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UTILIZATION OF AI AMONG SCIENCE HIGH SCHOOL TEACHERS: A COMPARATIVE ANALYSIS

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JANET MARIE D. BILLOAN
University of the Visayas
Janetmarie.dinela@deped.gov.ph

ABSTRACT:

This research study explores the use of artificial intelligence (AI) by high school science instructors and attempts to determine how various instructor-related factors are used to differentiate levels of AI usage in terms of instructional practices. The study uses a quantitative-comparative methodology, in which a survey was completed by science instructors from publicly funded secondary schools in Dumanjug, Cebu in order to gather information regarding science instructors' experiences related to AI integration. The responses were analyzed through a comparative analysis to identify the significant variables that differentiate between instructors by their level of AI usage. The findings indicate that technological expertise, years of teaching experience, instructors' perception of the usefulness of AI and instructors' attitudes toward innovation are all significant factors of differentiation between instructors who have high levels of AI usage and those who have low levels of AI usage. More specifically, science instructors who have high technological proficiency levels and positive perceptions of AI integration into their practice are more likely to use AI tools in their lesson plans, classroom instruction, and assessment effectively. The study also identifies several barriers to the complete use of AI in science instruction, including a lack of resources and a lack of training. In a more general sense, the results from this study indicate that in order to provide increased professional development and support services at the school-level to provide science instructors with confidence to increase the level of use of AI in their instructional practices, these will ultimately improve instructional outcomes and increase student engagement in science instruction. The study also provides three areas of contribution to the literature; (a) demonstrates that teacher characteristics influence AI usage; (b) investigates AI usage in the specific context of science instruction among secondary education; and (c) creates an empirically based model that can assist educators, policymakers and administrators with the integration of AI into classroom instructions. The understanding of these relationships will help schools utilize AI based educational tools to improve teacher practice and student outcomes in science education.

Keywords: Artificial intelligence, Science education, Artificial Intelligence utilization, Technology integration, Digital literacy

INTRODUCTION

Rationale

The emergence of Artificial Intelligence (AI) in education represents a significant transformation in how teaching and learning are designed and delivered. AI-powered tools such as adaptive learning systems, intelligent tutoring systems, automated feedback tools, and virtual simulations have been shown to enhance student engagement and improve comprehension, particularly in complex subjects like science (Holmes et al., 2021; UNESCO, 2023).

AI utilization in this study is operationally defined as the extent to which science teachers integrate Artificial Intelligence tools into their classroom instruction (Holmes et al., 2021; UNESCO, 2023). Although access to resources and training remain limited in many public schools, some science teachers have already begun using AI-powered tools such as adaptive learning systems, intelligent tutoring systems, automated feedback mechanisms, and virtual simulations to support teaching and learning. It is measured based on the frequency and manner of use of these

tools in instruction, reflecting not only whether AI is used but also how effectively it is integrated into teaching practices.

Despite these developments, a significant gap remains between national AI initiatives and actual classroom implementation, particularly in provincial public schools such as Dumanjug, Cebu. Although AI programs and teacher training initiatives have been introduced, there is still limited empirical evidence on the extent of AI utilization among science teachers in these contexts. More importantly, there is a lack of studies comparing teachers who use AI and those who do not, particularly in terms of their instructional practices and classroom experiences. This gap indicates that current knowledge is insufficient to fully understand variations in AI adoption at the school level, especially in underserved areas.

Broader systemic challenges further contribute to this situation. A national audit for the 2023–2024 academic year revealed a shortage of approximately 160,000 classrooms in the Philippine public school system, with only 3,600 constructed during the same period (Commission on Audit [COA], 2024). Such limitations restrict the implementation of technology-enhanced instruction. In addition, teachers face challenges such as limited training opportunities, outdated facilities, and insufficient exposure to AI tools, which hinder effective integration in classroom instruction (Salac & Kim, 2020). These constraints widen the gap between teachers who are able to use AI and those who are not.

In response to these challenges, the Department of Education (DepEd) launched the Education Center for AI Research (E-CAIR) in February 2025, its first AI-focused initiative for education (DepEd, 2025a). This center aims to develop AI-driven tools for teaching, learning, assessment, and educational management. In partnership with Microsoft Philippines, DepEd also implemented AI immersion training programs for teachers using tools such as Microsoft 365 Copilot, Reading Progress, and Reading Coach. Early reports suggest positive outcomes, with teachers saving up to 20 hours per week in lesson preparation, grading, and administrative tasks (Microsoft Philippines, 2025). Furthermore, DepEd has begun developing AI-based interventions for learners with disabilities to promote inclusive education (DepEd, 2025b).

While these national efforts indicate progress, their actual impact at the local level remains unclear, particularly in provincial schools. There is still limited evidence on how science teachers in Dumanjug, Cebu utilize AI in their classrooms and how their practices differ from those who do not use AI. Understanding these differences is essential for identifying patterns of adoption and barriers to integration. This highlights the need for a comparative analysis of AI utilization among science teachers.

In this context, the present study employs a comparative research design to examine differences between science teachers who utilize AI and those who do not, in terms of their instructional practices and related characteristics. The findings of this study will serve as a basis for developing targeted interventions and professional development programs aimed at improving the effective integration of AI in science teaching.

Theoretical Framework

The research model is underpinned by Venkatesh et al.'s UTAUT (2003). UTAUT is one of the most popular models explaining user acceptance and use of new technology. Four key factors–performance expectancy, effort expectancy, social influence, and facilitating conditions–perceive the acceptance of or the intention to use technology and actual use of technology. These constructs are mediated by demographic variables, such as age, sex, education, and experience; therefore, the model is highly applicable to the domain of education and technology integration.

UTAUT, in the light of this research, offers a solid model for assessing the acceptance and use of AI tools in classroom teaching by science teachers in provincial schools. Demographic characteristics of the teachers - age, educational background and the length of teaching experience - are among mediating variables in the adoption of technology by

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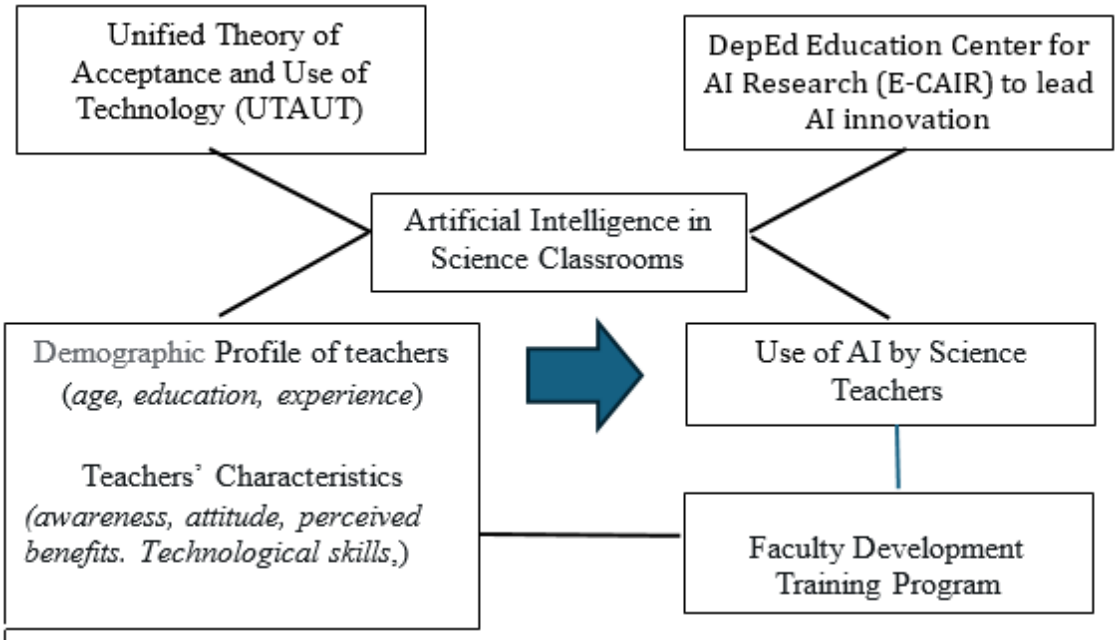
the teachers. For example, young teachers may be more adaptive to AI-based teaching trend; whereas experienced teachers might resist it for they are well familiar and trained for traditional practices.

Figure 1.
Theoretical Framework



Consistent with UTAUT, this study also considers teacher factors such as awareness, attitudes, perceived ease of use, perceived usefulness, and skills. In this sense, the use of AI by science teachers, as central phenomenon of the study, can be explained through the UTAUT model, since the teachers are likely to adopt AI when they perceive that AI is useful, easy to use, supported by colleagues and institutions, and compatible with available resources. Yet the gap of adoption can vary between AI-user teachers and non-users, particularly in rural areas such as Dumanjug, Cebu, that lack infrastructure and training.

To fill this gap, the model includes the Faculty Development Training Program as an outcome of the research. By recognizing which demographic or teacher attributes best demarcate AI users and non-users, this initiative expects to improve teachers' digital skills and attitude towards technology and thereby provide an equitable access to the AI resources. Furthermore, E-CAIR initiatives are embedded within the study to align the analysis with national priorities and, in so doing, draw attention towards the Philippines' AI-centered education development.

In summary, the theoretical model applies UTAUT to explore the influence of demographic and teacher factors on AI use in science classrooms. This principle also is closely related to the general objective of the study, because our final objective is not only the identification of the barriers and underlying factors to the separation of users and non-users of AI, but also a proposal of focused professional development for bridging this gap to empower the teaching to expanding the students´ understanding of scientific procedure by these users and non-use.

Literature Review

Globally, education has progressed with Artificial Intelligence (AI) at breakneck speeds, introducing many educational tools with the growth of all types of intelligent technologies such as adaptive learning platforms, intelligent tutors, automated feedback systems, etc. Research shows that these types of technologies improve student engagement and personalize learning while also supporting depth in reasoning-based subject areas such as science and mathematics (Holmes et al., 2021; UNESCO, 2023). Recent studies also show that teacher usage of AI is

significantly impacted by perceived usefulness and perceived ease of use of AI. For instance, Chen and Tsai (2025) found that performance expectancy was a primary factor in predicting K-12 teachers' use of learning analytics.

Likewise, Khan et al. (2024) found that both trust in AI and effort expectancy had positive effects on teachers' adoption intentions toward learning analytics, but privacy concerns adversely affected adoption. Overall, these findings indicate that to facilitate the global growth of AI, trust and user engagement must come from developing effective AI technologies. In the Philippines, an overwhelming majority of teachers in public schools have not adopted AI, and the extent of use of the technology across urban and rural areas demonstrates unequal access to the technology. For example, according to the DepEd (2022) report, 13% of public high schools have AI-assisted materials, while only 7% of educators have formal AI training (DepEd, 2022).

This discrepancy is related to the issues of infrastructure, access, and teacher readiness.In addition, Grade 10 Region VIII students have been shown to have a weak grasp on the implementation of scientific inquiry and investigative techniques, according to the 2022 National Results Achieved for Science Class by DepEd, meaning students need support. The National Results Achieved with Science Class also showed the need to support students in their understanding of the outcomes of their science projects and experiments, which were highlighted in the 2022 report on student science inquiry and investigative skills. In February 2025, with the creation of the E-CAIR centre by DepEd, AI research for education will be supported through the development of solutions to provide instruction and support to educators, as well as inclusive educational opportunities to enable educators to provide instruction to all students regardless of their learning preferences.

When partnered with vendors like Microsoft, initiatives such as Microsoft 365 Copilot, Reading Progress and Reading Coach, provide more than 20 hours a week for lesson planning and administrative support to educators. Additionally, with the implementation of these types of programs, research results have been presented that indicate literacy gains for students who were not yet reading have occurred as a result of implementing these types of supports. Moreover, while these types of programs presented indicate positive results, in some cases, have been tested in only a small number of schools and within regionally defined pilot projects, such as in Cebu, there is currently no official tracking of how many schools have adopted these types of supports to date.

In respect to the characteristics of teachers and the use of AI in teaching and learning, other critical factors influencing teacher acceptance of technology are identified. Research has demonstrated that teachers' age (both younger and older), experience using technology and overall technology confidence can aid teachers when making decisions about adopting the use of technology, such as AI, in their instruction. Specifically, teachers who are older or more experienced with the use of technology are more likely to reject using AI in the classroom when compared to younger or less experienced teachers. In this regard, many older or experienced teachers who are accustomed to using traditional forms of technology will resist the ability to adopt AI into their instruction, as they have used long-standing instructional practices and have less exposure to with ever growing use of artificial intelligence (AI) technologies in curriculum delivery to promote student learning throughout the education sector, numerous studies included in this narrative literature review focus on faculty attitude and perception of effectiveness (performance expectancy) as the two principle predictors of teacher's successful adoption of AI in classrooms (Zhang et al., 2023).

Administrative support and peer encouragement are particularly significant. Likewise, a blended approach to the TPACK and UTAUT constructs provides teachers confidence to innovate teaching practices by utilizing artificial intelligence (Li et al., 2025). In addition to the success of faculty attitudes and peer collaboration towards technology use, the evidence from the literature review shows that the professional development of faculty continues to be one of the primary mechanisms for the equitable adoption of AI technologies in international classrooms. The recommendations from the community of educational researchers and practitioners suggest that the professional development of teachers be a key focus for mitigating resistance and equipping teachers with the skills and confidence to use AI purposefully in the classroom (UNESCO, 2023). With access to numerous professional development opportunities for using AI in multiple classroom environments, both the faculty and school leaders will have the opportunity to demonstrate higher performance expectations (through demonstrating how AI can support

teachers with the delivery of instructional content) and higher effort expectations (due to savings of time created through the use of technologies).

Through data showing AI in use through the DepEd AI Immersion Programs that have been run in partnership with Microsoft in the Philippines, teachers who participated reduced their workload and became more efficient in the design and delivery of Learning Activities (LAs) throughout the subsequent school year (Microsoft Philippines, 2025). The increasing use of AI to support curriculum delivery and learning environments for students with disabilities is also being supported by the implementation of E-CAIR (DepEd, 2025b), both of which provide evidence that AI has the potential to aid in making the educational service delivery systems more equitable and inclusive to all learners in the Philippines. In addition to the positive contributions AI will have on the quality of science education delivery through the identified moderating variables from the UTAUT model (i.e., performance expectancy, effort expectancy, social influence, and facilitating conditions), the introduction of CDSS technology for IOT has also raised awareness globally to the impact of privacy and trust on personal data with respect to the available AI technologies. In addition to the availability of global technologies available as AI CDSS tools, additional demographic factors and variables are additional barriers to teachers' use of AI technologies in their classrooms.

Presently, while the DepEd E-CAIR project and Microsoft AI immersion program have laid the groundwork for developing insights into the impact of professional development on teachers' successful use of AI, there continues to be limited professional insight regarding the patterns for teachers of schools located in the municipality of Dumanjug (the last of the provincial schools in Cebu, PH). Future studies to examine the demographic and other factors that impact teachers' use of AI will assist in the development of effective faculty professional development programs to mitigate those barriers and better support teachers of science in enhancing students' engagement in the development of skills associated with scientific inquiry.

RESEARCH METHODOLOGY

Method

This study employed a quantitative-comparative research design to determine the extent of Artificial Intelligence (AI) utilization among science teachers in public secondary schools in Dumanjug, Cebu. The comparative design was considered appropriate since significant differences between groups of teachers who utilize AI and those who do not were identified based on their demographic and teacher-related characteristics. Through comparative analysis, factors that best distinguish AI-utilizing teachers from non-users are examined.

Environment

This research was implemented in public secondary schools in the Municipality of Dumanjug, Cebu, Philippines. The work was set in junior and senior high school Science classrooms. These schools were chosen because they are representatives of the ordinary public-school scenario in the area, where the infusion of new technologies, including Artificial Intelligence, was not yet fully integrated but was already being initiated in several DepEd programs. The chosen site was not only relevant to the study but also where the researcher also resided thus, it enabled the researcher to have easier access to schools, and thus respondents and a better understanding of the local educational scene. The setting was a mix of standard instruction and technology supported instruction and was considered appropriate for studying how teachers use or intend to use AI tools in teaching SPSs. The presence of Infrastructures, the accessibility of AI platforms, and the application of DepEd training program would establish a proper setting for analyzing teachers' perception, experiences, and the challenges. It allowed the study to meet its objective of producing tangible recommendation around AI to improve science education.

Participants

Sample Size . The respondents of the study were 30 high school Science teachers who were teaching in the public secondary schools in the Municipality of Dumanjug, Cebu, Philippines. This group was studied through total

population sampling since the population size was modest and directly central to the focus of the research. The inclusion criteria were defined as follows: the sample consists of certified teachers in junior or senior high school who were teaching at least one Science course during the academic year. Teachers who were not specialized in Science, teachers on leave, and those who were assigned only to administrative functions were not included. The research site was selected because it is the residence of the researcher, making it more accessible and more readily understood within its local educational context.

Sampling Technique This research used a total enumeration (also called a census and total population sampling). All population member, the 30 public secondary school Science teachers in the Municipality of Dumanjug, Cebu were considered respondents of the study. This approach was justified by the fact that the target population was very limited and accessible, and in the direct core of the end of studying AI-using teachers and non -users.

Instrument

This questionnaire was the primary data-gathering tool for the study has been adopted from Canillo, J. M., et al. (2025) and modified by the researcher to align with the objectives and scope of the present study. The instrument was designed to collect quantitative data on Science teachers' awareness, attitudes, perceptions, and technological skills in relation to Artificial Intelligence (AI) integration in teaching science procedures.

The questionnaire was divided into four (4) major parts, namely: (1) Awareness and Knowledge of Artificial Intelligence, (2) Attitude towards Artificial Intelligence, (3) Perceptions of the Benefits of Artificial Intelligence, and (4) Technological Skills in Using AI for Science Teaching. Each item is rated on a five-point Likert scale with the following options: 1 – Strongly Disagree, 2 – Disagree, 3 – Neutral, 4 – Agree, and 5 – Strongly Agree.

Prior to the administration of the main survey, the modified questionnaire was subjected to content validation and pilot testing to ensure its appropriateness, clarity, and reliability. The instrument was reviewed by a panel of three experts consisting of specialists or panelists during my design hearing. Each expert assessed the items for clarity, relevance, and alignment with the study's objectives. Minor revisions were made based on their suggestions to improve readability and construct alignment. The resulting Content Validity Index (CVI) was 0.92, indicating excellent content validity.

A pre-test was then conducted with a total of ten teachers to determine the internal consistency of the instrument. The sample included five Science major teachers from schools outside the Municipality of Dumanjug and five non–Science major teachers from the school where the researcher is currently assigned. This sampling ensured diverse respondent backgrounds and minimized bias from familiarity with the study context.

The responses from the pre-test were statistically analyzed using Cronbach's Alpha to measure the reliability of each subscale and the overall instrument. The results are summarized below:

Constructs	Number of Items	Cronbach's Alpha (α)	Interpretation
Awareness & Knowledge of AI	5	0.87	Highly Reliable
Attitude towards AI	5	0.91	Highly Reliable
Perceived Benefits of AI	5	0.89	Highly Reliable
Technological Skills	5	0.88	Highly Reliable
Overall Instrument	20	0.89	Highly Reliable

The high Cronbach's Alpha values across all subscales confirm that the questionnaire has strong internal consistency and is both valid and reliable for measuring the extent of AI utilization and related teacher characteristics among Science teachers in public secondary schools in Dumanjug, Cebu.

Data Gathering Procedure

Pre Data Gathering Before conducting the study, the researcher sought the necessary approvals. A formal request was first submitted to the Dean of the Graduate School of Education at the University of the Visayas to obtain clearance. After approval, the researcher completed all graduate school requirements, including the title proposal and research design defense.

The researcher then prepared and sent a formal letter to the Cebu Province Schools Division Superintendent, Senen P. Paulin, requesting permission to conduct the study, and also submitted a request to the University of the Visayas – Research Ethics Committee (UV-REC). The researcher waited for the approval and the official Notice to Proceed before distributing questionnaires. Once permissions were granted, coordination with each school head ensured that the study's purpose, ethical considerations, and questionnaire distribution process respected respondents' rights, privacy, and schedules.

Actual Data Gathering. Once all necessary approvals were secured, the researcher proceeded to administer the validated questionnaire to the Science teachers of public secondary schools in Dumanjug, Cebu. The method of distribution depended on the situation and preference of each school. For schools that allowed face-to-face interaction, the researcher personally delivered and retrieved the printed questionnaires. In schools that preferred online communication, the researcher sent the instrument electronically via email or online forms, along with a consent page and clear instructions on how to accomplish it.

Respondents were given one to two weeks to complete the questionnaire at their convenience. During this time, the researcher maintained communication with the teachers, sending gentle reminders through head teachers, email, or mobile messages to encourage completion.All responses were treated with strict confidentiality. Completed paper forms were kept in a locked folder, while electronic responses were saved in a password-protected file that only the researcher could access.

Post–Data Gathering. After the data had been collected, the researcher carefully reviewed, encoded, and organized all responses. The data were then processed and analyzed using suitable statistical methods. To describe the respondents' profile and summarize their answers, descriptive statistics such as frequency, percentage, mean, and standard deviation were used. The weighted mean and standard deviation helped determine how much AI was being used by teachers and how they rated their awareness, attitude, perceived benefits, and technological skills.

To identify which factors best distinguished teachers who used AI from those who did not, discriminant analysis was applied as the main inferential statistical tool. The challenges and barriers encountered by the teachers in using AI were also tallied and ranked.

Finally, the findings served as the foundation for the development of a Faculty Development Training Program designed to strengthen Science teachers' ability to integrate Artificial Intelligence into classroom instruction and promote deeper student engagement in learning science processes.

Data Analysis

Profile of the respondents in age, education, and teaching experiences was described in terms of frequency counts and percentages for categorical data and the mean and standard deviation for continuous data like the participants' age and years of experiences. How far high school Science teachers utilized AI tools for teaching science procedures.

The analysis of the data based on weighted mean and standard deviation which was interpreted on the basis of Likert scale and its ranges. The level of being (teacher's awareness and knowledge of AI, attitude towards AI, benefits of AI and technological skills) and (or considered knowledge) were also measured using the weighted mean and standard deviation also interpreted based on the Likert scale as well.

Comparative analysis, as the primary inferential statistic of the study, was used to test if differences exist between users and non-users of AI in their teaching in terms of demographic background and teacher characteristics. The problems encountered by teachers relevant to the use of AI are found through frequency counts using percentages and rank order to determine the greatest problems. Lastly, the qualitative faculty development design is developed as a result of the synthesis of the previous research questions.

Ethical Considerations

The study was conducted in accordance with the guidelines set by the research committee, and approval was obtained from the Research and Ethics Committee of the University of Visayas, with Reference No. 2025-0128 dated December 10, 2025. The study involved respondents who were of legal age and voluntarily participated in answering the survey and interview. Prior to completing the questionnaires, participants were provided with an informed consent form detailing the purpose, procedures, risks and benefits of the study, measures to ensure confidentiality, voluntary participation, and contact information. No financial incentives were offered for participation. The researcher declared no conflict of interest.

RESULTS AND DISCUSSION

Demographic Profile of The Teachers

Table 1 presents the demographic profile of the teacher-respondents in terms of age, educational attainment, and teaching experience. These background variables are essential as they may influence teachers' professional practices, instructional decision-making, and openness to educational innovations.

Table 1
Demographic Profile of the Teachers

Variable	Category	Frequency	Percentage
Age	25-34 years old	13	40.00
	35-44 years old	12	40.00
	45-54 years old	2	6.67
	55 and above	3	10.00
Education	Bachelors degree	6	20.00
	With Masters's Units	23	76.67
	Master's Degree Holder	0	0.00
	With Doctoral Units	0	0.00
	Doctorate Degree Holder)	1	3.33
Teaching Experience	1-5 years	8	26.67
	6-10 yrs	9	30.00
	11-15 yrs	9	30.00
	16-20 yrs	1	3.33
	More than 20 yrs	3	10.00

The breakdown of the all teachers' demographic categories show that the categories of age, educational attainment and teaching experience have a roughly equal amount of individuals in them. Since the age distribution is dominated by teachers that are considered to fall into the early to mid-career teaching categories, the literature suggests that in general, these types of teachers are more adaptable to change and more willing to use new and innovative teaching strategies, including technology-enhanced learning strategies (OECD, 2019). Additionally, because younger

teachers have recently completed contemporary teacher preparation programs, they have historically been more flexible to adopting new methods of teaching (Darling-Hammond, 2000).

The small proportion of older teachers may also indicate that there is a lack of availability of highly experienced teachers to act as mentors, which is central to developing instructional leadership and to providing professional development support within schools (Ingersoll, 2001). The high degree to which teachers are engaged in graduate-level studies demonstrates their positive perspective toward continuous professional development. Specifically, teachers who pursue advanced studies tend to demonstrate greater instructional effectiveness and reflect upon their own practices more when working in their classrooms (Villegas-Reimers, 2003). However, the small number of teachers completing advanced studies may indicate the existence of barriers to completing their programs, such as their work or the lack of institutional support. Continuous professional development is critical for maintaining good quality of teaching because it enhances teachers' pedagogical content knowledge and leads to improved student learning outcomes (Guskey, 2002).

The distribution of years of experience implies most of the teachers in our population have moderate levels of experience. The literature indicates that teachers, who are classified in this experience range tend to have a balance of effective classroom management and instruction and are therefore able to carry out structured and learner-centered teaching strategies effectively (Day, 1999). Conversely, the lack of a sufficient number of highly experienced teachers may limit opportunities for those teachers to receive mentorship and coaching as well as acquire tacit pedagogical knowledge from their peers in school settings (Ingersoll, 2001). Highly experienced teachers are vital to maintaining good quality of instruction and to assisting less-experienced colleagues develop professionally.

Table 2
Extent of AI Integration in Science Classrooms

Indicators	Mean	SD	Description
1. I use AI- simulations (e.g. virtual labs, models)	3.87	0.957	Agree
2. I have adopted AI instruments which guide students to perform science experiments step-by-step	3.81	0.703	Agree
3. I utilize AI enabled apps to illustrate complex and abstract science activities	3.84	0.688	Agree
4. I use AI generated graphics and animations to help explain scientific processes.	3.81	0.703	Agree
5. I utilize AI in designing and preparing science materials in science experiments.	3.90	0.700	Agree
Average	**3.85**	**0.586**	**Well Integrated**

Legend: 1.00-1.80=Strongly Disagree/Not integrated; 1.81-2.60=Disagree/least integrated; 2.61-3.40=neutral /moderately integrated; 3.41-4.20-agree/well integrated; 4.21-5=strongly agree/very well integrated

Table 2 reflects a generally positive level of artificial intelligence integration in science classrooms, suggesting that AI technologies are becoming part of mainstream instructional practices. This aligns with contemporary findings that AI-supported instruction enhances both pedagogical efficiency and conceptual learning in science education (Holmes et al., 2022; Chen et al., 2023). The overall implication is that teachers are not merely experimenting with AI tools but are beginning to embed them within instructional design and delivery, which is consistent with global trends in digital transformation in education (UNESCO, 2023).

The results imply that AI is being most strongly utilized in instructional preparation and visualization of scientific concepts. This reflects the growing recognition that AI can reduce teacher workload in lesson design while improving

the clarity of abstract science topics (Zawacki-Richter et al., 2020). In particular, the use of AI for simulations and virtual laboratories supports experiential learning in environments where physical laboratory resources may be limited, reinforcing the argument that AI can help bridge resource gaps in science education (Makransky & Petersen, 2021). Such tools also align with constructivist learning principles, where students learn more effectively through interactive and exploratory experiences (Bruner, 1966; Mayer, 2009).

The findings further suggest that AI tools are increasingly supporting guided experimentation and visualization, which has important pedagogical implications. Research indicates that AI-assisted scaffolding systems can provide immediate feedback and reduce student misconceptions during inquiry-based learning activities (Holmes et al., 2022). This supports the view that AI functions not only as a content delivery tool but also as a cognitive support system that enhances students' scientific reasoning processes (Luckin et al., 2016).

Moreover, the relatively consistent responses across indicators imply a shared level of acceptance and familiarity among teachers regarding AI integration. This may reflect a growing normalization of educational technology use in schools, which is critical for sustained innovation (Ertmer & Ottenbreit-Leftwich, 2010). However, the literature also cautions that meaningful integration depends not only on access but on pedagogical alignment and continuous professional development (Koehler & Mishra, 2009).

Overall, the implications of these findings suggest that AI is contributing to more interactive, efficient, and conceptually rich science instruction. When effectively implemented, AI tools have the potential to transform traditional science teaching into a more learner-centered and inquiry-driven process, provided that teachers are adequately supported through training and institutional resources (UNESCO, 2023; Chen et al., 2023).

Table 3
Extent of Teachers' AI Knowledge, Attitude and Skills

Indicators	Mean	SD	Description
Awareness and Knowledge	4.06	0.635	Very Aware
1. I am aware that AI-powered tools simulate scientific processes	4.16	0.934	Agree
2. I understand how AI can be applied in analyzing scientific data from experiments and investigations.	4.13	0.806	Agree
3. I am knowledgeable about AI-driven platforms that can support science teaching and learning.	3.68	0.945	Agree
4. I am aware of AI chatbots or tutoring systems that provide science-related explanations to students.	4.13	0.763	Agree
5. I understand that AI can be used to improve students' comprehension of science procedures	4.23	0.560	Strongly Agree
Attitude	**4.25**	**0.510**	**Very positive**
1. I am confident in using AI to support my science teaching.	3.84	0.934	Agree
2. I am willing to integrate AI-powered applications in teaching science concepts and procedures.	4.35	0.661	Strongly Agree
3. AI can enhance students' interest and engagement in science.	4.26	0.575	Strongly Agree
4. I consider AI a valuable tool for improving my teaching strategies in science.	4.39	0.558	Strongly Agree
5. I am motivated to learn new AI technologies for teaching science	4.39	0.558	Strongly Agree
Technological Skills	**3.65**	**0.607**	**Proficient**
1. I can operate AI-powered simulation tools to demonstrate science experiments and phenomena.	3.45	0.850	Agree
2. I can use AI-assisted tools for analyzing experimental results and scientific data.	3.68	0.748	Agree

3. I can integrate AI-driven models (e.g., 3D structures, interactive diagrams) into science instruction.	3.84	0.779	Agree
4. I can troubleshoot technical issues when AI tools are used	3.26	0.729	Agree
5. I am capable of continuously learning and adapting to new AI applications for teaching science.	4.03	0.836	Agree

Legend: 1.00-1.80=Strongly Disagree/Not Proficient; 1.81-2.60=Disagree/least Proficient;; 2.61-3.40=neutral /moderately Proficient;; 3.41-4.20-agree/well integrated; 4.21-5=strongly agree/very well integrated

Table 3 indicates that teachers have high levels of knowledge regarding artificial intelligence (AI), very positive attitudes towards it, and a high level of technology skills. Collectively, these factors illustrate that teachers are well positioned for the use of AI in science teaching. Teacher preparedness is widely accepted as a significant factor in the success or failure of technology integration in education (Ertmer & Ottenbreit-Leftwich, 2010). When teachers possess both the proper attitudes and skills, they are more likely to use digital tools substantially through their teaching than superficially (Koehler & Mishra, 2009). Having a strong level of AI knowledge means teachers are cognitively capable of comprehending how AI works in an educational context, particularly in relation to assisting students with their scientific inquiry and data analysis. Research indicates that the knowledge teachers have about educational technology has a direct effect on how effectively it is implemented within a classroom (Niess, 2005). In terms of AI, such AI knowledge assists teachers in being able to appropriately select AI-assisted educational technologies, such as multimedia simulations, intelligent tutoring systems, and AI-based data-driven learning tools, to support students' conceptual understanding in science (Luckin et al., 2016). The high levels of positive attitudes toward AI indicate that teachers are willing to accept and continue to use the new technologies in their teaching. Teacher attitudes are some of the strongest predictors of technology acceptance and integration in schools (Teo, 2011).

In addition, the Technology Acceptance Model (TAM) demonstrates that perceived usefulness and positive attitudes toward using the technology have a substantial effect on a teacher's actual use of it (Davis, 1989). Accordingly, the openness of the teachers to using AI indicates that there is likely to be a strong environment of innovative practices regarding science instruction. Regarding technology skills, this suggests that teachers have a functional level of competence to successfully teach using AI-based technologies for instruction, data analysis, and data visualization, although it is likely that there will be some range of technical confidence among teachers. While general digital competence is typical for teachers, additional technology integration skills, such as technical troubleshooting and adaptive use of AI-based technologies, require ongoing professional development in order for teachers to maintain those higher-level skills (UNESCO, 2023).

Therefore, on-going professional development programs are necessary for increasing teachers' advanced ICT and AI pedagogical skills in STEM education (Voogt & McKenney, 2017). In conclusion, the evidence suggests that teachers in general are well positioned to incorporate AI into their science classes, however, they require continued institutional support to deepen their technical competence in using AI in a pedagogically meaningful way. Additionally, the literature consistently shows that the success of AI in education depends on three things: continued access to technology, positive attitudes toward technology, and continued organizational support for developing teachers' capacity to use technology in their classrooms (Holmes et al., 2022; Chen et al., 2023).

Teachers' Perceived Benefits, Challenges and Barriers of Using AI

According to the information presented in this table, teachers perceive various types of benefits, obstacles, and barriers to incorporating AI tools into their classrooms. In general, this research shows that teachers support the benefits of AI technology; they also report experiencing several challenges and barriers to implementing those technologies..

Table 4
Teachers' Perceived Benefits, Challenges and Barriers of Using AI

Indicators	Mean	Sd	Description
Perceived Benefits	4.23	0.487	Highly Beneficial
1. AI-powered simulations make abstract science concepts easier for students to understand.	4.16	0.820	Agree
2. AI provide immediate feedback to students on science tasks.	4.10	0.746	Agree
3. AI helps students in following science procedures accurately.	4.13	0.670	Agree
4. AI reduces the time in preparing learning materials.	4.35	0.486	Strongly Agree
5. AI helps personalize science learning to fit students' different levels of understanding	4.42	0.502	Strongly Agree
Average	4.03	0.602	Challenging
Challenges and Barriers			
1. I lack of access to AI tools & resources for teaching science.	3.65	0.877	Agree
2. I experience insufficient training or professional development in using AI for instruction.	4.06	0.892	Agree
3. I faced technical difficulties, when using AI.	4.39	0.667	Strongly Agree
4. I believe there is a lack of institutional support for AI integration in science instruction.	4.13	0.846	Agree
5. I find it challenging to align AI tools with the science curriculum and learning competencies.	3.90	1.012	Agree

Legend: 1.00-1.80=Strongly Disagree/Not Beneficialt; 1.81-2.60=Disagree/least Beneficialt;; 2.61-3.40=neutral /moderately Beneficial;; 3.41-4.20-agree/highly Beneficial; 4.21-5=strongly agree/very highly beneficial

The data in Table four suggests that educational professionals believe that artificial Intelligence will enhance science learning by simplifying abstract ideas; developing quality systems for providing individual feedback to every student; and by assisting with personalizing students learning experiences. These perceptions support prior research that has shown that AI-enhanced instructional tools can increase students' conceptual understanding through the visualization and simulation of complex scientific ideas (Holmes et al., 2022).

Additionally, research has shown that AI-based feedback tools improve the learning outcomes of students by providing immediate, adaptive responses to students and assist with formative assessment practices (Luckin et al., 2016). The greatest possibility indicated by the perceived benefits of using AI technology is the positive outcomes for improving students' learning and instruction of teachers by decreasing their workloads and increasing their efficiency in preparing instructional materials and personalizing instruction. Findings from multiple studies have confirmed that AI technologies can automate and offload routine tasks providing teachers with more time to facilitate learning and utilize higher-order teaching strategies (Chen et al., 2023). A high volume of research has identified that personalized learning processes, where AI technology is used in science classrooms, leads to improved levels of student engagement and achievement through the effective use of technology within differentiated instruction (UNESCO, 2023)

However, Findings indicated that there are still many barriers identified in successfully integrating AI into education, and specifically with regard to science teaching and learning. More specifically, the technical challenges, lack of training, and insufficient institutional support are all consistent with previous studies related to technology integration within education, which have shown that lack of teacher resources and training represents one of the primary barriers to meaningful technology integration, despite the positive disposition of teachers toward technology integration and innovation (Ertmer & Ottenbreit-Leftwich, 2010). Additionally, research supports that the inadequate professional training of instructional staff is a significant constraint to the successful integration of advanced technologies, such as artificial intelligence, into classroom instruction (Voogt & McKenney, 2017). Findings suggest that the technical difficulties may also necessitate to the development of a stronger digital infrastructure, and ongoing technical support given to teachers. Research indicates that successful AI technologies into the classroom is directly related to the availability of dependable technological resources, system support, and teacher

preparedness (Zawacki-Richter et al., 2020). In addition, research indicates that there must be sufficient alignment between the use of AI tools with educational standards, and therefore sufficient time for the redesign of curriculum and the alignment of pedagogy, since successful technology integration requires alignment of tools, content, and pedagogy (Koehler & Mishra, 2009). Collectively, the findings illustrate that AI offers a dual experience with regard to the educational benefits of improving science education; however, significant barriers remain to fully realizing the benefits to students and teachers. Sustaining professional development, institutional support, and curriculum alignment strategies will help teachers fully realize the educational benefits of AI to their science instruction (Holmes et al., 2022; UNESCO, 2023).

Difference Between the Higher and Lower Group of AI Integration

The teachers were classified into two groups according to their extent of AI integration. Fortunately, the grouping revealed a proportional group with 15 teachers in each group. Then it was hypothesized that the two groups did not differ in their knowledge, attitude, skills, perceived AI benefits and challenges encountered including AI. The comparison used the t-test of independent sample. Table 5 presents the table of comparison.

Table 4.
Mean Difference Between the lower and Higher AI Integration Groups

Variable	Group	N	Mean	SD	MD	t-value	p-value	Decision	Significance
Awareness	Higher	15	21.8	2.62	2.600	2.524*	0.018	Reject	Significant
	Lower	15	19.2	3.00					
Attitude	Higher	15	22.4	1.95	1.733	2.092*	0.045	Reject	Significant
	Lower	15	20.7	2.47					
Technological Skills	Higher	15	19.1	2.74	0.333-	-1.282	0.210	Accept	Not Significant
	Lower	15	17.7	3.22					
Perceived Benefits	Higher	15	21.5	1.96	1.400	0.411	0.684	Accept	Not Significant
	Lower	15	21.2	2.46					
Challenges	Higher	15	19.7	3.13	0.333	1.204	0.239	Accept	Not Significant
	Lower	15	20.9	2.60					

- Significant at $\leq .05$

This finding is consistent with recent studies showing that teachers' attitudes and acceptance of AI are strongly influenced by their level of experience and engagement with the technology, as increased exposure enhances perceived usefulness, confidence, and intention to integrate AI into teaching practices (Li & Noori, 2024; Velli & Zafiropoulos, 2024)

The significant difference in attitude also implies that teachers who are more engaged in AI integration tend to perceive it as more useful and are more willing to adopt it in instruction. continues to be supported by recent studies demonstrating that perceived usefulness, ease of use, and attitudes significantly influence teachers' intention to adopt AI technologies in education (Xiao et al., 2024; Velli & Zafiropoulos, 2024). Similarly, studies in educational technology indicate that positive attitudes toward digital tools are critical for sustained integration in classroom practice, especially in science education where technology supports inquiry-based learning (Teo, 2011; Holmes et al., 2022).

On the other hand, the absence of significant differences in technological skills, perceived benefits, and challenges implies that these factors are relatively consistent regardless of the level of AI integration. This suggests that technical competencies may be shaped more by standardized training and institutional exposure rather than individual integration intensity. Research supports this by highlighting that ICT skills among teachers often develop through structured professional development programs, leading to relatively uniform skill levels within educational systems (Voogt & McKenney, 2017).

The non-significant difference in perceived benefits implies that teachers, regardless of their AI integration level, similarly recognize the educational value of AI tools in improving instruction. This aligns with studies showing that perceived usefulness of educational technologies tends to be widely shared once teachers are exposed to their pedagogical functions (Zawacki-Richter et al., 2020).

Overall, the implications suggest that while AI integration level is strongly associated with teachers awareness and attitude, it does not significantly influence their skills or perceptions of benefits and challenges. This highlights that cognitive and affective readiness are more sensitive indicators of AI integration than technical or contextual factors. Strengthening teacher awareness and fostering positive attitudes through continuous professional development may therefore be more effective in enhancing AI integration in science education (Holmes et al., 2022; UNESCO, 2023).

The findings imply that since awareness significantly differentiates AI integration levels, training programs should focus on deepening teachers' understanding of AI applications in science education. The significant difference in attitude suggests that fostering positive perceptions of AI can increase its adoption. Schools should promote success stories, peer sharing, and supportive environments to strengthen teacher confidence.

The lack of significant difference in technological skills indicates that technical competence alone does not guarantee higher AI integration. Training should therefore integrate pedagogical and practical applications of AI, not just technical operation. Since perceived benefits and challenges are similar across groups, institutional barriers (e.g., infrastructure, policies) affect all teachers equally. Schools must address these systemic issues to improve overall AI integration. The findings suggest that successful AI integration requires a combination of knowledge, attitude, and support systems, rather than focusing on a single factor.

Findings and Conclusion

Teachers who responded to the questionnaire are mainly younger to middle age and have relatively little teaching experience. Most of them are taking classes on advanced degrees. Their profile suggests that they are a nimble, developing, and growth-oriented workforce.

The evidence for the use of AI in science classes is established. The teachers reported that they commonly used simulation, instructional materials, and visualisation technologies, as well as other AI tools to support both teaching and learning. Teachers have a high degree of awareness about AI and also have positive attitudes towards it and good technology skills. This means that they are generally able and willing to include AI in their science teaching, but some additional technical skills may need development.

Teachers also believe that using AI has greatly benefited them by allowing them to provide personalised learning opportunities, provide better conceptual understanding and save time preparing for lessons. While teachers perceive that they have several challenges, such as technical issues, lack of resources, insufficient training, and a lack of institutional support, they clearly identify that those who have higher and lower levels of use of AI have a significant difference in awareness and attitudes that affect whether or not they will use AI. However, there are no significant differences in the teachers' technology skills, perceived benefits of using AI, or challenges to using AI regardless of their level of use.

This indicates that both awareness and attitude significantly affect whether or not teachers will use AI in their science classes, but the effect of AI technology in the classroom will be determined by the level of awareness and attitude of teachers and by the level of support from the institutions from which they exist.

Recommendations

Based on the findings and conclusions, the following recommendations are provided:

For Policy. Educational institutions should provide ongoing and targeted training to teachers on integrating AI including both technology and instructional practice. Schools should actively support teachers in obtaining their master's and doctoral degrees by offering scholarships or reducing teaching loads. Curriculum developers and principals should have guidelines to align the use of AI with the competencies and learning standards of science.

For Practice. Schools should invest in technology infrastructure, including reliable internet access, sufficient classroom machines for students, and up-to-date AI tools in order to limit or eliminate technical problems and make AI easier for teachers and students to use.

For Research. More research should examine students' perceptions of AI in comparison to the tasks assigned to them by their teachers. Research on technology's ability to assign work accurately to improve students' grades should also be conducted. Finally, a qualitative study should be completed to determine the reasons for fear of using AI by teachers.

LAC SESSION REPORT (Session No. 1)
LAC ID: AI Integration in Science
Region: VII – Central Visayas
Facilitator: Ms. Tyra Lee Ibale
Session No.: 1
Date & Time: June 2026
Venue: SCIENCE FACULTY. DUMANJUG NHS
Number of Participants: 10

Materials & Resources

- DepEd LAC Session Guide template on AI Integration
- AI-powered simulation tools (virtual labs, interactive diagrams)
- Sample lesson plans integrating AI in science topics
- ICT resources (projector, PC/laptops, tablets, internet access)
- Worksheets and activity cards for group exercises

Part A: Member Participation & Facilitation

Statement	Rating (SD–SA)	Comments / Remark
Members came prepared	A	Reviewed pre-session AI materials
Opportunity to share ideas	SA	All members contributed AI use cases
Members listened actively	A	Discussions flowed smoothly

Assignments showed understanding	A	Work samples reflected AI integration plans	
Members enthusiastic	SA	High energy in brainstorming AI applications	
Facilitator kept focus on topic	SA	Session stayed aligned with AI integration objectives	
Encouraged active participation	SA	Everyone felt safe to share ideas	
Provided useful feedback	A	Feedback helped refine AI lesson plans	

Part B: Reflections & Plans

1. Best part of session:

Teachers demonstrated AI integration in mini-lessons using simulations and interactive apps, creating rich discussions and exchange of innovative teaching strategies.

2. Challenges & resolutions:

Some teachers were unfamiliar with certain AI tools. Resolved through guided hands-on demonstration and small-group peer coaching.

3. Other discussed topics:

- Aligning AI tools with science learning competencies
- Personalized learning using AI for different student levels
- Strategies for overcoming technical and resource limitations

4. Recommendations / Next session plans:

- Teachers to implement AI-integrated lessons in their classrooms
- Collect student feedback and share outcomes in the next session
- Invite an expert on educational AI tools for advanced applications

Part C: SESSION MATRIX & PLAN

Rationale:

Integrating AI in science instruction supports experiential and inquiry-based learning, improves conceptual understanding, and enhances student engagement (Holmes et al., 2022; Makransky & Petersen, 2021). Teachers need structured sessions to explore AI tools, share strategies, and plan classroom implementation.

Audience: Science teachers (elementary and secondary)

Objectives:

- Explore AI tools and their applications in science instruction
- Design mini-lessons incorporating AI simulations, virtual labs, and interactive models
- Develop strategies to implement AI-integrated lessons and assessments

Expected Outcomes:

- AI-integrated lesson exemplars per teacher
- Shared repository of AI teaching resources
- Action plan for classroom implementation and reflection

Session Matrix

Session	Time	Activity	Assigned
1	10 min	Attendance & Pre-Read Overview	Host
2	15 min	Introduction: AI in Science Education	Facilitator
3	45 min	Workshop: Design Mini-Lessons Using AI	Small Groups
4	20 min	Sharing and Feedback	All Participants
5	20 min	Planning Next Steps & Classroom Pilot	Facilitator & Members

LAC Plan Overview

Phase	Activities	Persons Involved	Time Frame	Resources	Success Indicators
Planning	Needs assessment, AI tool preparation	Teachers	[Insert Dates]	AI apps, sample lessons	Ready-to-use AI integration toolkit
Implementation	Pilot AI-integrated lessons	Individual Teachers	[Insert Dates]	Virtual labs, interactive apps	Student engagement increases
Evaluation	Share successes and challenges	LAC Members	[Insert Dates]	Reflection forms, feedback data	Refined and improved AI lessons

Prepared by: JANET MARIE D. BILLOAN
Facilitator: TYRA LEE L. IBALE
Approved by: RICARDO I. FERRER

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