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Utilization of Artificial Intelligence and its Influence on Science Teaching Practices Towards Facilitating the Utilization of Smart Intelligence for Optimized Science Instruction (FUSION) Framework

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ABSTRACT
Artificial intelligence is widely used across different professions. Artificial intelligence is also used by students and teachers alike. This study analyzes the utilization of artificial intelligence and its influence on science teaching practice. In which the aim of this study is to analyze the utilization of artificial intelligence and its influence on science teaching practices of science teachers. The data is gathered through a purposive sampling in which the respondents mainly consist of 140 science teachers in the division of Manila across six districts of Manila. Prior to the data gathering of the study permit to conduct study is settled from the division office of Manila. Also, ethical clearance was affixed as before conducting the survey to the science teachers. The respondents were guided by a 4-point Likert scale to answer various questions on the utilization of artificial intelligence and its influence on science teaching practices. The study is mainly focused on descriptive study in which it seeks to observe, describe, record, and describe a particular phenomenon or population of the study without manipulating any variables. The study resulted in which teachers moderately utilized artificial intelligence in science teaching practices. Additionally, teachers were often influenced by artificial intelligence in science teaching practices. However, teachers often face challenges in utilizing artificial intelligence in science teaching practices. The study also resulted in that there is a significant difference in the extent of utilization of artificial intelligence to the demographic background of the respondents. Also, there is a significant difference in the influence of artificial intelligence in science teaching practices to the demographic background of the respondents. Lastly, the study revealed that there is a significant relationship between the extent of utilization of artificial intelligence to the degree of influence of artificial intelligence in science teaching practices.

Keywords: *Artificial Intelligence, Background, Challenges, Demographics, Influence, Utilization, Practices; Science, Teaching*

INTRODUCTION

The use of artificial intelligence across different learning areas offers benefits, such as improved teaching efficiency, personalized learning and assessment, and novel pedagogical strategies for educators. According to a recent study conducted by Shi et al. (2024), there is significant potential for artificial intelligence to enhance teachers' instructional practices, particularly in lesson planning, personalized teacher intervention and feedback, and performance assessment. According to Ayeni (2024), the use of artificial intelligence has the potential to

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transform how scientific knowledge is comprehended, applied, and shared. Teachers can customize lessons to match the different needs of the students. In the same study, the integration of artificial intelligence into science education could profoundly impact teaching practices by enabling more personalized and dynamic lessons. The incorporation of artificial intelligence into science education, as explored in the same research, has the potential to significantly alter pedagogical approaches, facilitating more individualized and adaptable instructional strategies. Furthermore, Aduloju and Adedotun's (2025) study indicates that artificial intelligence promotes greater engagement with scientific concepts. Consequently, artificial intelligence has the potential to revolutionize science education, thereby cultivating essential 21st-century competencies, including critical thinking and problem-solving. Globally, artificial intelligence provides ease and benefits to both teachers and students. As it enhances teaching and learning practices. There are similar studies on the influence of artificial intelligence teaching practices in science education in the Philippine setting. According to Ortiz et al. (2025), artificial intelligence is an important tool for teachers to generate, collect, and process data, as well as to design pedagogical instruction. In a congruent Dela Cruz (2025), Artificial Intelligence is perceived as beneficial for effective instruction and learning acquisition. According to Flores (2025), the adoption of artificial intelligence is strongly associated with the successful implementation of science education in the Philippines. Artificial intelligence adoption improved teaching effectiveness, enhanced student outcomes, and improved instructional productivity. According to Mangubat and Paglinawan (2025), teachers in the Philippines recognize that AI tools have the potential to enhance instructional efficiency and personalize learning.

Previous Research and Gaps

The use of artificial intelligence offers various benefits for both teachers and students across learning areas. However, different challenges arise in the utilization of artificial intelligence. First is the overreliance of students and teachers on using artificial intelligence in teaching practices. Second are the infrastructure challenges or gaps, as the internet infrastructure in the Philippines remains a hurdle to technological development. Third is the acceptance of artificial intelligence in classroom teaching, as some seasoned educators are wary of using it. Fourth is the ethical consideration, particularly regarding plagiarism, as artificial intelligence presents information quickly. Lastly, there is data privacy, as artificial intelligence exposes users' data and research algorithms. The research gap focuses on the Extent of utilization of artificial intelligence through measuring the acceptance of teachers on the utilization of artificial intelligence. This is done by assessing attitudes towards the use of artificial intelligence. Another research gap identified in this study is the Extent of the influence of the use of artificial intelligence in science teaching practice. This is measured by assessing how effectively teachers integrate artificial intelligence into pedagogy, content, and scientific knowledge. These are the various challenges and gaps in the use of artificial intelligence in teaching practice across learning areas. Aligned with these various gaps and challenges are the current research presented by different studies. In the study by Mangubat and Paglinawan (2025), significant barriers persist, including limited technological infrastructure, insufficient training, and ethical concerns related to plagiarism and overreliance on automation. Teachers adopt collaborative and adaptive strategies, such as peer learning and professional development, to navigate these challenges and emphasize the importance of guiding students in responsible AI use. Successful integration of AI-based tools depends on science teachers' acceptance and their ability to effectively incorporate these technologies into their instructional practices (Wen and Nasri, 2025). This study focuses on assessing the influences of artificial intelligence in science teaching praxis. Additionally, a different research problem is identified, which serves as the core of this study. The following: (1) The demographic profile of science teachers in terms of: (a) age, (b) gender, (c) years in teaching, and (d) digital citizenship. (2) The Extent of utilization of artificial intelligence in science teaching practice in terms of (a) Technological proficiency, (b) Teaching and learning practice, (c) Attitudes towards artificial intelligence. (3) The degree of influence of artificial intelligence in science teaching practice in terms of: (a) Instructions (b) Methods (c) Assessment (4) The challenges in utilizing artificial intelligence in science teaching practice in terms of: (a) Instruction (b) methods (c) assessments (5) The significant difference between Extent of utilization of artificial intelligence in science teaching practice when grouped according to their profile. (6) The

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significant difference between the degree of influence of artificial intelligence in science teaching practice when grouped according to their profile. (7) The significant difference between the Extent of utilization of artificial intelligence in science teaching practice and the degree of influence of artificial intelligence in science teaching practice.

Objectives

This study aims to investigate how teachers use artificial intelligence, thereby crafting a framework for its utilization and its influence on science teaching practices, including the ethical and proper use of artificial intelligence in science teaching. The aim of this research is to create a framework that will help the City School of Manila utilize artificial intelligence, including its ethical and proper use in science teaching practices, and to contribute to the development of education in the division of Manila. Furthermore, the objective of this paper is to:

1. Identify the demographic background of the teachers.
2. Explain the Extent of utilization of artificial intelligence in scientific practice.
3. Analyze the degree of influence of artificial intelligence on science teaching practices. Investigate the challenges in utilizing artificial intelligence in science teaching practice. Analyze the significance of teachers' demographic profiles to the Extent of utilization of artificial intelligence in science teaching practice.
4. Investigate the significance of teachers' demographic profiles for the Extent of artificial intelligence's influence in science teaching practice.
5. Examine the significance of the Extent of utilization of artificial intelligence to the degree of influence of artificial intelligence on science teaching practices and investigate the relationship between the Extent of utilization of artificial intelligence in science teaching practices and the degree of influence of artificial intelligence in science teaching practices.

Contributions

This research aims to contribute to the development of a framework for the use of artificial intelligence and its influence on science teaching practice, anchored in the Department of Education's existing policy on its use.

Statement of the Problem

Despite numerous research into the utilization of artificial intelligence across learning areas including science different limitations are still presented in different research. This research aims to investigate and analyze how artificial intelligence influence teachers in science teaching practice. It addresses empirical evidence on the influence of artificial intelligence in science teaching practice. Where in this paper the researcher will delve into the different factors that influence the teachers on utilizing artificial intelligence. In which this paper aims to create a policy paper on the ethical use of artificial intelligence in science teaching praxis. In order to attain such output listed below are the following research questions:

1. What is the demographic profile of teachers in terms of:
   1.1 Age
   1.2 Sex
   1.3 Years in teaching science
   1.4 Digital Citizenship
2. What the extent of utilization of artificial intelligence is science teaching practice in terms of:
   2.1 Technological Proficiency
   2.2 Teaching and learning practice
   2.3 Attitudes towards artificial intelligence

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3. What is the degree of influence of artificial intelligence in science teaching practice in terms of:
   3.1 Instructions
   3.2 Methods
   3.3 Assessments
4. To what extent do teachers encounter challenges in utilizing artificial intelligence in science teaching practices based on the following aspects:
   4.1 Learning Acquisition
   4.2 Teaching Methods
   4.3 Assessment
5. Is there a significant difference between the extent of utilization of artificial intelligence in science teaching practice when grouped according to their profile?
6. Is there a significant difference between the degree of influence of artificial intelligence in science teaching practice when grouped according to their profile?
7. Is there a significant relationship between the extent of utilization of artificial intelligence in science teaching practice and the degree of influence in science teaching practice?

What output may be proposed based on the result of the study?

METHODS

Research Design

There are various quantitative research designs available. However, identifying the research problem is one of the core foundations for aligning a particular quantitative research design. In this study, the quantitative research design is descriptive.

The research design employed in this study is descriptive, within the quantitative research paradigm. Descriptive research design study, document, and analyze characteristics, behavior, and/or trends of a population or phenomenon. The usual data gathering procedure employed in this research design is a survey questionnaire. In which respondents in the population answer specific questions using a Likert scale. It usually involves statistical analysis using descriptive statistics. However, inferential statistics were used to analyze significant differences in the demographic profile of the respondents and in the Extent and degree of artificial intelligence utilization in science teaching practices.

This research analyzed the utilization of artificial intelligence and its influence on science teaching practices. Given the nature, rationale, and problems of this study, it is imperative to use a descriptive research design to better understand the Extent of the utilization and influence of artificial intelligence on science teaching practice.

The study's respondents were selected through purposive sampling, in which the researcher chose participants who met the research criteria. The criteria for the study are as follows: (1) a science teacher who teaches science subjects, (2) a secondary junior high school teacher, (3) teaching science subjects for at least 6 months, and (4) teaching within the six districts in the division of Manila.

Research Locale

The study investigates the different utilization and influence of artificial intelligence in science teaching practices. The study focuses on science teachers in secondary junior high schools. The study's research locale focuses on teachers in the Division of Manila, where the researcher is currently affiliated. To delimit the study's respondents, the study comprises 140 science teachers across the six districts of Manila, where the researcher is currently stationed. These 140 teachers are mainly science teachers in public secondary junior high schools across all six districts of Manila.

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The study respondents were selected, and the researcher established inclusion criteria. In which standards or criteria are set by the researcher to choose the respondents of the study. Additionally, the tools utilized in this study are validated by professionals. The research survey questionnaires underwent pilot testing with 20 respondents who were not from the research locale. Then, the respondents' responses were validated using Cronbach's Alpha, which assessed the validity and reliability of each survey question.

Sampling Technique

The study population consists of science teachers in the Manila division. There are six districts in Manila that employ more than 300 science teachers in the division of Manila. Various sampling techniques could be used in this study, including probability and non-probability sampling. Probability sampling is when all members of a population have an equal chance of being selected as respondents. Usually, in probability sampling, the study respondent is randomly selected. As for non-probability sampling, the researcher sets criteria and selects a sample that meets the study's needs. The sampling method used in this research was purposive sampling. It is a non-probability sampling method in which samples from the population are precisely selected based on a specific criterion. In this case, a junior high school science teacher within the Manila division.

The study's respondents were selected through purposive sampling, in which the researcher chose participants who met the research criteria. The criteria for the study will be as follows: (1) a science teacher who teaches science subjects, (2) a secondary junior high school teacher, (3) teaching science subjects for at least 6 months, and (4) teaching in the second district of Manila.

Research Instrument

In this section of the study, the instruments and tools to be used are described in detail. In this section, the instrumentation process is thoroughly elaborated, clearly demonstrating that the data collection procedures are systematic, reliable, and appropriate for measuring the variables identified in the research. The discussion should describe the nature of the instruments used, their structure, the types of data they generate, and how they align with the study's objectives.

The instrument used in this study is the survey questionnaire. The survey questionnaire includes the demographic profile of the respondents, which includes Sex, Age, Academic Position, and years of teaching science subjects. The demographic background or profile of the respondents may affect the utilization of artificial intelligence and its influence on science education. Where the survey questions are adopted from the research of Ablid and Mediodia (2025) and Ortiz et al. (2025)

General instructions were provided to the respondents, who answered by ticking the appropriate entries in the table on a 4-point Likert scale. There are four parts of the survey which focus on the demographic background of the respondents, the Extent of utilization of artificial intelligence in science teaching practices, the degree of influence of artificial intelligence in science teaching practices, and the challenges to the utilization of artificial intelligence in science teaching practices. The respondents answered the survey on the frequency and Extent of artificial intelligence use in science teaching practices, the level of agreement on its influence, and the frequency of challenges in using it.

The survey questionnaire was adapted from prior research on the use of artificial intelligence. Proper citation in the survey questionnaire will be used to ensure acknowledgment and that ethical practices are strictly adhered to. The survey questionnaire was aligned with the objective, the statement of the problem, the theoretical framework, and the conceptual paradigm of the study to ensure the study followed a thematic format.

Data Collection Procedure

The researcher used a survey questionnaire guided by a four-point Likert scale. The survey questions are validated by a professional or expert in the field. Two Master Teachers who have finished his/her Doctorate Degree in Science Education and/or any related specialization are the external validators for this study. Also, three internal validators from the institution validated the survey questionnaire.

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A survey questionnaire is a structured research tool comprising a closed-ended question design to collect, gather, measure, and analyze data based on the behavior, characteristics, and behavior of the target respondents. A survey questionnaire usually contains a scale to measure the levels of attitudes, opinions, and characteristics of the study's respondents. A Likert scale is a psychometric survey tool used to measure the levels of behaviors, attitudes, opinions, and characteristics by asking respondents to rate their level of agreement or feeling on a spectrum.

The survey focused on teachers of science subjects in the secondary junior high school department. In which the survey questionnaire was distributed across six districts of Manila to respondents who met the aforementioned criteria. The study's respondents consist of 140 junior high school science teachers across six districts of Manila.

The respondents' responses were recorded, tabulated, analyzed, and interpreted using SPSS (26th edition). Where the researcher used descriptive statistics, mainly the mean and standard deviation, as well as the inferential statistics, which will be the t-test of comparative means to compare the significance of the utilization of artificial intelligence to the demographic background of the respondents, and the degree of influence of artificial intelligence on science teaching practice to the demographic background of the respondents. Also, the researcher used Pearson's r to analyze the relationship between the Extent of artificial intelligence utilization in science teaching practices and the degree of its influence on these practices.

Ethical standards were strictly adhered to, as the researcher obtained a permit from the Division Office of Manila to conduct the study. Once the permit is secured, a letter of communication is sent to the principal or the school head for proper channeling before distributing the survey questionnaire. Additionally, the respondents were given a consent form and a non-disclosure agreement to ensure strict adherence to ethical procedures during the research. Moreover, the survey is answered voluntarily by respondents.

The use of a survey questionnaire was aligned with both the quantitative and qualitative research designs. The research design focuses on opinions, attitudes, or characteristics regarding a particular trend: the utilization of artificial intelligence and its influence on science teaching practice.

RESULTS AND DISCUSSION

This section presents the descriptive statistical results of the data collected in the study. Descriptive statistics were computed to summarize the characteristics of the respondents and the levels of the variables examined in the research. The results are presented using tables accompanied by narrative explanations to facilitate interpretation.

Demographic Profile of Teachers in terms of Age, Sex, Years in teaching science, and Digital Citizenship

To address this research question, the respondents were classified by age, sex, years of teaching science, and digital citizenship. Frequency counts and percentages were computed to describe the distribution of respondents across categories. The results are presented in the tables provided below.

Table 1. *Profile of Respondents According to Age*

	Frequency	Percent
Below 25 years old	3	2.1
26 - 30 years old	24	17.1
31 - 35 years old	26	18.6
36 - 40 years old	12	8.6
41 - 45 years old	17	12.1
46 - 49 years old	22	15.7
Above 50 years old	36	25.7
Total	140	100.0

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Table 1 presents the distribution of respondents by age group. The results reveal that the largest proportion of respondents falls within the 50-plus age group, with 36 respondents, accounting for 25.7% of the total sample. This is followed by respondents in the 31–35 age group, with a frequency of 26 (18.6%). Then the 26–30 age group, with a frequency of 24, accounts for 17.1%. Followed by the 46 – 49 age group with a frequency of 22, accounting for 15.7%. Then the 36–40 age group, with a frequency of 12, accounts for 8.6%. Then the smallest proportion of respondents falls within the below 25-year-old age category, with a frequency of 3, comprising 2.1% of the participants. The results indicate that the respondents are predominantly aged 50 and above. This demographic profile provides important contextual information for interpreting the responses obtained in the study.

Table 1 presents the distribution of respondents according to age. The results indicate that the majority of respondents were aged 50 and above, comprising 25.7% of the total sample. This was followed by the 31–35-year-old age group, which accounted for 18.6%. The findings suggest that the respondents are predominantly above 50 years old. This demographic distribution provides contextual information that may help explain respondents' responses to the variables examined in the present study.

To determine the sex distribution of the respondents, frequency counts and percentages were computed. This analysis provides an overview of the demographic characteristics of the study's respondents. The results are presented in Table 2.

Table 2. *Profile of Respondents According to Sex*

	Frequency	Percent
Male	40	28.6
Female	100	71.4
Total	140	100.0

The results in Table 2 indicate that the majority of respondents were female, with a frequency of 100, comprising 71.4% of the total sample. This was followed by male respondents, with a frequency of 40 and representing 28.6%. The findings suggest that the respondents are predominantly female. This demographic distribution provides contextual information that may help explain participants' responses to the variables examined in the present study.

To reveal the distribution of respondents according to years of teaching science, frequency counts and percentages were computed. This analysis provides a bird ’s-eye view of the demographic characteristics of the respondents included in the study. The results are presented in Table 1.3.

Table 3. *Profile of the Respondents According to the Years of Teaching Science*

	Frequency	Percent
Less than 1 year	5	3.6
1 - 3 years	9	6.4
4 - 6 years	21	15.0
7 - 10 years	25	17.9
11 - 14 years	20	14.3
Above 15 years	60	42.9
Total	140	100.0

Table 3, which focuses on respondents' years of science teaching, shows that the largest share of responses comes from those with more than 15 years of science teaching, with 60 responses (42.9% of the total sample). It is followed by 7–10 years of teaching experience in science, with a frequency of 25, representing 17.9% of the

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total sample. Then followed by 4–6 years of teaching experience in science, with a frequency of 21, accounting for 15% of the total sample. Then, 11–14 years of teaching experience in science, with a frequency of 20, represents 14.3% of the total sample. Then, with 1 – 3 years of teaching experience in science, which has 9 frequencies, accounting for 6.4% of the total sample. The one with the lowest frequency, 5, representing 3.6% of the total sample, has less than a year of science teaching experience.

Table 3 presents the distribution of respondents by number of years of teaching science. The results indicate that the majority of respondents had more than 15 years of science teaching experience, comprising 42.9% of the total sample. This demographic distribution provides contextual information that may help explain respondents' responses to the variables examined in the present study.

To present the distribution of respondents by digital citizenship, frequency counts and percentages were computed. This analysis provides an overview of the demographic characteristics of the respondents included in the study, to which the concept of digital citizenship is applied. The results are presented in Table 4.

Table 4. *Demographic Profile of Respondents in terms of Digital Citizenship*

	Frequency	Percent
Digital Natives	62	44.3
Digital Immigrant	76	54.3
Digital Refugee/Avoiders	2	1.4
Total	140	100.0

Table 4 presents the respondents' digital citizenship. The digital immigrant category comprises 46 responses, accounting for 54.3% of the study's total sample. It is followed by the digital natives with a frequency of 62, accounting for 44.3% of the total sample. The fewest responses are for the digital refugee, with 2 frequencies, accounting for 1.4% of the total sample.

A large proportion of the sample comprises digital immigrants, with 76 responses (54.3%). It is followed by the digital natives, comprising 62 responses and representing 44.3% of the total sample. This demographic distribution provides contextual information that may help explain respondents' responses to the variables examined in the present study

Extent of the Utilization of Artificial Intelligence in Science Teaching Practice in terms of Technological Proficiency, Teaching and Learning Practice, Attitudes towards Artificial Intelligence.

Table 5. *Extent of Utilization of Artificial Intelligence in Science Teaching Practice in terms of Technological Proficiency*

	Mean	Std. Deviation	Verbal Interpretation
1. I am confident in using basic computer applications such as Microsoft Word and Excel.	3.77	0.47	Highly Utilized
2. I can navigate and use online platforms effectively (e.g., email, browsers, social media	3.54	0.69	Highly Utilized
3. I can prepare presentations with multimedia elements (e.g., images, audio).	2.99	0.80	Moderately Utilized
4. I know how to use email for sending, receiving, and organizing messages.	3.49	0.63	Moderately Utilized
5. I can install and uninstall software on my device.	3.74	0.51	Highly Utilized
6. I am capable of using shortcuts and other time-saving tools to enhance productivity.	3.43	0.64	Moderately Utilized
7. I can use advanced tools like programming languages, data analysis software, or graphic design applications.	3.48	0.63	Moderately Utilized

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8. I am confident in using technology to automate tasks and increase efficiency.	3.31	0.75	Moderately Utilized
9. I stay updated with technological trends and integrate new tools into my work.	3.29	0.73	Moderately Utilized
10. I can analyze data using advanced spreadsheet functions (e.g., pivot tables, charts).	3.72	0.51	Highly Utilized
11. I am knowledgeable about optimizing device performance, such as clearing cache or updating drivers.	3.63	0.60	Highly Utilized
12. can evaluate and choose appropriate digital tools for specific tasks.	3.46	0.60	Moderately Utilized
Technological Proficiency	3.49	0.50	Moderately Utilized

Legend: 3.50 – 4.00 Highly Utilized, 2.50 – 3.49 Moderately Utilized, 1.50 – 2.49 Seldom Utilized, 1.00 – 1.49 Not Utilized

Table 5 presents the mean and standard deviation for each indicator measuring the extent of artificial intelligence utilization in science teaching practice, specifically technological proficiency. The overall mean score of 3.49 corresponds to a verbal interpretation of Moderately utilized, indicating that respondents generally are technologically proficient to an acceptable or agreeable extent. Among the indicators, "I am confident in using basic computer applications such as Microsoft Word and Excel," obtained the highest mean score of 3.77, suggesting that this dimension was most strongly manifested among the respondents. In contrast, "I can prepare presentations with multimedia elements (e.g., images, audio)" recorded the lowest mean score of 2.99, indicating relatively lower ratings for this aspect. The overall standard deviation is 0.50, indicating that the responses of the various respondents are close to one another. This further indicates that the responses were relatively close, suggesting a constant level of agreement among the respondents regarding the indicators included in the study.

To present the extent of utilization of artificial intelligence in science teaching practice in terms of teaching-learning practice, the mean and standard deviation were computed for each indicator. The mean represents the average rating of respondents for each item, while the standard deviation indicates the variability of the responses. The results are presented in Table 6.

Table 6 presents the mean and standard deviation for each indicator measuring the extent of artificial intelligence utilization in science teaching practice, in terms of teaching and learning. The overall mean score of 3.48 corresponds to a verbal interpretation of Moderately Utilized, indicating that respondents generally are technologically proficient to an acceptable or agreeable extent. Among the indicators, "AI enhances but does not replace the teacher's role" obtained the highest mean score of 3.64, suggesting that this dimension was most strongly manifested among the respondents. In contrast, "AI reduces routine tasks, giving me more time for students," recorded the lowest mean score of 3.46, indicating relatively lower ratings for this aspect. The overall standard deviation is 0.49, indicating that the responses of the various respondents are close to one another. This further indicates that the responses were relatively close, suggesting a constant level of agreement among the respondents regarding the indicators included in the study.

Table 6. *Extent of Utilization of Artificial Intelligence in Science Teaching Practice in terms of Teaching and Learning Practice*

	Mean	Std. Deviation	Verbal Interpretation
1. I understand how AI-powered tools can personalize learning experiences for my students.	3.53	0.56	Highly Utilized
2. I believe AI can help improve student engagement in the classroom.	3.48	0.58	Moderately Utilized
3. I feel confident integrating AI-driven educational tools into my teaching	3.47	0.57	Moderately Utilized
4. I am familiar with AI-powered assessment tools and their impact on student learning outcomes.	3.52	0.58	Highly Utilized

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5. I believe AI can reduce the workload of teachers by automating certain tasks.	3.35	0.62	Moderately Utilized
6. AI tools make learning more engaging for students.	3.49	0.58	Moderately Utilized
7. AI supports early literacy and numeracy development.	3.36	0.65	Moderately Utilized
8. AI provides timely feedback to enhance student learning.	3.38	0.63	Moderately Utilized
9. AI reduces routine tasks, giving me more time for students.	3.46	0.63	Moderately Utilized
10. AI enhances but does not replace the teacher's role.	3.64	0.55	Highly Utilized
11. AI improves communication with parents about student progress.	3.61	0.56	Highly Utilized
12. I need professional development to integrate AI effectively.	3.49	0.59	Moderately Utilized
Teaching and learning Practice	3.48	0.49	Moderately Utilized

Legend: 3.50 – 4.00 Highly Utilized, 2.50 – 3.49 Moderately Utilized, 1.50 – 2.49 Seldom Utilized, 1.00 – 1.49 Not Utilized

To reveal the extent of the utilization of artificial intelligence in science teaching practice, in terms of attitudes towards it, the mean and standard deviation were calculated for each indicator. The mean represents the average rating of respondents for each item, while the standard deviation indicates the variability of the responses. The results are revealed in Table 7.

Table 7. *The extent of the utilization of artificial intelligence in science teaching practice in terms of Attitudes towards artificial intelligence*

	Mean	Std. Deviation	Verbal Interpretation
1. Using AI tools may help teachers to acquire more content knowledge.	3.54	0.53	Highly Utilized
2. AI tools enable teachers and students to interact and communicate in new and innovative ways.	3.41	0.55	Moderately Utilized
3. AI tools can assist teachers in improving academic achievement and grades among students	3.39	0.57	Moderately Utilized
4. AI Tools may assist in making teaching and learning interesting and enjoyable.	3.41	0.60	Moderately Utilized
5. AI may assist in activating teaching and learning during lessons.	3.43	0.59	Moderately Utilized
6. AI tools may help teachers to meet the different needs of the learners in the classroom.	3.40	0.60	Moderately Utilized
7. AI tools can enhance traditional teaching methods, like group discussions, by providing instant answers to support students' learning.	3.42	0.60	Moderately Utilized
8. Knowledge of AI's ethical issues encourages teachers to use it confidently.	3.47	0.58	Moderately Utilized
9. AI tools can help standardize academic assessments, ensuring fairness and consistency in evaluating students.	3.40	0.55	Moderately Utilized

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10. AI helps students become more independent learners while also appreciating the guidance and expertise of their teachers.	3.37	0.64	Moderately Utilized
11. Having sufficient facilities motivates teacher educators to use AI tools effectively.	3.43	0.55	Moderately Utilized
12. Teachers need to learn how AI tools can be used appropriately and how they can be generated into the current curriculum effectively.	3.52	0.56	Highly Utilized
Attitude Towards Artificial Intelligence	3.43	0.47	Moderately Utilized

Legend: *3.50 – 4.00 Highly Utilized, 2.50 – 3.49 Moderately Utilized, 1.50 – 2.49 Seldom Utilized, 1.00 – 1.49 Not Utilized*

Table 7 presents the mean and standard deviation for each indicator measuring the extent of artificial intelligence utilization in science teaching practice, with respect to teaching and learning. The overall mean score of 3.43 corresponds to a verbal interpretation of Moderately Utilized, indicating that respondents generally are technologically proficient to an acceptable or agreeable extent. Among the indicators, "Using AI tools may help teachers to acquire more content knowledge" obtained the highest mean score of 3.54, suggesting that this dimension was most strongly manifested among the respondents. In contrast, "AI tools can assist teachers in improving academic achievement and grades among students" recorded the lowest mean score of 3.39, indicating relatively lower ratings for this aspect. The overall standard deviation is 0.47, indicating that the responses of the various respondents are close to one another. This further indicates that the responses were relatively close, suggesting a consistent level of artificial intelligence utilization among the respondents across the indicators included in the study.

To further analyze the data on the extent of artificial intelligence utilization in terms of technological proficiency, teaching and learning practices, and attitudes towards artificial intelligence, a composite table is used to compare and analyze frequencies, means, and standard deviations. Additionally, the aforementioned descriptive statistical analysis method will be used to further analyze the data. Below is the composite table regarding the three variables.

Table 8. *Composite Table on the Extent of Utilization of Artificial Intelligence in Science Teaching Practice*

	Mean	Std. Deviation	Verbal Interpretation
Technological Proficiency	3.49	0.50	Moderately Utilized
Teaching and learning Practice	3.48	0.49	Moderately Utilized
Attitude Towards Artificial Intelligence	3.43	0.47	Moderately Utilized
The extent of the utilization of artificial intelligence is science teaching practice	3.47	0.44	Moderately Utilized

Legend: *3.50 – 4.00 Highly Utilized, 2.50 – 3.49 Moderately Utilized, 1.50 – 2.49 Seldom Utilized, 1.00 – 1.49 Not Utilized*

To further analyze the variables, Table 8 presents a composite table that shows the extent of the use of artificial intelligence in science teaching practices. The overall mean for the extent of artificial intelligence utilization in science teaching practices is 3.47, corresponding to Moderately Utilized. This indicates that science teachers Moderately Utilize artificial intelligence in science teaching practices. Technological proficiency has the highest mean score, at 3.49, followed by teaching and learning practices at 3.48. The least mean score, 3.43, is attitudes towards artificial intelligence. The overall standard deviation obtained is 0.44. This indicates that there is a low variability of responses. Recent research on the extent of artificial intelligence utilization and science teachers' technological proficiency has shown a moderate level of technological proficiency among science teachers (Ibragimov et al., 2025). Science teachers in the Philippines show high readiness in attitudes towards

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artificial intelligence but lack technological proficiency, creating a gap in the utilization of artificial intelligence (Gines, 2025).

The Degree of Influence of Artificial Intelligence in Science Teaching Practices in terms of Instruction, Methods, and Assessments

To analyze the degree of influence of artificial intelligence on science teaching practices in terms of instruction, methods, and assessments, descriptive statistics such as the mean and standard deviation are used. The mean represents the average rating of respondents for each item, while the standard deviation indicates the variability of the responses. The primary objective of this analysis is to determine the trends and patterns in the responses of the study's respondents.

To present the data on the degree of utilization of artificial intelligence in science teaching practices in terms of instruction, where the mean and standard deviation are implied to analyze the trends and patterns towards the degree of utilization of artificial intelligence in science teaching practices in terms of instruction. Table 9 below reveals the results.

Table 9. *The Degree of Influence of Artificial Intelligence in Science Teaching Practices in terms of Instruction*

	Mean	Std. Deviation	Verbal Interpretation
1. AI builds relevant information	3.23	0.67	Often Influenced
2. AI provides easy access data	3.21	0.70	Often Influenced
3. AI create comprehensive narration topics	3.27	0.67	Often Influenced
4. AI provides realistic insights	3.37	0.65	Often Influenced
5. AI provides illustrative examples and practical explanation of topics	3.27	0.68	Often Influenced
6. Instructions	3.27	0.59	Often Influenced

Legend: 3.50 – 4.00 Always Influenced, 2.50 – 3.49 Often Influenced, 1.50 – 2.49 Rarely Influenced, 1.00 – 1.49 Never Influenced

Table 9 presents data on the degree of influence of artificial intelligence on science teaching practices, specifically in instructional practices. Descriptive statistics are used to interpret the data by identifying trends and patterns in respondents' responses. The mean and standard deviation are used to analyze the trends and patterns in the responses. Moreover, this descriptive statistical analysis provides an overview of the extent of artificial intelligence's influence on science teaching practice, particularly in instructional practice. The overall mean for the degree of influence of artificial intelligence on science teaching practices, in terms of instruction, is 3.27, indicating that respondents are often influenced by artificial intelligence in this area. Among the indicators, “AI provides realistic insights” had the highest mean score, at 3.37. It also reveals a standard deviation of 0.65, indicating low variability in answers. Among the indicators with the least mean score is “AI provides easy access to data,” with a mean of 3.21 and a standard deviation of 0.70. It shows low variability in responses; however, it has slight variation. To determine the data on the degree of influence of artificial intelligence in science teaching practices in terms of methods, where mean and standard deviation are implied to analyze the trends and patterns towards the degree of utilization of artificial intelligence in science teaching practices in terms of instructions. Table 10 below reveals the results.

Table 10. *The Degree of Influence of Artificial Intelligence in Science Teaching Practices in terms of Methods*

	Mean	Std. Deviation	Verbal Interpretation
1. AI provides current methods of teaching and learning	3.13	0.74	Often Influenced
2. AI provides comprehensive procedures in designing teaching and learning methods	3.16	0.71	Often Influenced

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3. AI creates highly engaging activities	3.18	0.70	Often Influenced
4. AI provides reliable and accurate sources for developing impactful teaching methods	3.16	0.72	Often Influenced
5. AI creates comprehensive discussions on procedures and technical aspects of relevant teaching methods	3.15	0.78	Often Influenced
Methods	3.16	0.67	Often Influenced

Legend: 3.50 – 4.00 Always Influenced, 2.50 – 3.49 Often Influenced, 1.50 – 2.49 Rarely Influenced, 1.00 – 1.49 Never Influenced

Table 10 presents data on the degree of influence of artificial intelligence on science teaching practices, in terms of methods. Descriptive statistics are used to interpret the data by identifying trends and patterns in respondents' responses. The mean and standard deviation are used to analyze the trends and patterns in the responses.

Moreover, this descriptive statistical analysis provides an overview of the extent of artificial intelligence's influence on science teaching practice, particularly regarding methods. The overall mean for the degree of influence of artificial intelligence on science teaching practices, in terms of methods, is 3.16, indicating that teachers are often influenced to utilize artificial intelligence in these practices. The indicator that received the highest mean score is "AI creates highly engaging activities," with a mean of 3.18, indicating that teachers are influenced to use artificial intelligence to design highly engaging activities in science teaching. It shows a standard deviation of 0.70, indicating low variability in responses among respondents. The indicator with the least mean is "AI provides current methods of teaching and learning" with a mean of 3.13 and a standard deviation of 0.74, with low variability of responses; however, with a slight increase in standard deviation, there is also a slight decrease in mean score in relation to this indicator. The standard deviation of this variable is 0.67, indicating low variability in responses.

To analyze the data on the degree of utilization of artificial intelligence in science teaching practices in terms of methods, where mean and standard deviation are implied to analyze the trends and patterns towards the degree of utilization of artificial intelligence in science teaching practices in terms of assessments. Table 11 below reveals the results.

Table 11. *The Degree of Influence of Artificial Intelligence in Science Teaching Practices in terms of Assessments*

	Mean	Std. Deviation	Verbal Interpretation
1. AI provides accurate assessment methods dependent on learner activities	3.14	0.69	Often Influenced
2. AI creates accurate formula for assessment under a certain activity	3.11	0.69	Often Influenced
3. AI builds standard procedures in assessing learners' performance	3.05	0.72	Often Influenced
4. AI provides comprehensive explanation as to the proper assessment tools to use	3.01	0.72	Often Influenced
5. AI explains concepts of assessment extensively when asked about particular assessment tool.	3.01	0.74	Often Influenced
Assessment	3.06	0.65	Often Influenced

Legend: 3.50 – 4.00 Always Influenced, 2.50 – 3.49 Often Influenced, 1.50 – 2.49 Rarely Influenced, 1.00 – 1.49 Never Influenced

Table 11 presents data on the degree of influence of artificial intelligence on science teaching practices, specifically in assessments. Descriptive statistics are used to interpret the data by identifying trends and patterns in respondents' responses. The mean and standard deviation are used to analyze the trends and patterns in the responses. Moreover, this descriptive statistical analysis provides an overview of the extent of the influence of artificial intelligence on science teaching practice in terms of assessment. The overall mean for the degree of influence of artificial intelligence on science teaching practices, in terms of assessments, is 3.06, indicating that teachers are often influenced to use artificial intelligence in this area. The indicator that received the highest mean

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score is "AI provides accurate assessment methods dependent on learner activities," with a mean score of 3.14, indicating that teachers are often influenced to use artificial intelligence to create engaging activities related to science teaching practices. It shows a standard deviation of 0.69, indicating low variability in responses among respondents. The indicator with the least mean is "AI builds standard procedures in assessing learners' performance" with a mean of 3.13, and a standard deviation of 0.72, with low variability of responses; however, with a slight increase in standard deviation, there is also a slight decrease in mean score in relation to this indicator. The standard deviation for this variable is 0.65, indicating low variability in responses.

To further analyze the data regarding the degree of influence of artificial intelligence in science teaching practices in terms of instructions, methods, and assessments, a composite table is used to compare and analyze the frequency, mean, and standard deviation. Additionally, the aforementioned descriptive statistical analysis method will be used to further analyze the data. Below is the composite table regarding the three variables.

Table 12. *Composite Table on the Degree of Influence of Artificial Intelligence in Science Teaching Practices*

	Mean	Std. Deviation	Verbal Interpretation
Instructions	3.27	0.59	Often Influenced
Methods	3.16	0.67	Often Influenced
Assessment	3.06	0.65	Often Influenced
The degree of influence of artificial intelligence in science teaching practices	3.16	0.59	Often Influenced

Legend: 3.50 – 4.00 Always Influenced, 2.50 – 3.49 Often Influenced, 1.50 – 2.49 Rarely Influenced, 1.00 – 1.49 Never Influenced

To further analyze the variables, Table 12 presents a composite table that shows the extent of the use of artificial intelligence in science teaching practices. The general mean of the degree of utilization of artificial intelligence in science teaching practices is 3.16, which is interpreted as Often Influenced. This indicates that science teachers are often influenced to utilize artificial intelligence in science teaching practices. The instructions had the highest mean score among the variables, at 3.27, followed by the methods at 3.16. The lowest mean score was 3.06 in assessments. The overall standard deviation obtained is 0.59. This indicates that there is a low variability of responses. Generally, artificial intelligence significantly influenced teaching strategies by changing different elements and improving learning efficiency and learning abilities (Huang et al., 2021).

Extent do Teachers Encounter Challenges in Utilizing Artificial Intelligence in Science Teaching Practices Based on the Following Aspects: Learning Acquisition, Teaching Methods, and Assessment

To analyze the extent to which teachers encounter challenges in using artificial intelligence based on the following aspects: learning acquisition, teaching methods, and assessment. Where descriptive statistical analysis is implied, such as mean and standard deviation. The mean represents the average rating of respondents for each item, while the standard deviation indicates the variability of the responses. The primary objective of this analysis is to determine the trends and patterns in the responses of the study's respondents.

To determine the challenges encountered by the teachers in using artificial intelligence for learning acquisition. Where the mean and standard deviation are implied to analyze the trends and patterns towards the degree of utilization of artificial intelligence in science teaching practices in terms of assessments. Table 13 below reveals the results.

Table 13. Extent Do Teachers Encounter Challenges in Utilizing Artificial Intelligence in Science Teaching Practices Based on Learning Acquisition

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	Mean	Std. Deviation	Verbal Interpretation
1. I find AI confusing because of overlapping discussion	2.51	0.78	Often Encountered
2. AI gives extensive data which are difficult to understand by the learners	2.62	0.76	Often Encountered
3. AI gives complex discussions that are out of context	2.52	0.78	Often Encountered
4. AI exceeds the data provided for each topic searched	2.60	0.75	Often Encountered
5. AI fails to provide numerical data to support explanation provided	2.48	0.72	Rarely Encountered
Learning Acquisition	2.55	0.65	Often Encountered

Legend: 3.50 – 4.00 Always Encountered, 2.50 – 3.49 Often Encountered, 1.50 – 2.49 Rarely Encountered, 1.00 – 1.49 Never Encountered

To interpret the data in Table 13, the mean score, a measure of central tendency, is used to examine the trends and patterns in respondents' responses. Additionally, the standard deviation is analyzed to further assess the variability in respondents' answers. The overall mean for the challenges encountered in utilizing artificial intelligence in science teaching practice, based on learning acquisition, is 2.55, indicating that teachers often face such challenges. As for the indicator with the highest mean, it is "AI gives extensive data that is difficult to understand by the learners," which garnered a mean score of 2.62, reflecting that teachers often encounter challenges when artificial intelligence provides extensive data that is difficult for learners to understand. It also had a standard deviation of 0.76, indicating low variability among respondents. The least mean score is "AI fails to provide numerical data to support explanation provided" with a mean of 2.48, which is interpreted as rarely encountered. It means that the teachers rarely encounter challenges, as artificial intelligence provides numerical data to support their explanations. It also gained a 0.72 standard deviation, indicating low variability of responses.

To present the variable on the challenges of using artificial intelligence in science teaching practices, based on the mean and standard deviation of teaching methods, is implied. This descriptive statistical analysis provides an overview of the trends, patterns, and responses of the respondents regarding the variable in question. Below is Table 4.2, which presents the challenges of using artificial intelligence in science teaching practices by teaching method.

Table 14. Extent Do Teachers Encounter Challenges in Utilizing Artificial Intelligence in Science Teaching Practices Based on Teaching Methods

	Mean	Std. Deviation	Verbal Interpretation
1. AI gives multiple methods or styles to use	3.04	0.76	Often Encountered
2. AI gives different styles which do not consider learners' needs and interests	2.52	0.84	Often Encountered
3. AI gives difficult methods that are impossible to execute	2.56	0.81	Often Encountered
4. AI concentrates on technology-based methods	2.77	0.73	Often Encountered
5. AI dominantly gives gamified lesson as teaching methods	2.84	0.74	Often Encountered
Teaching Methods	2.75	0.61	Often Encountered

Legend: *3.50 – 4.00 Always Encountered, 2.50 – 3.49 Often Encountered, 1.50 – 2.49 Rarely Encountered, 1.00 – 1.49 Never Encountered*

Based on the results in Table 14, teachers often encountered challenges in using artificial intelligence in science teaching practices based on teaching methods. This is evident, as the general mean is 2.75 with a standard deviation of 0.61, indicating low variability in responses among teacher respondents. Across the indicators in Table 4.2, the indicator which artificial intelligence provided multiple teaching methods. It also had a standard deviation of 0.76, indicating low variability in responses among teacher respondents.

The lowest mean score across indicators is for "AI gives different styles which do not consider learners'

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	Mean	Std. Deviation	Verbal Interpretation
Learning Acquisition	2.55	0.65	Often Encountered
Teaching Methods	2.75	0.61	Often Encountered
Assessment	2.63	0.74	Often Encountered
The challenges in utilizing artificial intelligence in science teaching practices	2.64	0.61	Often Encountered

needs and interests," at 2.52. Also, the standard deviation of the variable is 0.84, which still indicates low variability; however, it has slightly increased, implying a slight but not significant variation in responses.

"AI gives multiple methods or styles to use" had the highest mean score, at 3.04, reflecting that teachers often encountered challenges in which artificial intelligence provided multiple teaching methods. It also had a standard deviation of 0.76, indicating low variability in responses among teacher respondents. The lowest mean score across indicators is for "AI gives different styles which do not consider learners' needs and interests," at 2.52. Also, the standard deviation of the variable is 0.84, which still indicates low variability; however, it has slightly increased, implying a slight but not significant variation in responses.

Table 15 presents the challenges teachers encountered when using artificial intelligence in science teaching, as assessed. Descriptive statistical analysis is used to interpret data and patterns in teachers' responses.

Table 15. *Extent Do Teachers Encounter Challenges in Utilizing Artificial Intelligence in Science Teaching Practices Based on Assessment*

	Mean	Std. Deviation	Verbal Interpretation
1. AI provides complex assessment procedure	2.74	0.83	Often Encountered
2. AI gives multiple procedures under specific assessment tool	2.89	0.76	Often Encountered
3. AI gives unrealistic methods for assessing students' performance	2.55	0.85	Often Encountered
4. AI gives no numerical formula for assessment	2.49	0.87	Rarely Encountered
5. AI gives no explanation about the relevant assessment tool	2.46	0.91	Rarely Encountered
Assessment	2.63	0.74	Often Encountered

Legend: 3.50 – 4.00 Always Encountered, 2.50 – 3.49 Often Encountered, 1.50 – 2.49 Rarely Encountered, 1.00 – 1.49 Never Encountered

Based on the result of Table 15, which focuses on the challenges encountered by teachers in utilizing artificial intelligence in science teaching practices in terms of assessments. Based on the study's results, teachers often encountered challenges in using artificial intelligence in science teaching, particularly in assessment. This is reflected in a mean score of 2.63 and a standard deviation of 0.74, indicating low variability among the teacher respondents' responses. The highest mean score among all indicators in the variable is "AI gives multiple procedures under a specific assessment tool," at 2.89. This reflects that the teacher respondents often encountered challenges when artificial intelligence provided multiple procedures within a specific assessment tool. The standard deviation of this indicator is 0.76, indicating low variability in responses among teacher respondents. The indicator with the lowest mean is "AI gives no numerical formula for assessment" with a mean score of 2.49. This indicates that the teacher respondents rarely encounter challenges where artificial intelligence provides no numerical data for assessment. However, the standard deviation is 0.85, which is still low but slightly higher than that of the indicator with the highest mean.

To further analyze the study results, Table 16 presents a composite table of all variables. This will provide an in-depth analysis of the trends and patterns in teachers' challenges in utilizing artificial intelligence in science teaching practices, based on learning acquisition, teaching methods, and assessment.

Table 16. Composite Table on the Extent Do Teachers Encounter Challenges in Utilizing Artificial Intelligence in Science Teaching Practices

Table 16 provides information on the challenges of utilizing artificial intelligence in science teaching practices. The overall mean score is 2.64, indicating that teachers often encountered challenges in using artificial

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intelligence in science teaching. Also, the standard deviation is 0.61, indicating low variability in responses. The highest mean across all variables is for teaching methods, at 2.75, reflecting that teachers often encounter challenges when using artificial intelligence in their teaching. This is evident with a standard deviation of 0.61, which indicates low variability of responses. The variable with the lowest mean is learning acquisition, which had a mean of 2.55 and a standard deviation of 0.65, indicating low response variability. To further provide a solid foundation and evidence regarding the extent to which teachers encounter challenges in using artificial intelligence in science teaching, Adli et al. (2024) report these challenges. These include a lack of teacher-student interaction, heavy reliance on AI, insufficient teacher training, and integration issues in using AI. Teachers face different hurdles in integrating artificial intelligence into science lessons. This is due to the lack of content mastery and difficulties in curriculum adaptation (Park et al., 2023).

Significant Difference Between the Extent of Utilization of Artificial Intelligence in Science Teaching Practice When Grouped According to Their Profile

Table 17. Significant Difference Between the Extent of Utilization of Artificial Intelligence in Science Teaching Practice When Grouped According to Their Profile

	t	df	Sig. (2-tailed)	Decision	Remarks
Age - The extent of the utilization of artificial intelligence is science teaching practice	6.434	139	0.000	Reject	Significant
Sex - The extent of the utilization of artificial intelligence is science teaching practice	-32.429	139	0.000	Reject	Significant
Years in teaching science - The extent of the utilization of artificial intelligence is science teaching practice	8.436	139	0.000	Reject	Significant
Digital Citizenship - The extent of the utilization of artificial intelligence is science teaching practice	-30.010	139	0.000	Reject	Significant

To test this hypothesis, an independent-samples *t*-test was conducted to determine whether a statistically significant difference exists between the two groups, which are the study's dependent and independent variables. In this case, the independent variable will be the respondents' demographic profile, and the dependent variable will be the extent of artificial intelligence utilization in science teaching practices. The results of the analysis are presented in Table 17. Table 17 presents the result of the t-test of independent samples. A t-test is conducted to determine whether there are significant differences between the two groups in the respondents' demographic profiles or backgrounds. The demographic profile of the respondents used in this analysis includes age, sex, years of teaching science, and digital citizenship. This is paired with the extent of artificial intelligence use in science teaching practices. The results show that the computed *t* value for age and the extent of utilization of artificial intelligence is 6.434 with a *p* value of 0.0000, indicating that the difference between the two groups is significant at the 0.05 level. Since the p-value for the association between age and the extent of artificial intelligence utilization is less than 0.05, the null hypothesis is rejected. This implies a significant relationship between age and the extent of artificial intelligence use in science teaching practices.

For the second pair of groups, age and the extent of artificial intelligence use in science teaching practices are analyzed. The results show that the computed t-value for sex and the extent of utilization of artificial intelligence in science teaching practices is 32.429 with a p-value of 0.0000, indicating that the difference between the two groups is significant at the 0.05 level. Since the p-value for the association between age and the extent of artificial intelligence utilization is less than 0.05, the null hypothesis is rejected. This implies that there is a significant relationship between age and the extent of utilization of artificial intelligence in science teaching practices.

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Based on the result in Table 17 regarding the years in teaching science to the extent of utilization of artificial intelligence in science teaching practices, where the value of *t* is 8.436 with a *p* value of 0.0000, which indicates that there is a significant difference between years of teaching science to the extent of utilization of artificial intelligence in science teaching practices. This rejects the null hypothesis as the p-value is lower than 0.05. This also suggests that years of teaching science and the extent of artificial intelligence use differ significantly between the two groups.

Based on the result in Table 17 regarding the digital citizenship to the extent of utilization of artificial intelligence in science teaching practices, where the value of *t* is 30.010 with a *p* value of 0.0000, which indicates that there is a significant difference between digital citizenship to the extent of utilization of artificial intelligence in science teaching practices. This rejects the null hypothesis as the p-value is lower than 0.05. This also suggests that digital citizenship and the extent of artificial intelligence use differ significantly between the two groups. In line with this, Ramos's (2026) study found that teachers' readiness to integrate artificial intelligence is influenced by age and years of teaching experience. Additionally, regardless of age, sex, years of teaching experience, and digital competence, it is associated with positive attitudes towards artificial intelligence (Dominguez et al., 2024).

Significant Difference Between the Degree of Influence of Artificial Intelligence in Science Teaching Practices When Grouped According to Their Profile

To test this hypothesis, an independent-samples *t*-test was conducted to determine whether a statistically significant difference exists between the two groups, which are the study's dependent and independent variables. In this case, the independent variable will be the respondents' demographic profile, and the dependent variable will be the extent of artificial intelligence utilization in science teaching practices. The results of the analysis are presented in Table 18.

Table 18. *Significant difference between the degree of the influence of artificial intelligence in science teaching practices when grouped according to their profile*

	t	df	Sig. (2-tailed)	Decision	Remarks
Age - The degree of influence of the artificial intelligence in science teaching practices	8.380	139	0.000	Reject	Significant
Sex - The degree of influence of the artificial intelligence in science teaching practices	-22.452	139	0.000	Reject	Significant
Years in teaching science - The degree of influence of the artificial intelligence in science teaching practices	10.672	139	0.000	Reject	Significant
Digital Citizenship - The degree of influence of the artificial intelligence in science teaching practices	-23.444	139	0.000	Reject	Significant

Table 18 presents the result of the t-test of independent samples. A t-test is conducted to determine whether there are significant differences between two groups in the demographic profile or background of the respondents. The demographic profile of the respondents used in this analysis includes age, sex, years of teaching science, and digital citizenship. This is paired with the degree of influence of artificial intelligence in science teaching practices. The results show that the computed t-value for the relationship between age and the degree of influence of artificial intelligence in science teaching practices is 8.380 with a p-value of 0.0000, indicating that the difference between the two groups is significant at the 0.05 level. Since the p-value for the association between age and the degree of influence of artificial intelligence in science teaching practices is less than 0.05, the null hypothesis is rejected. This implies that there is a significant relationship between age and the extent of utilization of artificial intelligence in science teaching practices.

For the second pair of groups, where age and the degree of influence of artificial intelligence in science teaching practices are analyzed. The results show that the computed *t* value for sex and the degree of influence of artificial intelligence in science teaching practices is 22.452 with a p-value of 0.0000, indicating that the difference

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between the two groups is lower than the 0.05 level of significance. Since the p-value for the association between age and the degree of influence of artificial intelligence is less than 0.05, the null hypothesis is rejected. This implies a significant relationship between age and the degree of artificial intelligence's influence on science teaching practices.

Based on the result in Table 17 regarding the years in teaching science to the degree of influence of artificial intelligence in science teaching practices, where the value of *t* is 10.672 with a *p* value of 0.0000, which indicates that there is a significant difference between years of teaching science to the degree of influence of artificial intelligence in science teaching practices. This rejects the null hypothesis as the p-value is lower than 0.05. This also suggests that years in teaching science and the degree of influence of artificial intelligence are significant between the two groups.

Based on the result in Table 18 regarding the digital citizenship to the degree of influence of artificial intelligence in science teaching practices, where the value of *t* is 23.444 with a *p* value of 0.0000, which indicates that there is a significant difference between digital citizenship and the degree of influence of artificial intelligence in science teaching practices. This rejects the null hypothesis as the p-value is lower than 0.05. This also suggests that digital citizenship and the degree of influence of artificial intelligence in science teaching practices are significant between the two groups. Subsequently, recent studies also presented the same result. Teachers' perceptions of the integration of artificial intelligence vary significantly across demographic factors such as age, years of service, and educational attainment. Younger and more educated teachers hold favorable views toward the integration of artificial intelligence (Abodencio, 2025). The readiness of science teachers who integrate artificial intelligence is mainly influenced by age, with younger educators showing higher readiness (Gines, 2026).

The Relationship Between the Extent of The Utilization of Artificial Intelligence in Science Teaching Practices and The Degree of Influence of Artificial Intelligence in Science Teaching Practices

To determine whether a relationship exists between the variables, Pearson's product-moment correlation coefficient was computed. The results are presented in Table 19.

Table 19. *Correlation Between the Extent of The Utilization of Artificial Intelligence in Science Teaching Practices and The Degree of Influence of Artificial Intelligence in Science Teaching Practices*

		The degree of influence of artificial intelligence in science teaching practices
The extent of the utilization of artificial intelligence is science teaching practice	Pearson Correlation	.613**
	Sig. (2-tailed)	0.000
	N	140

**. Correlation is significant at the 0.05 level (2-tailed).

Table 19 presents the correlation analysis examining the relationship among the study variables. The results show that the extent of artificial intelligence utilization in science teaching practice correlates with its influence, with a p-value of 0.000. This indicates that the relationship between the two variables is statistically significant at the .05 level. The p-value also indicates that the null hypothesis should be rejected, as it is less than the significance level of 0.05. In line with the study's results, recent research has shown that the level of artificial intelligence utilization and its influence on science teaching practices are highly significant in the relationship (Flores, 2025). The extent of artificial intelligence utilization and its influence on teachers' lesson preparation show a positive and significant relationship (Reyes, 2026). Additionally, a positive relationship is presented between the use of artificial intelligence and its influence on science teaching practice (Alarabi et al., 2025).

Output Proposed Based on the Result of the Study.

The findings of this study also have important implications for professional practice, particularly for individuals and institutions involved in the use of artificial intelligence and its influence on science teaching. The

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results suggest that strengthening the use of artificial intelligence and its influence may contribute to improvements in science teaching practice, thereby enhancing institutional effectiveness and professional performance through a framework. The framework is called FUSION or Facilitating the utilization of Smart Intelligence for Optimal Science Instruction: The Mediated Effects of TAM and TPACK.

For practitioners, the findings highlight the importance of adopting strategies that support the use of artificial intelligence to improve outcomes in science teaching practices. Educational leaders, administrators, and practitioners may consider implementing programs, professional development initiatives, or institutional policies that promote the use of artificial intelligence as part of broader improvement efforts. Research has shown that institutions that foster supportive environments and collaborative practices are more likely to achieve sustainable improvement in organizational outcomes (Darling-Hammond et al., 2022; OECD, 2023).

CONCLUSION

This section presents the conclusions drawn from the study's major findings. The conclusions are based on the empirical evidence presented in the preceding chapters and directly address the research questions guiding the study. Each conclusion synthesizes the essential meaning of the findings without repeating statistical details.

Based on the findings of the study, the following conclusions were drawn:

1. Respondent Profile. The demographic characteristics of the respondents provide an important contextual foundation for understanding their perspectives and experiences regarding the use of artificial intelligence and its influence on science teaching practices in the research setting. As the demographics are the key indicators in identifying the significance of the utilization, as well as the degree of influence of artificial intelligence in science teaching practices
2. Extent of Utilization of Artificial Intelligence in Science Teaching Practices. The extent of artificial intelligence utilization showed that teachers agreed to use it in science teaching practices.
3. Degree of Influence of Artificial Intelligence in Science Teaching Practices. The results of the study presented that teachers are often influenced by artificial intelligence in science teaching practices.
4. The Challenges in Utilizing Artificial Intelligence in Science Teaching Practices. Based on the results of the study, teachers often encounter challenges in utilizing artificial intelligence for learning acquisition, teaching methods, and assessment.
5. Significance of the Extent of the Utilization of Artificial Intelligence in Science Teaching Practices when grouped according to their profile. Generally, the results of the study presented that there is a significant difference between the extent of utilization of artificial intelligence in science teaching practices and the demographic profile of the respondents. This is evident across all variables, including age, sex, years of teaching science, and digital citizenship.
6. Significance of the Degree of Utilization of Artificial Intelligence in Science Teaching Practices when Grouped According to their Profile. The study's analysis reveals a significant difference between the degree of artificial intelligence utilization in science teaching practices and the respondents' demographic profile. This is evident across all variables, including age, sex, years of teaching science, and digital literacy.
7. Relationship Between the Extent of Utilization of Artificial Intelligence in Science Teaching Practices and the Degree of Influence of Artificial Intelligence in Science Teaching Practices. According to the study's results, there is a significant relationship between the extent of artificial intelligence use in science teaching practices and its degree of influence on those practices. This indicates that changes in one variable are associated with corresponding changes in the other.

In general, there is significance in both the use of artificial intelligence in science teaching practices and its degree of influence on them. Additionally, significant relationships are revealed between the extent of artificial

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intelligence use in science teaching practices and the degree of such use. These findings will aid the development of existing policies and frameworks and inform future studies on the use of artificial intelligence in teaching practices across all fields.

Practical Output

Facilitating the Utilization of Smart Intelligence for Optimized Science Instruction (FUSION); The Mediating Effects of TAM and TPACK

Rationale

This practical output was developed based on the findings of the present study, which examined utilization of artificial intelligence and its influence science teaching practices within the context of science educators. The results of the research indicated that extent of utilization of artificial intelligence plays a significant role in science teaching practices. This result is also true to the degree of influence of artificial intelligence in teaching practices. Consequently, the extent of utilization of artificial intelligence and the degree of influence of artificial intelligence reveals a correlation to one another. In response to these findings, a structured framework was designed to provide institutions and practitioners with a practical tool for strengthening the utilization of artificial intelligence and its influence in science teaching practices within their respective contexts.

The framework translates the empirical findings of the study into actionable strategies that may guide institutional leaders, educators, practitioners, or policymakers in improving practices related to utilization of artificial intelligence in science teaching practices and its influence in science teaching practices. The target users of this framework are the following benefactors: First the students, as they are the back end of the study. To which students are the back end or the end result of the pedagogical integration of artificial intelligence in teaching practices in general. Then the teachers, as they are the initial or the start to which teachers utilize artificial intelligence in teaching practices. Also, teachers' acceptance on adopting or utilizing artificial intelligence depends on the pedagogical integration of artificial intelligence in teaching practices. Then the administrators, to which professional development through Learning Action Cell (LAC) session may be conducted on the utilization of artificial intelligence in teaching practices guided by this proposed framework. Furthermore, educational policy makers are target users for this framework as it aims to study the effects of artificial intelligence through extent of utilization and degree of influence of artificial intelligence in teaching practices. Lastly, the researchers and academics as this framework may give additional perspective on the utilization of artificial intelligence and its influence on teaching practices.

Objectives

The following statements are the objectives of this framework:

1) Fortify pedagogical integration of artificial intelligence in teaching practices to enhance students learning
2) Provide avenue for teachers' professional development on the utilization of artificial intelligence and its influence in teaching practices.
3) Support and strengthen existing policy on the use of artificial intelligence in science teaching practices.
4) Promote evidence-based decision-making informed by the findings of the study.

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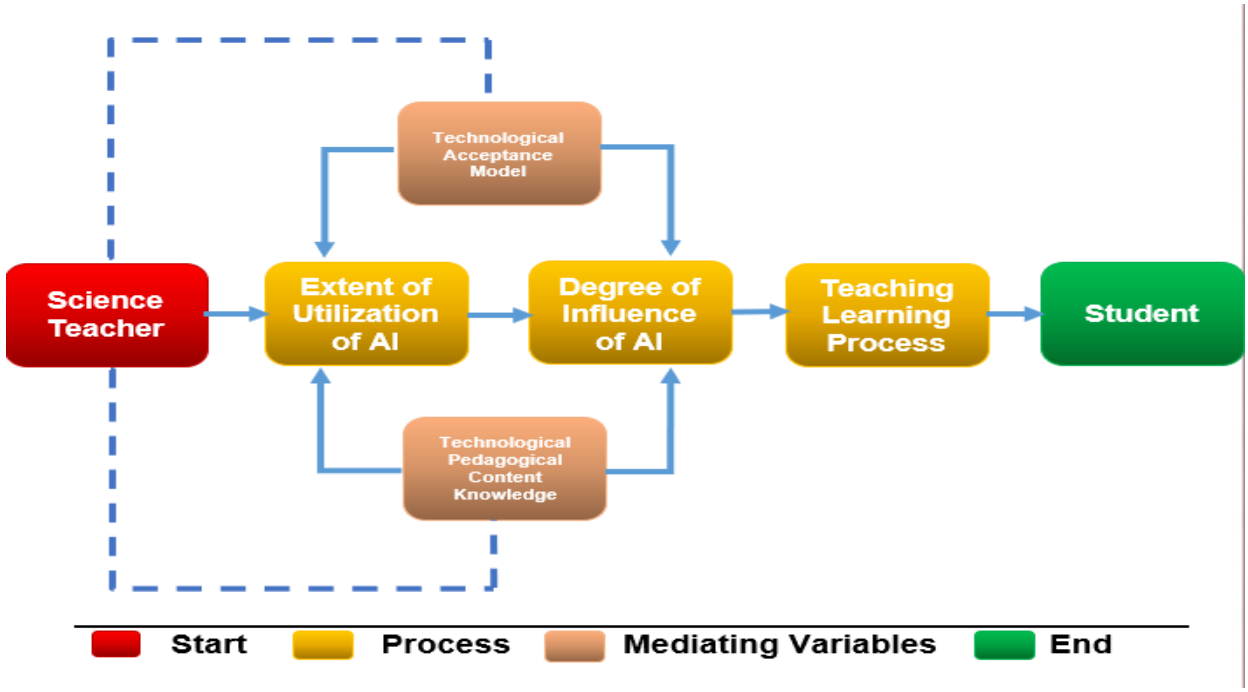
Conceptual Representation of the Framework



Facilitating the Utilization of Smart Intelligence for Optimized Science Instruction (FUSION)

Framework is crafted based on the results of the study across various variables and indicators. The framework of the study is entitled "Facilitating the Utilization of Smart Intelligence for Optimized Instruction (FUSION): The Mediating Effects of TAM and TPACK". This framework focuses on the utilization and influence of artificial intelligence in science teaching practices. The framework presents how teachers facilitate the utilization of artificial intelligence in teaching and learning process. As to which it is translated to the students.

The framework begins with the science teachers as to which the study is conducted. The direction directs at the extent of utilization of artificial intelligence to which it focuses on the acceptance of science teachers to utilize artificial intelligence. This portion of the framework is anchored with the technological proficiency, teaching learning practices, and attitudes towards artificial intelligence. In which technological proficiency of the teachers shows that science teachers moderately utilize artificial intelligence. As for the teaching and learning process, science teachers moderately utilize artificial intelligence in teaching and learning process in science teaching practices. Also, science teachers reveal that artificial intelligence in moderately utilized as for the attitudes towards utilization of artificial intelligence. These three indicators are anchored with the Technological Acceptance Model (TAM) and Technological Pedagogical Content Knowledge (TPACK) to which teachers are utilizing artificial intelligence moderately. This presents a positive indication that teachers are open to utilize artificial intelligence in science teaching practices.

As teachers utilize artificial intelligence the direction is pointing towards that degree of influence of artificial intelligence in science teaching practices. In which this expounds on how artificial intelligence influence science teaching practices. In congruence to the data gathered science teachers are often influenced to utilize artificial intelligence in science teaching practices. Wherein, teachers are often influenced to utilize artificial intelligence in terms of instructions. This shows that science teachers are often influenced to use artificial intelligence in instructional process in science teaching. Moreover, teachers are often influenced to utilize artificial intelligence in teaching methods. To which teachers apply various teaching strategies, engaging activities, impactful teaching methods, create comprehensive discussions, and provide current or novel teaching strategies.

Furthermore, science teachers are often influenced by artificial intelligence in terms of assessment. To which science teachers are influenced to provide accurate assessment methods, create accurate formula for assessment under a certain activity, builds standard procedures in assessing learners, builds standard procedures in assessing learners, and builds standard procedures in assessing learners. Generally, teachers are often influenced to utilize artificial intelligence in science teaching practices. The indicators in this variable are anchored to the Technological Acceptance Model (TAM) as well as the Technological Pedagogical Content Knowledge (TPACK).

As teachers are influenced to use artificial intelligence in science teaching practices it is reflected towards the teaching and learning process. As the aforementioned variables are mediated to Technological Pedagogical Content Knowledge (TPACK). To which TPACK focuses on integrating technology in teaching and learning practices. IN this case the technology being applied is the artificial intelligence. Wherein it is connected to the extent of utilization and degree of influence of artificial intelligence in science teaching practices.

The result where the artificial intelligence is used and integrated in science teaching practices are the students or the learners. The learning process of the students are the end point on how science teachers utilize artificial intelligence and how teachers are influenced by artificial intelligence and how these two variables are applied to teaching and learning process through TPACK.

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