tasks such as understanding concepts, summarizing lessons, and using Meta AI, while advanced tools like ChatGPT, QuillBot, and Gemini AI are rarely used. This indicates that AI tools are underutilized for higher-level Science learning tasks.
2. AI-based tools are used by Grade 8 learners to support learning in science, particularly in understanding lessons, completing assignments, and reviewing topics, which helps improve their comprehension.
3. There is no significant relationship between the students conceptual understanding and the type of AI-based tools use as well as their duration of usage. However, significant relationship was found between the level of interactivity of AI base tools and their conceptual understanding particularly reduction of misconception.

CONCLUSION

The findings of the study led to the conclusion that Junior High School students have moderate to high exposure to Artificial Intelligence (AI)-based tools in terms of type of AI tool used, duration of usage, and level of interactivity. The students also demonstrated a high level of conceptual understanding in Science, particularly in knowledge of scientific concepts, ability to explain scientific principles, application in problem-solving, and reduction of misconceptions.

Furthermore, the study revealed that there is no overall significant relationship between students' level of exposure to AI-based tools and their conceptual understanding in Science. However, a significant relationship was identified in terms of level of interactivity, particularly in reducing misconceptions.

Therefore, the null hypothesis stating that there is no significant relationship between the level of exposure to AI-based tools and the conceptual understanding of Junior High School students in Science is partially rejected.

RECOMMENDATIONS

In light of the findings and conclusion of the study, the following recommendations are offered:

1. Teachers are encouraged to provide proper guidance on the appropriate and ethical use of AI-based tools in science 8. They may integrate AI tools into classroom activities through specific strategies such as creating AI-assisted infographics, interactive quizzes, concept mapping activities, virtual science simulations, and guided research tasks. Teachers may also use AI-generated step-by-step explanations and problem-solving exercises to improve student engagement, conceptual understanding, and critical thinking while still promoting independent learning and active classroom participation.
2. Students are encouraged to use AI-based tools responsibly as supplementary learning resources in science 8. They may utilize AI applications such as ChatGPT, QuillBot, Gemini, and Meta AI for clarifying scientific concepts, summarizing lessons, generating practice questions, and improving understanding of science topics. However, students should avoid overdependence on these tools and continue exerting effort in understanding concepts and completing academic tasks independently.
3. School administrators are encouraged to conduct orientations, seminars, or training programs for both teachers and students to raise awareness regarding the proper use, limitations, and potential risks of AI-based tools in education. They may also support the integration of AI-based tools through school policies, digital learning resources, and improved internet accessibility within the school environment.
4. Parents and guardians are advised to monitor their children's use of AI-based tools at home to ensure that these technologies are used mainly for educational purposes. They may also guide students in using AI responsibly and ethically by encouraging balanced study habits and critical evaluation of AI-generated information.
5. Future researchers may conduct similar studies using different variables, research designs, or larger samples to further explore other factors that may affect the conceptual understanding of learners in science. Future studies may also focus on other subject areas, grade levels, or the long-term effects of AI-based learning tools on academic performance and critical thinking skills.
6. To enhance the effectiveness of AI-based tools and address misconceptions in science learning, teachers may implement specific strategies such as fact-checking activities, AI response analysis, reflective journaling, inquiry-based learning tasks, collaborative group discussions, and guided error analysis activities. Students may be asked to compare AI-generated answers with information from textbooks, teacher discussions, and reliable scientific references to verify accuracy and deepen conceptual understanding. Teachers may also encourage learners to explain AI-generated responses in their own words, identify incorrect information, and participate in problem-solving and peer discussion activities to strengthen critical thinking and reduce misconceptions in science 8.

ACKNOWLEDGMENT

The researchers wish to express their most profound and heartfelt gratitude to the following people who offered their wholehearted and sympathetic support and who allotted their valuable resources toward the completion of this piece of work.

Behind the fulfilment of this work, the researchers would like to extend their deepest gratitude to certain valuable persons for their help and support in the completion of this study. Recognition and heartfelt thanks are hereby extended to the following:

Dr. Nelson “Sonny” Perez Collantes, Chairman Emeritus of Tanauan, and **Hon. Ma. Theresa “Maitet” Collantes**, Congresswoman of the 3rd District of Batangas, for the scholarship given to the researchers;

Ms. Guia S. Azur, our research teacher, for her brilliant ideas and substantial knowledge, for her constructive criticisms, which serve as a foundation and challenge for the success of our profession;

Mrs. Annie B. Presto, Ms. Madelle Masongsong and Ms. Bel Patrice T. Tisuela, the validators, for their valuable suggestions and comments;

Mr. Mark Andrew Rimas, our statistician, for his dedication to helping in fulfilling our research;

Ms. Nicca Angela M. Piamonte, our grammarian, for her invaluable assistance as the grammarian for this research;

Dr. Nelia Mananguit, dean of studies, for his understanding and consideration in working on this thesis;

The **Administrators and Teachers** at Tanauan Institute Inc. for their wholehearted cooperation and support;

Above all, to the **Almighty God** for being good and gracious to them throughout the completion of this research.

REFERENCES

1. AIRAJ, M. (2024). ETHICAL ARTIFICIAL INTELLIGENCE FOR TEACHING-LEARNING IN HIGHER EDUCATION. EDUCATION AND INFORMATION TECHNOLOGIES, 29(13), 17145–17167
[HTTPS://DOI.ORG/10.1007/S10639-024-12545-X](https://doi.org/10.1007/s10639-024-12545-x)
2. Almasri, F. (2024). Exploring the impact of artificial intelligence in teaching and learning of science: A systematic review of empirical research. *Research in Science Education*, 54(5), 977–997.
<https://doi.org/10.1007/s11165-024-10176-3>
3. Althaus, B. E. (2026). The effects of artificial intelligence use on school psychologists' job satisfaction and perceived workload (Master's thesis, University of Dayton). OhioLINK Electronic Theses and Dissertations Center. http://rave.ohiolink.edu/etdc/view?acc_num=dayton1771921924667274
4. Bond, M., Buntins, K., Bedenlier, S., Zawacki-Richter, O., & Kerres, M. (2020). Mapping research in student engagement and educational technology in higher education: A systematic review. *Educational Technology Research and Development*, 68(4), 1875–1906. <https://doi.org/10.1007/s11423-020-09825-5>
5. Chen, L., Chen, P., & Lin, Z. (2020). Artificial intelligence in education: A review. *IEEE Access*, 8, 75264–75278. <https://doi.org/10.1109/ACCESS.2020.2988510>
6. Chi, M. T. H., & Wylie, R. (2014). The ICAP framework: Linking cognitive engagement to active learning outcomes. *Educational Psychologist*, 49(4), 219–243.
<https://doi.org/10.1080/00461520.2014.965823>
7. Cheng, M., Fu, C., Okabe, R., Chotrattanapituk, A., Boonkird, A., Hung, N. T., & Li, M. (2026). Artificial intelligence-driven approaches for materials design and discovery. *Nature Materials*, 25(2), 174–190. <https://doi.org/10.1038/s41563-025-02403-7>
8. Cox, A. M. (2021). Exploring the impact of artificial intelligence and robots on higher education through literature-based design fictions. *International Journal of Educational Technology in Higher Education*, 18(1), Article 3. <https://doi.org/10.1186/s41239-021-00248-2>
9. Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). SAGE Publications.
10. Da Paixão, J. L. (2026). Artificial intelligence and school assessment: Formative potential, teacher mediation, and ethical challenges in contemporary evaluative practices. *Journal International Review of Research Studies*, 1(4), 1–15. <https://doi.org/10.66104/374y8m47>
11. Department of Education. (2020). Basic education learning continuity plan for School Year 2020–2021 in light of the COVID-19 public health emergency. Department of Education, Republic of the Philippines.
12. Department of Education. (2022). Basic education report 2022. Department of Education, Republic of the Philippines.
13. Driver, R., Asoko, H., Leach, J., Mortimer, E., & Scott, P. (2014). Constructing scientific knowledge in the classroom. *Educational Researcher*, 23(7), 512. Forman, N., Udvaros, J., & Avornicului, M. S. (2023). ChatGPT: A new study tool shaping the future for high school students. *International Journal of Advanced Natural Sciences and Engineering Researches*, 7(4), 95–102.
14. Hao, Q., Xu, F., Li, Y., & Evans, J. (2026). Artificial intelligence tools expand scientists' impact but contract science's focus. *Nature*, 649(8099), 1237–1243. <https://doi.org/10.1038/s41586-025-09922-y>

15. Hattie, J. (2023). *Visible learning: The sequel*. Routledge.
16. Holmes, W., Bialik, M., & Fadel, C. (2019). *Artificial intelligence in education: Promises and implications for teaching and learning*. Center for Curriculum Redesign.
17. Hwang, G.-J., & Chien, S.-C. (2022). Definition, roles, and potential research issues of the metaverse in education: An artificial intelligence perspective. *Computers and Education: Artificial Intelligence*, 3, 100082. <https://doi.org/10.1016/j.caeai.2022.100082>
18. Imran, M., & Almusharraf, N. (2023). Analyzing the role of ChatGPT as a writing assistant at higher education level: A systematic review of the literature. *Contemporary Educational Technology*, 15(4), ep464. <https://doi.org/10.30935/cedtech/13605>
19. Kasneci, E., Sessler, K., Küchemann, S., Bannert, M., Dementieva, D., Fischer, F., Gasser, U., Groh, G., Günnemann, S., Hüllermeier, E., Krusche, S., Kutyniok, G., Michaeli, T., Nerdel, C., Pfeffer, J., Poquet, O., Sailer, M., Schmidt, A., Seidel, T., ... Kasneci, G. (2023). ChatGPT for good? On opportunities and challenges of large language models for education. *Learning and Individual Differences*, 103, 102274. <https://doi.org/10.1016/j.lindif.2023.102274>
20. Khalil, M., & Er, E. (2021). Will AI replace teachers? Artificial intelligence in education and the future of learning. *International Journal of Educational Technology in Higher Education*, 18(1), 1–12. <https://doi.org/10.1186/s41239-021-00255-3>
21. Lim, J., Leinonen, T., Lipponen, L., Lee, H., DeVita, J., & Murray, D. (2023). Artificial intelligence as relational artifacts in creative learning. *Digital Creativity*, 34(3), 192–210. <https://doi.org/10.1080/14626268.2023.2236595>
22. Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). *Intelligence unleashed: An argument for AI in education*. Pearson.
23. Marrone, R., Taddeo, V., & Hill, G. (2022). Creativity and artificial intelligence—A student perspective. *Journal of Intelligence*, 10(3), 65. <https://doi.org/10.3390/jintelligence10030065>
23. National Academies of Sciences, Engineering, and Medicine. (2018). *How people learn II: Learners, contexts, and cultures*. The National Academies Press. <https://doi.org/10.17226/24783>
24. National Research Council. (2012). *A framework for K–12 science education: Practices, crosscutting concepts, and core ideas*. National Academies Press. <https://doi.org/10.17226/13165>
25. OECD. (2019). *OECD skills outlook 2019: Thriving in a digital world*. OECD Publishing. <https://doi.org/10.1787/df80bc12-en>
26. Okonkwo, C. W., & Ade-Ibijola, A. (2021). Chatbots applications in education: A systematic review. *Computers and Education: Artificial Intelligence*, 2, 100033. <https://doi.org/10.1016/j.caeai.2021.100033>
27. Paloma, N. F. M., Osabel, F. R., & Mojado, C. M. (2026). Artificial intelligence integration and student learning outcomes at Palompon Institute of Technology. *Open Access Research Journal of Science and Technology*, 17(1), 001–006. <https://doi.org/10.53022/oarjst.2026.17.1.0050>
28. Republic Act No. 10173. (2012). *Data Privacy Act of 2012*. Official Gazette of the Republic of the Philippines.
29. Republic Act No. 10533. (2013). *Enhanced Basic Education Act of 2013*. Official Gazette of the Republic of the Philippines.
30. Scherer, R., Siddiq, F., & Tondeur, J. (2020). The technology acceptance model (TAM): A meta-analytic structural equation modeling approach. *Computers & Education*, 152, 103766. <https://doi.org/10.1016/j.compedu.2020.103766>
31. Schunk, D. H. (2016). *Learning theories: An educational perspective (7th ed.)*. Pearson.
32. Taber, K. S. (2018). *The nature of the chemical concept: Reconsidering the role of conceptual profiles in chemical education*. Springer.
33. Tang, K. Y., Chang, C. Y., & Hwang, G.-J. (2021). Trends in artificial intelligence-supported e-learning: A systematic review and research agenda. *Interactive Learning Environments*, 29(4), 1–17. <https://doi.org/10.1080/10494820.2021.1875000>
34. UNESCO. (2019). *Artificial intelligence in education: Challenges and opportunities for sustainable development*. United Nations Educational, Scientific and Cultural Organization.
35. UNESCO. (2021). *AI and education: Guidance for policy-makers*. United Nations Educational, Scientific and Cultural Organization.
36. Wang, H., Fu, T., Du, Y., Gao, W., Huang, K., Liu, Z., Chandak, P., Liu, S., Van Katwyk, P., Deac, A.,

- Anandkumar, A., Bergen, K., Gomes, C. P., Ho, S., Kohli, P., Lasenby, J., Leskovec, J., Liu, T., Manrai, A., ... Zitnik, M. (2023). Scientific discovery in the age of artificial intelligence. *Nature*, 620(7972), 47–60. <https://doi.org/10.1038/s41586-023-06221-2>
37. Winkler, R., & Söllner, M. (2018). Unleashing the potential of chatbots in education: A state-of-the-art analysis. *Academy of Management Proceedings*, 2018(1), 15903. <https://doi.org/10.5465/AMBPP.2018.15903abstract>
38. Woolfolk, A. (2019). *Educational psychology* (14th ed.). Pearson.
39. Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education – Where are the educators? *International Journal of Educational Technology in Higher Education*, 16(1), Article 39. <https://doi.org/10.1186/s41239-019-0171-0>