

# Perceptions and Self-Regulation on the Role of Artificial Intelligence in Science Learning of Science, Technology and Engineering (STE) Students of Dasmariñas Integrated High School

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## ABSTRACT

The integration of artificial intelligence (AI) into education is reshaping how students learn and interact with digital resources. This study investigated the role of AI tools in science education by examining their application across various science subjects, students' perceptions, and self-regulation practices among 120 selected Science, Technology, Engineering (STE) students at Dasmariñas Integrated High School, Dasmariñas, Cavite, Philippines. Employing a descriptive-quantitative research design, the study utilized adapted instruments from related studies to gather data on the frequency, purpose, manner of AI usage in various science subjects, along with students' attitudes, beliefs, and multidimensional perceptions of AI integration in learning. Data were analyzed using descriptive statistics, one-way ANOVA, and Pearson correlation. The findings revealed the growing influence of AI tools in science, particularly in Chemistry and Physics, where it recorded the highest mean at 2.93 and 2.89, respectively. Interestingly, while students regarded AI tools as valuable supplementary

aids (M=2.71), many demonstrated critical engagement by verifying AI-generated information (M=3.98). Students maintained a moderately positive view (M=3.33) of its reliability and ethics, reflecting both openness and caution. A significant positive correlation (p-value .00) was found between students' purposeful use of ChatGPT and their attitude and beliefs, indicating that more frequent and intentional usage of the tool was associated with more favorable perceptions of its usefulness. Overall, these revealed the generation of learners who openly uses AI-assisted science learning but remain discerning by maintaining academic responsibility.

**Keywords:** artificial intelligence (AI), perceptions, self-regulation, science learning

## INTRODUCTION

Education has undergone various significant transformation over time, from the traditional teacher-centered approach to a more flexible, technology-driven learning environment. According to Dumbuya (2023), alongside these advancements, students' skill acquisition has also evolved,

from content knowledge focused solely on memorizing of concepts and ideas to the development of essential competencies such as critical thinking, problem-solving, and self-directed learning. As a result, students are increasingly seeking alternative tools and digital resources to support and enhance their academic growth.

One of the most important innovations in recent years is the integration of artificial intelligence (AI) tools in education. Youssef et al. (2024) and Shams et al. (2025) stated that this tool has proven to be beneficial to students as this assists in learning complex ideas, provide primary feedback, and offer timely academic support. AI-based systems such as ChatGPT, Gemini and DeepSeek could foster personalized learning which adapts to learners' individual needs, interests, and pace (Montenegro-Rueda et al., 2023).

It becomes a promising tool which acts like personal assistants that promotes student's active participation and cognitive advancement by adapting to their learning pace and offering support in their knowledge acquisition (Nur Fitria, 2021).

AI-driven tools show great potential in science education, where students are frequently required to grasp abstract concepts, analyze data, and comprehend complex scientific topics (Lamb et al., 2021). AI tools also encourage critical thinking and creativity, which are essential components of scientific inquiry (Royce and Bennett, 2024). It has been found that incorporating AI into science education enhances student engagement and motivation through personalized feedback (Almasri, 2024 and Ayeni, 2024), guiding them through intricate scientific ideas, and encouraging a thorough comprehension of scientific principles Abdulqayyum and Potter (2024, as cited in Ayeni, 2024).

Despite these promising benefits, Zhou et al. (2024) argued that its integration raises important educational concerns as the effectiveness of AI tools depends not only on the students' capabilities but also on their perceptions and self-regulation when

interacting with AI-driven tools. While current literature often emphasizes the general advantages and impacts of AI-powered tools in education, there remains limited research specifically examining their use in science learning contexts and students' perceptions of such usage. Specifically, this study seeks to answer the following research questions:

1. What specific science subjects (Biology, Chemistry, Physics, Earth Science) do students use AI tools for?
2. To what extent do students use AI tools like ChatGPT in Science Learning?
3. What are students' perceptions of AI tools' reliability and accuracy in science learning?
4. In what ways do students regulate their learning when using AI tools in science, considering their cognitive understanding of AI-generated content, metacognitive strategies for verifying information, affective responses towards its usefulness, and social considerations related to ethical and responsible use?
5. Is there a significant relationship between students' frequency of AI tools usage and their demographic characteristics (age, sex, and grade level)?
6. To what extent do students' attitudes and self-regulation influence their perceptions of AI tools' usefulness in science learning?

Although this study explored the use of AI tools in general, the research questions and results specifically referred to ChatGPT. This focus was adopted because the adapted research instruments used in the study was originally designed around ChatGPT.

For the purpose of this study, this null hypothesis is formulated and tested at 0.05 significant level.

(H<sub>01</sub>): There is no significant difference between students' frequency of AI tool usage across different science disciplines and their demographic profile.

(H<sub>02</sub>): There is no significant relationship between students' attitudes and self-

regulation and their perceived usefulness of AI tool in science learning.

## **LITERATURE REVIEW**

### **AI Tool as an Educational Tool**

According to Alqahtani (as cited in Nur Fitria, 2024) artificial intelligence (AI) has highly revolutionized various academic domains, including education and research. Balahadia et al. (2023) and Pachuashvili (2024) added that when teachers effectively utilize AI it reduces their workload by providing personalized and accurate feedback tailored to students' individual needs. This capability allowed educators to allocate more time toward realigning learning experiences and engaging students in more practical, collaborative activities (Montenegro-Rueda et al., 2023). Moreover, with well-crafted prompts, AI can generate and interpret questions efficiently, enhancing both teaching preparation and assessment processes (Özer et al., 2024).

On the other hand, students have also greatly benefited from ChatGPT as a tool in learning. According to Albayati (2024), students primarily seek help with academic assignments, either to clarify difficult concepts or to support their assignments. They interact with ChatGPT to gain insights into complex topics, solve academic challenges, or receive additional explanations Lund and Wang (2023, as cited in Alshammari, 2025). Baidoo-Anu and Ansah (2023), highlighted that students appreciate the tool's convenience, as it offers 24/7 access to information and immediate help.

In addition, AI tools have also shown significant importance in academic writing especially for non-native English speakers as this provides grammar, sentence structure suggestions, and appropriate vocabulary recommendations (Huang et al., 2023). Similarly, Urzúa et al. (2025) argued that the feedback generated by ChatGPT was considered to be much more detailed and comprehensive than conventional feedback. Furthermore, ChatGPT is deemed helpful in various research tasks such as suggesting

article titles, abstract modifications, result discussions, and ideas generation (Chukwuere, 2024) highlighting its wide use in academic research. As such, it is essential not only to embrace tools like ChatGPT but also to proactively prepare for the emergence of similar AI models.

The growing impact of AI in education extends beyond ChatGPT with tools like Gemini and DeepSeek reshaping teaching and learning practices. Nyaaba (2023, as cited in Imran and Almusharraf, 2024) noted that Gemini can assist in organizing study materials, developing lesson outlines, drafting lesson plans, and enhancing content with visual elements, including images, videos, and graphs. DeepSeek, on the other hand, focuses on how each student learns by adapting lessons and providing customized exercises that help learners master key concepts more effectively (Wang, 2025). Thus, integration of AI tools in education not only increases learners' engagement, and enhances deeper learning but boosts teachers' efficiency and productivity.

### **The Role of AI tools in Science Education**

As mentioned by Saro et al. (2023), Bello et al. (2023) highlights that science education equips students with the ability to acquire scientific knowledge through experimentation, utilizing inquiry-based learning approaches. It plays a pivotal role in equipping individuals to navigate an increasingly complex world through acquiring scientific knowledge and skills. However, learners often find understanding scientific concepts and acquiring skills such as problem-solving and critical thinking a challenge. According to Teofilo-Labidad and Paglinawan (2025), students who had access to digital tools were better able to analyze information and apply their knowledge in real-world situations. Additionally, a study conducted by Zudonu et al. (2024) revealed that students who received AI-based instruction demonstrated significantly higher academic achievement compared to those who received traditional instruction.

Suggesting the need to integrate AI into the teaching and learning of the sciences.

Chatbots act as intelligent learning companions that simulate conversation, provide explanations, and address common physics misconceptions (dos Santos, 2023). These findings make generative AI a versatile tool for addressing persistent challenges in science context. Incorporating AI into the science curriculum can create a more collaborative, effective, and interesting learning environment that better prepares students for the future. It not only deepens students' understanding of scientific concepts but also prepares them for future careers. Almusaed et al. (2023, as cited in Ayeni, 2024) argued that AI can enhance student interest, improve instructional quality, and reshape the way knowledge is delivered. It was revealed in the study of Daher et al. (2023) that ChatGPT encountered no conceptual difficulties in solving chemistry “remembering” problems where it solved 13 out of 30 problems but encountered challenges in complex representations.

Moreover, AI's ability to visualize abstract scientific concepts in dynamic ways creates a more immersive learning experience (Onyebuchi et al., 2020). Beyond supporting critical thinking and problem-solving, AI can simulate real-world challenges that mirror the scientific method guiding students through hypothesis formulation, experimentation, and drawing conclusions (Seo et al., 2021).

### **Students' Perceptions of AI Tools in Learning**

As artificial intelligence becomes increasingly integrated into education, student perspectives on its use vary widely from positive to negative. Some students appreciate the convenience and personalized support that AI tools offer, while others voice concerns regarding their limitations.

Albayati (2024) found that when students find ChatGPT easy to use, this perception positively influences their view of its usefulness and shapes their overall attitude

toward integrating it into their academic work. He also noted that many students see ChatGPT as a valuable tool that supports knowledge acquisition and boosts academic and professional performance. Additionally, Ozer et al. (2024) reported that students recognized ChatGPT's benefits in enhancing productivity and efficiency, and many expressed their intention to continue using it for tasks such as research, question generation, and content creation.

Despite these positive perceptions, a growing body of research has highlighted important limitations. von Garrel and Mayer (2023) highlighted that OpenAI acknowledged that the chatbot can sometimes produce responses that, while sounding plausible, are actually incorrect or misleading. ChatGPT's responses are not always accurate or reliable due to limitations like an outdated knowledge base (Gilson et al., 2023). Echoing these concerns, Ozer et al. (2024) and Montenegro-Rueda et al. (2023) noted that the tool can generate repetitive, incorrect, or unsupported content, leading to a need for further analysis and critical evaluation. This highlights the crucial role of educators in teaching students effective prompt formulation and critical evaluation of AI-generated content. Another concern raised by students and researchers alike is the potential impact of AI on creativity and original thinking. Chellappa and Luximon (2024) found that some students feel ChatGPT does not contribute to enhancing their creativity. For these students, reliance on AI idea generation or problem-solving may hinder deeper cognitive engagements and discourage the exploration of novel perspectives.

These contrasting viewpoints reflect a broader conversation about the responsible integration of AI tools in education. The divergence in student attitudes underscores the importance of digital literacy, not only in understanding how to use such tools effectively but also in discerning the quality and credibility of the information they produce.

### **Self-Regulated Learning in the Context of AI Tools in Education**

Since the emergence of artificial intelligence (AI) in the education field, students are more encouraged to develop independent learning through the use of these digital tools (Jin et al., 2023). It is essential that students develop self-regulation skills with independent learning. Sinkkonen and Tapani (2023) described the concept of self-regulated learning (SRL), as defined by Zimmerman and Schunk (2011) which refers to the regulation of personal thinking and actions. It equates to significant self-discipline and initiative, especially online where learners choose their engagement levels.

Nonetheless, there are valid concerns regarding the unintended consequences of integrating AI tools into learning environment. One major issue is the potential of overdependency that might hinder the development of higher-order thinking skills (HOTS) (Lee et al., 2024). The convenience of having easy access to information and problem-solving support through ChatGPT could significantly reduce students' engagement in deep, analytical thinking and independent reasoning. Similarly, the ease of accessing information and problem-solving assistance through tools like ChatGPT could discourage students from engaging in thorough thinking or independent problem-solving (Chan and Hu, 2023).

To use ChatGPT effectively, students must have a solid understanding of the subject matter. This background knowledge is crucial for formulating precise and meaningful prompts and for critically evaluating the information generated by the AI. Without sufficient prior knowledge, students may misinterpret or accept flawed content at face value, leading to misconceptions and superficial engagement. Furthermore, students must develop digital discernment skills to identify biases, inaccuracies, or gaps in AI responses—skills that are only honed through active learning and reflective practice

### **MATERIALS & METHODS**

A descriptive-quantitative research design was employed to comprehensively understand students' perception on the role of AI tools in science learning, specifically through a survey questionnaire as the primary data collection tool. According to Creswell (2014, as cited in Chellappa and Luximon, 2024), the survey strategy is considered highly appropriate when researchers aim to obtain a comprehensive and generalized understanding of a phenomenon. This approach is relevant when studying students' perception and its relationship with AI usage in science learning. In addition, the study examined the self-regulation strategies across multiple dimensions—general use, cognitive, metacognitive, and affective while integrating ChatGPT into their science learning process.

To ensure relevance and alignment with the context of study, the survey-questionnaires adapted from: (1) Valeri et al. (2025) exploring on students' experience of ChatGPT in STEM education and (2) Pallivathukal et al. (2024) assessing healthcare university students' knowledge, attitude, and practice regarding ChatGPT for academic purposes were subjected to reliability testing to assess its internal consistency using Cronbach's Alpha coefficient. The instrument was administered to a pilot group of 15 respondents who share similar characteristics with the target population. The responses were analyzed using Statistical Package for the Social Sciences (SPSS). The test resulted to an overall reliability coefficient of 0.71, which is considered acceptable. Accordingly, the instrument is considered reliable and suitable for use in the actual data collection phase.

The participants in this study consisted of students enrolled in the Science, Technology, and Engineering (STE) program at Dasmariñas Integrated High School. To ensure balanced representation across grade levels and sections, a stratified

random sampling technique was employed, following the approach outlined by Iliyasu and Etikan (2021). In this study, the population was stratified based on grade level, specifically Grades 7 to 10. Within each grade level, ten students were randomly selected from each of the three STE sections, resulting in a total sample of 120 students. This method ensures fair representation across academic levels, sex, and age, thereby minimizing sampling bias and enhancing the reliability and generalizability of the findings. The inclusion criteria ensured that only participants relevant to the study's objectives were selected. Students qualified to participate if they: (a) were currently enrolled in the STE program at DIHS, (b) had additional science subjects such as Environmental Science, Biology, Chemistry, Physics, (c) had access to a device and were familiar with any AI tools like ChatGPT and (d) expressed a willingness to participate in the research process.

The data gathering process was conducted in several stages to ensure ethical and methodological rigor. First, an orientation was conducted to explain the objectives and purpose of the study, including the academic requirement it fulfills. Informed consent forms were then distributed to the students ensuring that their participation was voluntary and that confidentiality would be strictly maintained. Once the consent forms were secured, the administration of survey-questionnaires commenced. The researchers personally distributed the questionnaires during the students' vacant time to avoid class disruptions. Finally, the completed surveys were carefully reviewed to ensure that responses were complete and legible. The data were then organized, item-analyzed, and encoded for further analysis.

## **STATISTICAL ANALYSIS**

To analyze the data gathered in this study, a combination of descriptive and inferential statistical tools was utilized. This

combination is essential in providing a comprehensive understanding of students' perceptions, usage, behavior, and self-regulation strategies when using ChatGPT in science learning.

According to Harbison and Simmons (2024), descriptive statistics are used to summarize and organize data to make analysis easier and provide an overview of the characteristics of sampled data. This is particularly relevant to the current study as this shows how many students use ChatGPT on specific science disciplines, how often they use it, and what their general attitudes are toward its usefulness and accuracy. Specifically, this study uses frequency, and mean distribution analyses to describe overall trends, dominant patterns, and prevalent behaviors among students in relation to their use of AI tools in science education.

Although it is possible to observe differences in values of variables, patterns in distributions, and relationships between variables from the descriptions of data, drawing conclusions through hypothesis testing must be done in inferential statistics (Tirangkoor and Chaiyasang, 2023). In this study, two specific tests were used: One-Way ANOVA and Pearson correlation coefficient. One-Way ANOVA is best used to compare the means across three or more groups. In this study, it is employed to test the hypothesis whether there are statistically significant differences in frequency and usage among science disciplines across different groups based on their demographic profiles, specifically age, sex, and grade level. This is crucial in determining whether observed differences are meaningful by providing a significance value called the p-value. The p-value is set at  $\alpha = .05$ ; a p-score less than .05 indicates statistically significant differences, while a p-score greater than .05 means that there is no statistically significant difference.

Meanwhile, the Pearson correlation is used to determine whether there is a statistically significant relationship between continuous variables, particularly between students'

purposeful interaction with ChatGPT in science learning and their multi-dimensional attitudes and beliefs (including general use, cognitive, metacognitive, affective, and social dimensions). This test helps identify whether students who frequently and purposefully use ChatGPT are more likely to hold positive perceptions of its usefulness in science learning. A positive correlation suggests that as purposeful usage increases, so does the likelihood of holding favorable attitudes, emphasizing the importance of aligning AI usage with students' self-regulation and digital literacy skills.

The integration of both descriptive and inferential statistical techniques in this study ensures a thorough analysis of the data. Descriptive tools provide clarity and context to the raw data, while inferential tests allow

the researcher to explore deeper relationships and patterns, and assess their statistical significance. This combination strengthens the study's findings and supports evidence-based conclusions about the role of ChatGPT in enhancing science education, particularly in relation to students' perception, usage behavior, and self-regulation strategies.

## RESULT

Table 1 presents the demographic distribution of the 120 respondents by grade level, age, and sex. The sample shows an equal representation across Grades 7, 8, 9, and 10, with 30 students (25%) from each level, ensuring balanced perspectives and minimizing grade-level bias.

**Table 1: Profile of the respondents**

Profile N- 120	Frequency	Percentage
Grade Level		
G7	30.0	25.0%
G8	30.0	25.0%
G9	30.0	25.0%
G10	30.0	25.0%
Age		
12–13 y/old	44.0	36.7%
14–15 y/old	62.0	51.7%
16–17 y/old	14.0	11.7%
Sex		
Male	55.0	45.8%
Female	65.0	54.2%

In terms of age, the majority of the respondent's 51.7 percent are aged 14–15 years old, corresponding to the age requirement of students in Grades 9 and 10 as stated in the Philippine K-12 Education Standards. Meanwhile, 36.7 percent of the participants fall within the 12–13 age bracket, generally representing younger students in Grades 7 and early Grade 8. A smaller portion, 11.7 percent, are aged 16–17, likely representing the older students in Grades 9 and 10. This distribution suggests a relatively normal age range for junior high school students in the Philippine context, with some age variation possibly due to late school entry or grade repetition.

Regarding sex, there is a slightly higher representation of female respondents with about 54.2 percent compared to male respondents about 45.8 percent. While the difference is not substantial, this gender distribution reflects a slight female majority in the sample. This may influence certain trends or preferences observed in the study, particularly if the research explores aspects where sex-based differences may emerge, such as interests, motivations, or competencies.

Overall, the demographic profile of the respondents indicates a well-balanced and representative sample of junior high school students, allowing for meaningful interpretation of subsequent findings.

**Result Related to SOP 1: What specific science subjects (Biology, Chemistry, Physics, Earth Science) do students use ChatGPT for?** Table 2 presents the mean frequency of AI tool usage among 120

respondents across Biology, Physics, Chemistry, and Environmental Science. Higher mean values indicate more frequent use based on a Likert scale, where “Often” reflects moderate to high engagement.

**Table 2. AI Tool Usage**

N-120	Mean	Description	Standard Deviation
Biology	2.53	Often	1.15
Physics	2.89	Often	1.28
Chemistry	2.93	Often	1.19
Environmental Science	2.61	Often	1.20

AI tool usage shows growing integration into science learning across disciplines. Chemistry recorded the highest mean (2.93), reflecting frequent use for explanations, simulations, and problem-solving, likely because students find its concepts abstract or challenging. This aligns with Daher et al. (2023), who found ChatGPT can assist with conceptual chemistry problems but struggles with complex representations and generating detailed explanations.

In contrast, Biology had the lowest mean (2.53), suggesting slightly lower AI usage, likely due to its descriptive and less computation-heavy nature, which allows self-paced study. Still, Baroud et al. (2025) noted that ChatGPT can provide clear, personalized explanations, helping students progress based on their prompts and queries. By offering instant responses and interactive exercises, AI aids understanding of complex topics like cell reproduction, improves performance, stimulates interest, and strengthens students’ confidence and autonomy.

Overall, AI usage is consistent across subjects, with standard deviations of 1.15–1.28 indicating moderate variability, likely due to differences in access, digital skills, or subject demands. This aligns with Baroud et al. (2025), who highlighted that technical issues and limited internet connectivity in remote areas can limit access, underscoring the need for solutions.

**Result Related to SOP 2: To what extent do students use AI tools like ChatGPT in science learning?** To answer this question,

a descriptive analysis using mean distribution was conducted. Table 3 shows respondents’ ratings on their purposes for using ChatGPT based on a 5-point Likert scale (Never to Always).

The overall mean of 3.23 indicates that students sometimes use ChatGPT for academic tasks. The highest-rated purposes were understanding phenomena and concepts (mean = 3.46) and guidance on how to approach assignments (mean = 3.45), both interpreted as “often.” This suggests that students primarily seek ChatGPT for help in grasping difficult topics and starting their work. Other purposes—including identifying mistakes (mean = 3.43), solving problems (mean = 3.36), clarifying tasks (mean = 3.35), improving assignment content (mean = 3.35), and summarizing research (mean = 3.30)—remained in the “sometimes” range. This range of use aligns with Pallivathukal et al. (2024), who noted that students use ChatGPT for diverse academic tasks, including assignment and essay composition, paraphrasing, research proposal drafting, information retrieval, composing emails, and facilitating exam preparation.

The lowest-rated uses of ChatGPT were for creativity (M = 2.82), learning activities (M = 2.90), and structuring presentations or texts (M = 2.91). İpek (2023) similarly noted that material suggested by ChatGPT often requires human creativity and nuance. This limitation may reduce the potential of AI-generated content for promoting engaged and affective learning.

**Table 3: Students' Rating on the Purpose on the Use of CHATGPT**

Indicators	Mean	Description
During the learning process	2.90	Sometimes
For understanding phenomena and concepts	3.46	Often
For being creative	2.82	Sometimes
For structuring oral presentations and texts	2.91	Sometimes
For guidance on the approach to completing a school assignment	3.45	Often
For clarifying school tasks and assignments	3.35	Sometimes
For identifying mistakes	3.43	Sometimes
For solving a problem	3.36	Sometimes
For improving the content in an assignment	3.35	Sometimes
For summarizing scientific articles and research papers	3.30	Sometimes
Total	3.23	Sometimes

**Result Related to SOP 3: What are students' perceptions of ChatGPT's reliability and accuracy in science learning?** A descriptive analysis using mean data on a five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree) was conducted to quantify students' perceptions of ChatGPT's reliability and accuracy. Table 4 summarizes their attitudes and beliefs.

The overall mean of 3.50 indicates a generally positive perception of ChatGPT in science learning. The highest rating was for double-checking AI-generated information (M = 3.98), showing active critical evaluation. This aligns with Pallivathukal et al. (2024), who noted that while students see ChatGPT's benefits, they also maintain uncertainty, skepticism, and ethical concerns. Consequently, students reported confidence in detecting inaccuracies (M = 3.72) and agreed it aids understanding difficult STEM concepts (M = 3.66).

Moderate awareness of how AI works observed (M = 3.51), though familiarity

with machine learning was lower (M = 3.39), indicating a need for improved AI literacy. Students also agreed on the importance of discussing AI use in schools (M = 3.72). Pallivathukal et al. (2024) similarly highlighted ChatGPT's limitations, including inaccuracies, citation issues, lack of real-time data, and the need for precise instructions, emphasizing responsible use. These findings emphasize understanding AI's boundaries and using it responsibly in academic and other contexts.

The lowest rating (M = 2.71) shows students view ChatGPT as a supplementary tool, not a replacement for books, reflecting a balanced approach to technology in education. This reflects a balanced approach and aligns with the view that ChatGPT supports learning without replacing people in education or academic writing, a finding noted by İpek (2023), among others (Alshater, 2022; Bishop, 2023; Firat, 2023; OpenAI/ChatGPT, 2023; Susnjak, 2022).

**Table 4: Rating on the Multi-Dimensional Analysis of Student Attitudes and Beliefs about ChatGPT in Learning Science**

Indicators	Mean	Description
AI tools such as ChatGPT can be substitute to traditional learning materials such as books.	2.71	Neither agree nor disagree
AI tools such as ChatGPT help me understand difficult concepts in the STEM subjects.	3.66	Somewhat agree
I have a good understanding of how AI tools such as ChatGPT generate texts.	3.51	Somewhat agree
I am familiar with the concept of machine learning, which is the technology behind AI tools such as ChatGPT.	3.39	Neither agree nor disagree
I can detect potential inaccuracies in responses generated by AI tools such as ChatGPT.	3.72	Somewhat agree
I double-check the information generated by AI tools like ChatGPT against	3.98	Somewhat agree

other sources.		
I am interested in learning more about how AI tools such as ChatGPT can be used in a way that helps me for my studies.	3.34	Neither agree nor disagree
I have sufficient knowledge to use AI tools such as ChatGPT to support my studies in the STEM subjects.	3.50	Somewhat agree
I am concerned about privacy aspects when using AI tools such as ChatGPT for my studies.	3.38	Neither agree nor disagree
I believe it is important to discuss how AI tools such as ChatGPT can be used in schools.	3.72	Somewhat agree
Total	3.50	Somewhat agree

**Results Related to SOP 4: In what ways do students regulate their learning when using ChatGPT in science, considering their cognitive understanding of AI-generated content, metacognitive strategies for verifying information, affective responses towards its usefulness, and social considerations related to ethical and responsible use?**

This section examines how students regulate their learning when using ChatGPT in science, considering cognitive understanding of AI content, metacognitive verification, affective responses, and ethical/social considerations. Descriptive statistics using mean scores were applied. Table 5 summarizes students' perceptions.

General ambivalence (M= 3.33) indicates a clear need for guidance, as students expressed neutral views on several key areas, aligning with Pallivathukal et al. (2024) who noted student uncertainty about AI's reliability and ethical impact. Specific areas of neutrality included ChatGPT's reliability (M= 2.86), its ability to retrieve recent data (M= 3.05), and its academic performance relative to their own (M= 3.09). In terms of AI-generated content and academic integrity, students acknowledged convenience (M = 3.38) but were unsure of its academic impact, reflecting awareness of its benefits and potential drawbacks.

Ethical uncertainty emerged as well, with neutral responses to whether AI use defeats educational purpose (M = 3.10) and whether using ChatGPT for assignments is cheating (M = 3.21). Sok and Heng (2024) emphasized that plagiarism is a major ethical problem arising from AI use without strict rules, defining it as copying AI-generated text without acknowledgment. This is reinforced by Halaweh (2023) (cited by Sok and Heng, 2024), who stated that submitting unrevised, uncredited ChatGPT output constitutes plagiarism.

Regarding academic integrity, students somewhat disagreed that teachers cannot detect AI-generated work (M= 2.03), reflecting awareness of detection risks. Sok and Heng (2024) noted that several rapidly advancing AI detection tools are available for lecturers to identify suspicious use of ChatGPT or similar tools in written texts.

Crucially, most students did not support banning ChatGPT (M= 2.63), preferring guidance. The highest mean (M= 3.63) shows students anticipate AI integration into education. This desire for integration contrasts with the NYC Department of Education, which prohibited access to ChatGPT due to concerns over plagiarism and negative learning effects (Elsen-Rooney, 2023 as cited by Sok and Heng, 2024).

**Table 5: Analysis of Students' Diverse Perspectives on ChatGPT's Reliability, Integrity, Ethical Considerations, and Its Use in Science Learning**

Indicators	Mean	Description
I believe that answers/responses from ChatGPT are reliable and accurate.	2.86	Neither agree or disagree
I believe that ChatGPT retrieves the most recent data for generating responses.	3.05	Neither agree or disagree
I feel ChatGPT can produce better results/responses than I can do in an examination/assignment.	3.09	Neither agree or disagree

I feel the use of ChatGPT by students for academic purpose defeats the purpose of education.	3.10	Neither agree or disagree
I believe teachers/subject experts cannot detect assignments written by ChatGPT.	2.03	Somewhat disagree
I believe that using ChatGPT has increased the convenience of completing my academic tasks, it has had an adverse effect on my education/learning.	3.38	Neither agree or disagree
I feel using ChatGPT for completing written assignments/examinations is malpractice/cheating.	3.21	Neither agree or disagree
I feel it is possible to use ChatGPT to support academic activities without violating ethical concerns.	3.37	Neither agree or disagree
I feel the institution should prohibit the use of ChatGPT for academic purposes.	2.63	Neither agree or disagree
I believe AI tools like ChatGPT will become the new normal in future.	3.63	Somewhat agree
Total	3.33	Neither agree or disagree

**Result Related to SOP 5: Is there a significant relationship between students' frequency of ChatGPT usage and their demographic characteristics (age, sex, and grade level)?** To analyze differences in students' frequency of ChatGPT use across demographics, a combination of inferential statistical methods was employed. The one-way ANOVA was conducted twice: first, to determine if the frequency of use significantly differed by age across the three brackets (12–13, 14–15, and 16–17 years

old); and second, to determine if use varied by grade level across Grades 7–10 in Biology, Physics, Chemistry, and Environmental Science. Additionally, an independent samples t-test was used to examine if a significant difference existed between male and female students in their frequency of ChatGPT use. All three analyses were supported by the calculation of t- value, F- ratios, and significance level (p- values).

**Table 6: Comparison of AI Tool Usage in subject areas according to Sex, Age and Grade Level**

Learning Area N-120	t- value	F-ratio	Significance	Interpretation
Biology				
Sex	0.98		0.33	Not Significant
Age		.890	0.41	Not Significant
Grade Level		9.76	0	Significant
Physics				
Sex	1.00		0.32	Not Significant
Age		2.84	0.06	Not Significant
Grade Level		5.57	0	Significant
Chemistry				
Sex	1.82		0.07	Not Significant
Age		1.44	0.24	Not Significant
Grade Level		2.74	0.05	Significant
Environmental Science				
Sex	0.39		0.70	Not Significant
Age		4.87	0.01	Significant
Grade Level		2.98	0.03	Significant
DECISION ON H <sub>01</sub>				
Sex	H <sub>01</sub> is accepted.			
Age	H <sub>01</sub> is accepted in Biology, Physics, and Chemistry; rejected in Environmental Science.			
Grade Level	H <sub>01</sub> is rejected.			

In terms of age, a significant difference in AI tool usage was observed in Environmental Science (F = 4.87, p = 0.01), while Biology, Physics, and Chemistry

showed no statistically significant differences across age groups ( $p > 0.05$ ), although Physics was near the significance threshold ( $p = 0.06$ ). This suggests age uniquely impacts AI use in Environmental Science, likely because the subject is a highly integrative biological science combining fields like chemistry, physics, and ecology to solve complex environmental problems (Hikamah et al., 2025). The subject's demand for creativity and affective learning—areas where AI is limited (İpek, 2023)—may cause the utility or drawbacks of AI tools to become more pronounced for different age groups encountering these complex, interdisciplinary challenges.

Regarding sex, no statistically significant differences were found between male and female students in their AI tool usage across all subjects. The  $p$ -values for Biology ( $p = 0.33$ ), Physics ( $p = 0.32$ ), Chemistry ( $p = 0.07$ ), and Environmental Science ( $p = 0.70$ ) all exceeded the 0.05 threshold, indicating that both sexes engage with AI tools at comparable levels across scientific domains. This result may be attributed to the unequal distribution of male and female respondents in the study, with females comprising 54.2% and males 45.8% of the sample. Although the difference is not substantial, the slight

female majority may have influenced the observed outcomes.

However, when analyzed by grade level, statistically significant differences emerged across all subjects—Biology ( $F = 9.76$ ,  $p < .01$ ), Physics ( $F = 5.57$ ,  $p < .01$ ), Chemistry ( $F = 2.74$ ,  $p = .05$ ), and Environmental Science ( $F = 2.98$ ,  $p = .03$ )—implying that students' engagement with AI tools increases or changes notably as they progress through grade levels. This may be attributed to the increasing complexity of the junior high school science curriculum as students' progress to higher grade levels. It highlights how AI tools such as ChatGPT can support learners in understanding more advanced science concepts, aligning with the spiral progression approach where topics deepen and become more complex each year.

**Result Related to SOP 6: To what extent do students' attitudes and self-regulation influence their perceptions of ChatGPT's usefulness in science learning?** A Pearson's  $r$  correlational analysis was used, supported by descriptive statistics and significance testing. Table 7 summarizes the relationship between students' purposes for using ChatGPT and their attitudes and beliefs toward its role in science learning.

**Table 7: Correlation between the purpose of the Usage of ChatGPT and Students Attitudes and Beliefs in using ChatGPT**

Dimension	Student Attitudes and Beliefs on ChatGPT in Learning Science				
	r	P-value	Significance	DECISION ON $H_{02}$	Interpretation
Purpose on the Use of the ChatGPT	3.491	.00	Significant	$H_{02}$ is rejected.	Moderate positive relationship

The analysis shows a positive correlation, with  $r = 3.491$ , indicating a moderate positive relationship between students' purposeful use of ChatGPT and their positive attitudes toward its usefulness. This correlation is statistically significant ( $p < .05$ ), so  $H_{02}$  is rejected. As students increasingly use ChatGPT purposefully, their positive beliefs about its value in science learning also increase. This finding is consistent with Pallivathukal et al. (2024), who suggested that students with higher

knowledge about ChatGPT are more likely to use it for academic tasks, further indicating that a positive attitude reinforces academic use.

## DISCUSSION

In relation to SOP 1 and SOP 2, which examined the science subjects where students use ChatGPT most and the extent of their usage, results indicate moderate but purposeful adoption of AI in science learning. Students primarily used ChatGPT

to understand difficult concepts and receive guidance on school tasks. This aligns with Ngo (2023), who found that ChatGPT provides accessible, time-saving support with personalized feedback. Similarly, Fadillah et al. (2024) reported that high school students improved their understanding of physics concepts and corrected misconceptions through ChatGPT. Eden (2024) also highlighted that AI, particularly ChatGPT, offers a promising alternative in Biology, positively supporting individual learning differences, pacing, feedback, and overall student engagement. Overall, students rely on AI as a supplementary aid rather than a replacement for instruction, particularly when tackling complex scientific content.

Addressing SOP 3, which explored perceptions of reliability and accuracy, students showed cautious optimism. They frequently verified AI-generated responses and recognized possible inaccuracies. This corresponds with Doty and Lipien (2024), who noted that high school students cross-check AI outputs, and Ding et al. (2023), who observed that students in physics classes questioned incorrect AI explanations. Students also valued AI assistance in clarifying complex topics, as seen in Wang et al. (2024). However, aligned with Espartinez (2024), they expressed the need for guidance and ethical protocols, highlighting the importance of structured AI literacy programs for safe and effective use.

Concerning SOP 4, which examined self-regulation and ethical perspectives, students expressed uncertainty about whether ChatGPT hinders learning or constitutes cheating, reflecting ambivalence similar to findings by Sila et al. (2023) and Doty and Lipien (2024), who reported concerns about critical thinking decline and AI accuracy issues. Likewise, Diaz (2025) found that students accept ChatGPT for research but hesitate when tasks require deeper reasoning. While students acknowledge convenience, they are aware of potential risks, demonstrating awareness of both

benefits and limitations. This contrasts sharply with the findings of Pallivathukal et al. (2024), where a substantial portion of students expressed strong agreement regarding various aspects of ChatGPT's capabilities, including its accuracy, data retrieval, and potential to produce better results than their own in examinations or assignments.

With respect to SOP 5, which examined the relationship between ChatGPT usage and demographic characteristics (age, sex, and grade level), important distinctions emerged. Regarding **age**, younger students demonstrated higher usage in Environmental Science, which contrasts with a recent study from Lund University in Sweden showing that only 14.8% of younger students used generative AI in their education compared to 52.6% of older adolescents (Atillah, 2024). Subject structure and teacher emphasis may explain this difference. In terms of grade level, significant variations emerged across Biology, Physics, Chemistry, and Environmental Science. In Biology, greater complexity at higher levels increases the need for AI support. Physics results reflect similar trends, consistent with Henze et al. (2024), who found that AI-supported data analysis enhances motivation and reduces stress in challenging physics tasks. Differences in Chemistry and Environmental Science, though slightly more moderate, suggest that AI supports concept integration and personalization, supporting Alasadi & Baiz (2023), who recognized AI's role in facilitating complex problem-solving and feedback. These trends underscore the need for grade-aligned AI integration to match developmental and curricular demands. Conversely, no statistically significant differences emerged by sex, despite literature suggesting otherwise. Carvajal et al. (2024) reported that female high-achieving students may hesitate due to ethical and cognitive concerns, and Draxler et al. (2023) found men often rate their AI competence higher. Yet this study indicates more equal

engagement, suggesting narrowing differences. Møgelvang et al. (2024) emphasized that female students often seek clarity on when to trust AI, reflecting thoughtful caution rather than reluctance. Finally, addressing SOP 6, which examined whether attitudes and self-regulation shape perceived usefulness, a significant positive correlation was found: students who used ChatGPT purposefully held more favorable attitudes. This supports Chan and Hu (2023), who found that recognizing benefits increases willingness to integrate AI in learning. This relationship is also consistent with Biggs' 3P model, where positive perceptions guide learning strategies and outcomes. As Diaz (2025) showed, students evaluate ChatGPT's usefulness depending on task demands, using it where they believe it adds learning value.

## **CONCLUSION**

This study investigated the extent of AI tools usage among junior high school Science, Technology, and Engineering (STE) students of Dasmariñas Integrated High School in relation to their science learning, focusing on their perceptions, attitudes, and self-regulation behaviors toward AI-assisted education. Findings revealed that AI tools, particularly ChatGPT, are increasingly incorporated into students' academic routines, especially in Chemistry and Physics where complex and abstract content often requires additional support. Students generally held positive attitudes toward AI as a supplementary learning resource and demonstrated responsible use by verifying information, reflecting emerging digital literacy and critical thinking skills.

Respondents generally showed a positive attitude toward AI tools, particularly as supplementary aids for understanding complex scientific concepts and supporting school tasks. Students demonstrated critical engagement by frequently verifying AI-generated information, indicating

developing digital literacy and a balanced approach to AI use in learning.

**They also held neutral to moderately positive views on ChatGPT's reliability and ethics.** While recognizing its convenience and learning benefits, students emphasized the continued importance of human judgment, creativity, and ethical responsibility, highlighting a cautious and responsible integration of AI into their academic routines.

Statistical results showed that grade level significantly influenced AI usage, while age and sex did not show significant effects. Therefore, H01 (age) and H01 (sex) were accepted, while H01 (grade level) was rejected, indicating that academic level plays a key role in AI engagement, likely due to increasing curriculum complexity. Additionally, a significant positive relationship was found between students' purposeful use of ChatGPT and their attitudes and beliefs, leading to the rejection of H02, meaning students who use ChatGPT more frequently and intentionally tend to hold more favorable perceptions of its usefulness. Overall, students appear open to AI-assisted science learning but remain discerning, using technology while maintaining academic responsibility.

In conclusion, while meaningful AI adoption in science learning was observed, the study is limited by its reliance on self-reported data and a single-school sample; future studies should involve broader populations and performance-based measures. It is recommended that AI literacy be integrated into the curriculum so students understand how AI works, its benefits, limitations, and ethical implications, supported by national guidelines from the Department of Education on responsible use, plagiarism, authorship, and academic honesty. Teachers should receive training on the pedagogical and ethical application of AI to effectively guide students and model responsible practice. Future research should also examine long-term effects of AI on student

performance, motivation, self-regulation, and higher-order thinking, and extend to diverse school contexts and subjects, including writing and quantitative sciences like Chemistry and Physics. These recommendations ensure AI integration remains ethical, equitable, and supportive of meaningful learning.

### **Declaration by Authors**

**Consent:** The authors affirm that informed consent was obtained from all student respondents prior to data collection. The authors also declare that AI tools, including ChatGPT and Google Gemini, were utilized to enhance the grammar and sentence construction of this research paper.

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