Lived Experiences of Junior High School Science Teachers in AI Integration in Science Pedagogy: A Phenomenological Study

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Abstract

This study explored the lived experiences of junior high school science teachers in overcoming challenges related to the integration of artificial intelligence (AI) in classroom instruction. Anchored in a qualitative phenomenological design, the research involved eleven (11) purposively selected teachers from a public secondary school in Leyte Division. Data were collected through open-ended questionnaire responses and analyzed using the phenomenological approach of Clark Moustakas (1994), focusing on identifying significant statements, clustering themes, and deriving the essence of participants' experiences. Findings revealed that teachers exhibit varying levels of AI competence, ranging from developing to skillful utilization, with many prioritizing practical applications over technical expertise. Key challenges identified include limited technological resources, concerns about the quality and reliability of AI outputs, and issues related to academic integrity. Additionally, insufficient training and lack of hands-on experience hinder effective AI integration. Participants emphasized the need for continuous, practical training, collaborative learning environments, and access to advanced technological resources. The study highlighted the gap between policy expectations and actual classroom practices, underscoring the importance of sustained professional development and institutional support to enhance teachers' competence and confidence in integrating AI into science education.

Keywords: *lived experiences, Artificial Intelligence, Classroom instruction*

Introduction

Artificial Intelligence also known as AI has transformed the delivery of instruction to the education sector as teachers make lesson plan through AI integration, assess learners to enhance experimentation, visualization and some inquiry-based learning. As such rapid rise of AI, some teachers didn't find the confidence or hesitant enough in using these available new trends in technologies and as a result, practices in classroom varies (Nazaretsky, et al., 2022). Some local public secondary schools can access such resources yet remains idle to adapt to the new trend. To ensure meaningful and equitable AI-enhanced Science learning, understanding teachers' competence regarding this topic is crucial.

Recent studies highlight that AI can simplify a complex concept, enhance student engagement and support personalized learning (Tariq, 2025). However, research also indicates that teachers often lack training, confidence, and proper guidance on integrating AI into their everyday teaching. Existing studies tend to focus on the benefits of AI rather than on actual competence of teachers' and the readiness to utilize it in the classroom. This concern aligns with Sustainable Development Goal (SDG 4 Quality Education) which

promotes inclusive and equitable access to quality learning supported by technology (Ikram, et al., 2018). Furthermore, national policies such as DepEd's Digital Rise Program and Commission on Higher Education (CHED) initiates in promoting digital literacy to enhance teachers' ability to use the emerging technologies. Despite all these efforts and mandates, many teachers remain insufficient in utilizing AI in science classroom setting.

Given this situation, there is a clear gap between policy expectations and actual teaching practices regarding AI integration. While training programs are available, their impact on teachers' competence and confidence has not been thoroughly explored at the school level. This study is therefore necessary to understand how Science teachers perceive, utilize, and navigate AI tools in their day-to-day instruction (Yadav, et al., 2023).

. The findings would benefit Science educators, school leaders, curriculum planners, and policymakers by providing insights for targeted capacity-building programs and technology-integration frameworks. This study is also anchored with Technological, Pedagogical Content Knowledge (Oved et al., 2025) which emphasizes that meaningful technology integration occurs when teachers are able to align their understanding of subject matter (content knowledge), instructional strategies (pedagogical knowledge), and digital tools (technological knowledge) in a cohesive manner.

This study focused on exploring the teaching competence of science teachers in utilizing AI within secondary school classrooms. It does not evaluate student performance or compare schools but rather centers on teachers' experiences and practices. The purpose is to identify current competencies, challenges, and opportunities related to AI integration. Specifically, this study seeks to answer the following research questions: (1) How do Science teachers describe their competence in utilizing AI tools in the classroom? (2) What challenges do Science teachers encounter in integrating AI in their instructional practices? (3) What support and training do teachers believe are necessary to enhance their competence in using AI?

1. Methodology

1.1. Research Design

This study utilized a qualitative phenomenological research design to explore the lived experiences of junior high school science teachers in integrating AI into science pedagogy. Phenomenology is appropriate in this study as it seeks to understand the essence of participants' experiences and how they perceive and make meaning relative to their overall experiences of AI integration in their classrooms.

2.2. Research Locale

The study was conducted in a selected public secondary school within Leyte Division. Some of these schools are equipped with computer laboratories, internet connectivity and basic digital learning resources, making it an appropriate setting for examining AI-related teaching practices. The locale represents a typical Science teaching environment where teachers are encouraged to integrate technology into instruction to the Gen Betta learners.

2.3. Research Participants

The participants of the study include eleven (11) Junior High School Science teachers who have experience or exposure to AI tools in instructional practices. According to Clark Moustakas (1994), phenomenological

studies typically involve a small number of participants who can provide rich and meaningful descriptions of their lived experiences. Participants were selected using purposive sampling to ensure that they could provide meaningful descriptions of their lived experiences related to AI integration in science pedagogy.

Inclusion Criteria

1. Junior High School Science teachers currently teaching in a public secondary school
2. Junior High School Science teachers with prior experience or exposure to using artificial intelligence (AI) tools in instructional practices.

Exclusion Criteria

1. Junior High School Science teachers who have no experience or exposure to AI tools in teaching.
2. Teachers teaching non-science subjects or not currently handling junior high school classes

2.4. Research Instrument

The study used a questionnaire-style research instrument with open-ended questions. The instrument was validated by experts before the conduct of the study. The purpose of the tool is to provide in-depth, thoughtful, and narrative answers from the participants (Taherdoost, 2016). The instrument comprises two sections: (1) Demographic Information (age, gender, teaching experience, subjects taught, and degree of familiarity with AI tools); and (2) Experiences in AI Integration (open-ended prompts asking participants to describe personal experiences, challenges, benefits, and reflections regarding AI integration). Participants were urged to include examples and were required to write answers in complete sentences, with at least three to five sentences each question. In this phenomenological study, reflexivity is attained through ongoing self-examination in which the researcher critically considers preconceived notions, prejudices, and past experiences that might affect how data is interpreted. To keep participants' lived experiences at the center of the study, this process is further reinforced by keeping reflective notebooks and purposeful bracketing.

2.5. Data Gathering Procedures

The researchers sought approval from the Schools Division Office and the school principal prior to data collection. After securing permits, participants were invited through formal letters and informed about the study’s purpose, confidentiality measures, and voluntary nature. Informed consent forms were then distributed to ensure voluntary participation, confidentiality, and ethical compliance. Upon obtaining consent, the questionnaires were given to the participants with instructions to complete it within a specified time-frame of two weeks. Completed questionnaires were collected and securely stored for analysis. This method of data collection allowed participants enough time for reflection, enabling them to provide detailed and meaningful descriptions of their lived experiences in the entire conduct of the study.

2.6. Data Analysis

The study applied phenomenological data analysis, drawing on the methods of Moustakas (1994) Phenomenological analysis, adapted for written questionnaire responses. Analyzing the data of this study did not merely focus on summarizing the responses, but to capture the true meaning and essence of a shared experiences. This type of data analysis includes the step-by-step process; (1) Horizontalization, (2) reduction and Elimination, (3) Clustering into Themes, (4) textural and descriptions and, (5) Synthesis of Meaning and Essence. First, all participant narratives were read multiple times to gain a thorough understanding of their

experiences. Significant statements capturing meaningful aspects of AI integration were identified, with each statement treated as having equal value.

2.7. Ethical Considerations

This study upheld ethical standards by ensuring voluntary participation and the right to withdraw at any time without consequence. All data will remain confidential and will be stored securely in password-protected files accessible only to the researcher. Pseudonyms will be used in reporting results to protect participants' identities. Permissions will be obtained from relevant authorities, and informed consent will be required before conducting interviews or observations.

2. Results and Discussion

The following data presents the lived experiences of eleven Junior High School Science teachers relative to the integration of Artificial Intelligence (AI) in their classroom practices.

Competence of Science Teachers in Utilizing AI in the classroom

Science teachers today are gradually finding their place in using artificial intelligence (AI) in the classroom. For many, it's not just about knowing what AI is, but learning how to use it in ways that make teaching more effective and engaging for students. AI tools can help simplify complex science concepts, support inquiry-based activities, and even provide materials that fit different learners' needs (Kunnath and Botes, 2025).

Theme 1: ***Developing and Transitional AI Competence.***

It was stressed by Iashvili, 2024 his study, becoming competent in AI is not something that happens overnight. It requires a mix of technical know-how, good teaching strategies, and an understanding of ethical concerns like accuracy, privacy, and responsible use. Many teachers are still in the process of building their confidence as well as moving from simply being aware of AI tools to using them more meaningfully in their lessons.

Significant Response 1*: "I may describe it as a foundational… I have limited hands-on experience." (P1)*

Significant Response 2: "I am not skilled… I am hesitant to integrate them." (P2)

Significant Response 3: "Mediocre. I may have the basic idea…" (P8)

Significant Response 4: "I would describe my competence… as developing and adaptable." (P10)

Theme 2: ***Practical Application Over Technical Expertise***

In exploring the competence of science teachers in utilizing AI tools, a clear pattern emerges: many teachers rely more on the practical application of these tools than on deep technical expertise. Rather than mastering every feature or function (Belloula, 2025), teachers focus on how AI can enhance lesson planning, simplify complex concepts, and support student engagement**.** Their confidence often comes from seeing tangible classroom results—how AI can generate practice materials, personalize learning, or assist in assessments—rather than from complete technical mastery.

Significant Response 1: "I could use it confidently with my learners… however not so competent technically." (P11)

Significant Response 2: "Somewhat using AI for more references and additional ideas." (P6)

Significant Response 3: "I am competent enough… as long as resources are available." (P5)

Significant Response 4: "I can use AI to help create lesson plans, generate activities…" (P10)

Theme 3: ***Skillful in AI Utilization***

Teachers who are skillful in AI utilization demonstrate confidence in selecting appropriate tools, As Pedro et al., (2019) mentioned, AI become more usable in adapting them to lesson objectives, and creatively addressing classroom challenges. This level of proficiency goes beyond basic understanding, emphasizing purposeful and efficient application that bridges technological capability with pedagogical goals.

Significant Response 1: "I can write an appropriate prompt… context, task, instructions…" (P4)
Significant Response 3: "By using proper prompt… very specific in details… AI tools are very useful." (P9)
Significant Response 4: "By using proper prompt… very specific in details… AI tools are very useful." (P9)

Theme 4: ***Insufficient Training and Practical Exposure***

Many teachers possess limited hands-on experience with AI tools, which hinders their confidence and ability to apply these technologies meaningfully in instruction. As stated by Worapongpat (2025), without adequate training and opportunities for practice, teachers often struggle to move beyond theoretical knowledge, this would result in hesitation or underutilization of AI in teaching.

Significant Response 1: "I need support and training in order to successfully integrate AI…" (P2)
*Significant Response 2**: "**Lacks formal training… nor the interest to integrate…" (P8)*
Significant Response 3: "Limited hands-on experience." (P1)

Challenges encountered by Science Teachers of AI Integration in their instructional practices.

These challenges include limited access to technological resources, insufficient training in AI applications, difficulties in aligning AI tools with curriculum objectives, and concerns about student data privacy and ethical use (Park et. al., 2023). Understanding these obstacles is crucial, as it highlights the complexities teachers navigate in adapting traditional science instruction to a rapidly evolving digital landscape, while striving to maintain effective and meaningful learning experiences for their students.

Theme 1: ***Technological and Resource Limitations and Constraints***

Rahiem (2023) found out in his study that limited access to modern devices, inadequate internet connectivity, and insufficient laboratory materials hinder teachers' ability to implement innovative instructional strategies. These constraints not only affect the quality of teaching but also limit students' opportunities to engage meaningfully with scientific concepts. Exploring these challenges is crucial to understanding how resource limitations shape instructional practices and influence the overall learning experience in technologically driven educational environments.

Significant Response 1: "Limited access to devices… and free AI software licenses" (P1)
Significant Response 2:" Not all students have gadgets and reliable internet access. "(P2)
Significant Response 3: "No Stable Internet connection…." (P8)

Theme 2: ***Quality of AI Output Concerns***

Errors, oversimplifications, or biases in AI outputs can mislead students and compromise learning outcomes. Understanding these concerns is essential, as it highlights the responsibility of teachers to ensure that AI serves as a supportive tool rather than a source of misinformation, while maintaining the integrity and rigor of science instruction (Wirzal et. al., 2024).

Significant Response 1: "Reliability of the information/answers given" (P6)
Significant Response 2: "Some AI do not include references" (P9)
Significant Response 3: Errors in the created models…. too many information" (P5)
Significant Response 4: "Accuracy of the product…. Couldn't generate the desired output" (P9)

Theme 3*: **Academic Integrity Dilemmas***

According to Pellerin and Ogandaga, (2024), Teachers are increasingly confronted with dilemmas surrounding plagiarism, unauthorized use of AI-generated content, and students' overreliance on automated tools for completing assignments. These issues raise questions about fairness, accountability, and the ethical development of learners' critical thinking skills. Examining academic integrity dilemmas is crucial for understanding how AI reshapes the responsibilities of educators and the strategies they must employ to promote honest, responsible, and meaningful learning practices in the classroom.

Significant Response 1: "Student over-reliance, their critical thinking become less developed" (P2)
Significant Respoonse 2: "Palgiarism, privacy and security concern.(P2)
Significant Response 3: Mainrtainign Academic Integrity and avoiding AI biases" (P3)
Significant Response 4: Ensuring AI responsibly rather than shortcuts." (P7)

Necessary teacher training and support in enhancing competence in using AI

To bridge the gap in AI literacy and technical troubleshooting, Kohen-Vacs and Jansen, (2025) proved that targeted professional development is vital. By prioritizing ongoing teacher support, schools can empower educators to move beyond simple automation and instead use AI to craft personalized, scientifically rigorous, and highly engaging student experiences.

Theme 1: ***Continuous Skill-Based AI Training***

Responses from participants highlight the importance of immersive workshops, ongoing training sessions, and webinars or seminars that provide real-world, application-based experiences (P7, P10). This was supported by the study of Lurckin (2025), such training approaches allow educators to actively engage with AI tools, experiment with instructional strategies, and address challenges in a supportive learning environment. Emphasizing continuous and practical professional development ensures that teachers are not only familiar with AI technologies but are also capable of leveraging them to enhance student learning outcomes in meaningful and innovative ways.

Significant Response 1: Hands-on Workshops, continuous training sessions…" (P7)
Significant Response 2: Continuous training workshops and webinars/seminars about AI." (P10)
Significant Response 3: Seminar Workshops in using AI" (P11)

Theme 2*: **Collaborative and Peer-Supported Learning Environment***

A collaborative and peer-supported learning environment plays a crucial role in helping teachers effectively integrate Artificial Intelligence (AI) into their instructional practices. Campbell (2019) believed that by engaging in shared learning experiences, mentorship, and peer-to-peer discussions, educators can exchange insights, troubleshoot challenges, and collectively develop innovative teaching strategies. Such an environment not only fosters professional growth but also encourages reflective practice and continuous improvement.

Significant Response 1: "Support from co-teachers who are experts through collaboration." (P2)
Significant Response 2:" Support from those who are well competent…" (P3)

*Theme 3: **Need for Access to Resources and Advanced Skill Development***

Limited availability of technological tools, instructional materials, and up-to-date AI applications can hinder educators' ability to design engaging and meaningful lessons (Rudick and Onyshchuk, (2024). At the same time, developing higher-level competencies in using AI—such as data analysis, personalized instruction, and ethical application—demands continuous professional growth. Addressing these needs is essential to empower teachers to harness AI effectively, ensuring that technological innovations translate into improved instructional practices and enriched learning experiences for students.

Significant Response 1: "Access to free AI software licenses" (P1)
Significant Response 2: "Learn how to make AI simulations." (P5)
Significant Response 3: "Generating videos using AI" ... (P9)
Significant Response 4: Knowledge pf Available Tools…" (P6)

This result demonstrated the disparities in scientific teachers' AI proficiency, which may be divided into three main phases: developing, practical, and skillful. George (2023) corroborated this, stating that while some teachers were in a foundational stage with little practical experience, many places more emphasis on practical application using AI to organize lessons and create activities than on in-depth technical expertise. Those who are deemed skilled exhibit a high degree of competence in "prompt engineering" to connect technical capabilities with educational objectives. Lack of formal training and real-world experience (Abbas and Aslam, (2025), however, continues to be a major obstacle that frequently leads to reluctance and the underuse of these resources in the classroom.

Teachers deal with a variety of difficult issues beyond individual proficiency, such as limited access to contemporary technologies and bad internet connectivity. Integration is made more difficult by worries about the quality of AI output, particularly mistakes, a lack of references, and potential biases, as teachers must guarantee the academic integrity and scientific rigour of their teachings. The document highlights the need for practical, ongoing professional development and the establishment of cooperative, peer-supported learning settings in order to overcome these challenges. Giving teachers access to software licenses and advanced skill training—like making AI simulations and videos—is seen to be crucial for enabling them to improve student learning results.

Conclusion

The research findings conclude varied outcomes pertaining to the teachers' competence in AI integration through a spectrum ranging from foundational and developing to skillful and adaptable. While some science teachers found it challenging in integrating AI in their classroom teaching pedagogy due to limited hands-on experience, others have found a "middle ground" by prioritizing practical application over technical expertise, focusing on AI's ability to simplify complex concepts and generate lesson materials rather than mastering the underlying technology. High levels of proficiency are specifically linked to the ability to write precise, detailed prompts to achieve specific pedagogical goals. Despite this growing interest, significant obstacles hinder full integration. Teachers encounter major challenges including technological and resource constraints, such as unstable internet and a lack of free software licenses, alongside deep concerns regarding the quality and accuracy of AI outputs. Furthermore, the rise of AI has introduced academic integrity dilemmas, forcing educators to balance the efficiency of AI with the need to prevent student over-reliance and the erosion of critical thinking skills. To bridge these gaps, teachers identify a critical need for hands-on, continuous, and practical training rather than one-time theoretical seminars. They advocate more for a collaborative and peer-supported learning environment where they can troubleshoot challenges with expert colleagues. Ultimately, enhancing competence requires a holistic approach that combines technical access such as advanced skill development in AI simulations and video generation with strong institutional support to ensure AI is used responsibly and effectively in the science classroom.

Recommendations

To support the transition of science teachers from foundational to skillful AI utilization, the following actions are recommended: (1) Implement Sustained, Hands-on Training. Move away from one-time seminars toward

continuous, immersive workshops that focus on practical applications like lesson planning and creating science simulations. (2) Establish Peer-Support Networks. Schools of the participants should foster collaborative environments where "expert" teachers' mentor those who are hesitant or developing, allowing for real-time troubleshooting. In bridging the Resource Gap, administrators from the school locale must prioritize providing stable internet connectivity, modern devices, and institutional access to free or subsidized AI software licenses. Most importantly, Formalize Ethical Guidelines, by developing a clear framework to address academic integrity, plagiarism, and student over-reliance, ensuring AI is used as a supportive tool rather than a shortcut.

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