

**TEACHERS' PERCEPTIONS AND CHALLENGES IN THE USE OF ARTIFICIAL INTELLIGENCE (AI) IN TEACHING SCIENCE****\*Mary Kimberly B. Peliño, Fe R. Janiola and Vera A. Villocido**

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**Received 15<sup>th</sup> January 2026; Accepted 18<sup>th</sup> February 2026; Published online 30<sup>th</sup> April 2026****Abstract**

This study examined the perceptions and challenges of public school science teachers regarding the integration of Artificial Intelligence (AI) in science education. Specifically, the research assessed teachers' perceived usefulness, perceived competence, professional development and training, and perceived challenges to AI adoption, while investigating the relationships among these variables, their predictive influence, and potential differences across demographic profiles. Adopting a quantitative descriptive-correlational design, data were collected from 113 science educators through a validated 40-item survey instrument. Statistical analyses included weighted means, Pearson  $r$ , multiple regression analysis, and differential tests (t-tests and ANOVA). Findings revealed that while teachers demonstrated a highly positive level of perceived usefulness (WM = 3.42, SD = 0.62), their perceived competence (WM = 3.14, SD = 0.62) and access to professional development and training (WM = 2.72, SD = 0.62) were only moderately developed. Additionally, respondents reported high levels of perceived challenges (WM = 3.02, SD = 0.60), specifically in the areas of data privacy, infrastructure limitations, and ethical concerns. Significant correlations were established between perceived competence, professional development and training, and perceived usefulness. Multiple regression analysis further indicated that competence and training significantly predicted perceived usefulness, accounting for 53% of its variance ( $R^2 = 0.53$ ). No significant differences were found across demographic variables. These results indicate that while teacher receptivity is high, effective AI integration in science teaching requires addressing technical gaps through structured professional development and training and mitigating systemic perceived challenges to ensure responsible and sustainable adoption.

**Keywords:** Artificial Intelligence, Perceived Usefulness, Perceived Challenges, Professional Development, Science Education, Teacher Competence, Technology Integration.**INTRODUCTION**

Artificial intelligence (AI) is increasingly transforming educational practices worldwide by enhancing instructional effectiveness, enabling personalized learning, and supporting innovative teaching strategies. AI-powered tools such as intelligent tutoring systems, automated assessment platforms, and generative applications like ChatGPT and Canva allow teachers to improve engagement and deliver more adaptive instruction (Chiu *et al.*, 2023b; Dwivedi *et al.*, 2023; Su *et al.*, 2022). Despite these advancements, AI adoption among science teachers remains inconsistent, largely influenced by perceived usefulness and perceived competence. Grounded in the Unified Theory of Acceptance and Use of Technology (UTAUT), this study posits that teachers are more likely to adopt AI when they perceive it as beneficial to instructional performance (Venkatesh *et al.*, 2003). Perceived usefulness reflects the extent to which AI enhances teaching efficiency, conceptual understanding, and student engagement (Ayanwale *et al.*, 2022; Ng *et al.*, 2021; Park *et al.*, 2023). Perceived competence, aligned with Bandura's Self-Efficacy Theory, refers to teachers' confidence in using AI tools effectively, which strongly predicts technology integration in classroom practice (Bandura, 1997; Chiu *et al.*, 2023a; Chou *et al.*, 2023). In addition, professional development and training are critical facilitating conditions that strengthen teachers' technical skills and pedagogical readiness for AI integration (Fitria and Suwono, 2023; Redmond *et al.*, 2021; Tiba and Condy, 2021). However, barriers such as limited infrastructure, insufficient training, ethical concerns, and a lack of institutional support continue to hinder effective implementation (Fitria and Suwono, 2023; UNESCO, 2023; OECD, 2023). In the Philippine context, despite national efforts by the Department of Education to promote digital

transformation, gaps in resources and training persist, particularly in public schools (Department of Education, 2022). This study examines how perceived usefulness, perceived competence, professional development and training, and perceived barriers influence science teachers' adoption of AI in education. It is anchored on UTAUT, Self-Efficacy Theory, and Diffusion of Innovations Theory (Rogers, 2003), and supported by Philippine educational policies promoting 21st-century skills and digital literacy.

**METHODOLOGY**

This study employed a quantitative descriptive-correlational research design to examine the relationships among perceived usefulness, perceived competence, professional development and training, and perceived challenges in the use of artificial intelligence (AI) among science teachers in Loon North and Loon South Districts, Division of Bohol, during the school year 2025–2026. The descriptive component was used to determine the levels of the variables, while the correlational design assessed relationships among them. Multiple regression analysis was used to identify predictors of perceived usefulness, and inferential tests were applied to determine differences across demographic profiles. The study was conducted in Loon District, Bohol, Philippines, covering 45 public elementary and secondary schools under the Department of Education. The district consists of both rural and semi-urban schools with varying access to educational resources and technology. It was selected due to its diverse school contexts and active participation in digital literacy and teacher development programs, making it suitable for examining AI integration in science education. The participants were public elementary and secondary science teachers from Loon North and Loon South Districts. A universal sampling approach was initially used, targeting 146 teachers across 45 schools. However, the final sample

consisted of 113 respondents due to unavailability and voluntary non-participation. Inclusion criteria required participants to be officially teaching science subjects and have exposure to AI tools in instruction, while non-science teachers, unavailable personnel, and those without AI experience were excluded. Ethical protocols were strictly observed, including informed consent, confidentiality, and the right to withdraw without penalty. Data were collected using a researcher-modified questionnaire adapted from Alshorman (2024) and Çayak (2024), consisting of 40 items across five sections: demographic profile, perceived usefulness of AI, perceived competence, professional development and training, and perceived challenges. Sections II–V used a four-point Likert scale ranging from Strongly Disagree (1) to Strongly Agree (4). The instrument was validated by a panel of experts and pilot-tested with 30 teachers not included in the final sample. Content validity was ensured through expert review by five specialists in science education and educational technology. Revisions were made based on their recommendations. Reliability testing using Cronbach's Alpha yielded high internal consistency: perceived usefulness ( $\alpha = 0.936$ ), perceived competence ( $\alpha = 0.950$ ), professional development and training ( $\alpha = 0.960$ ), and perceived challenges ( $\alpha = 0.890$ ), indicating that the instrument is highly reliable.

Data collection followed three phases: (1) ethical clearance and administrative approval from the Holy Name University Ethics Review Board and DepEd authorities; (2) survey administration through paper-based and digital distribution after obtaining informed consent; and (3) data coding, tabulation, and statistical analysis. Findings were formally reported to participating schools and the Division Office for future policy reference. The study complied with the ethical standards of the Holy Name University Ethics Review Board and the Data Privacy Act of 2012 (R.A. 10173). Participation was voluntary, with anonymity and confidentiality strictly maintained. No risks or incentives were involved, and participants were free to withdraw at any time. The researcher declared no conflict of interest. Descriptive statistics (frequency and percentage) were used for demographic profiling, while the weighted mean was used to determine levels of perception. Pearson product-moment correlation was applied to examine relationships among variables. Multiple linear regression was used to identify predictors of perceived usefulness. Independent samples t-test and one-way ANOVA were used to test differences in perceptions across demographic groups.

## RESULTS AND DISCUSSION

### Demographic Profile of Respondents

A total of 113 public school science teachers from Loon North and Loon South Districts participated in the study. As shown in Table 1, most respondents were aged 30–39 (30%), followed by 40–49 (29%), 50 and above (25%), and 20–29 (16%). The majority were female (76%), and most held bachelor's degrees (84%). In terms of position, 93% were Teacher I–III, and most had 1–15 years of teaching experience (77%). This demographic composition reflects the typical structure of basic education teaching personnel in the Philippines, where female educators dominate, and most teachers are within early to mid-career stages. Similar patterns have been reported in recent studies on educational technology adoption, where age, experience, and educational attainment

are frequently examined as contextual variables but are not necessarily determinants of technology acceptance (OECD, 2023; Zhao *et al.*, 2022).

**Table 1. Distribution of Respondents (N = 113)**

Variable	Category	f	%
Age	20–29	18	16
	30–39	34	30
	40–49	33	29
	50 and above	28	25
Gender	Female	86	76
	Male	27	24
Educational Attainment	Bachelor's Degree	95	84
	Master's Degree	15	13
	Doctorate Degree	3	3
Academic Rank	Teacher I	44	39
	Teacher II	12	10
	Teacher III	50	44
	Teacher V	2	2
	Teacher VI	2	2
	Master Teacher I	3	3
Length of Teaching Experience	1–5 years	34	30
	6–10 years	18	16
	11–15 years	35	31
	16–20 years	18	16
	21+ years	8	7

### Perceptions of Artificial Intelligence (AI) in Science Education

Science teachers demonstrated a very positive perception of artificial intelligence (AI) usefulness in science instruction ( $M = 3.42$ ). Respondents strongly believed that AI enhances instructional efficiency, supports personalized learning, improves teaching quality, and complements rather than replaces teachers' roles (Almasri, 2024; Park *et al.*, 2023). However, relatively lower agreement was observed in AI's capacity to enhance critical thinking and problem-solving skills, suggesting cautious optimism regarding its higher-order cognitive instructional impact. Similarly, teachers reported a positive but developing level of competence in using AI tools ( $M = 3.14$ ). They expressed confidence in understanding basic AI concepts, integrating AI with traditional instruction, and collaborating with peers (Ng *et al.*, 2021; Chiu *et al.*, 2023a). Nevertheless, lower ratings were observed in troubleshooting technical issues and learning new AI systems, indicating gaps in technical self-efficacy (Bandura, 1997; Chou *et al.*, 2023). In terms of professional development and training, respondents reported a generally high level of exposure ( $M = 2.72$ ), although formal structured AI training remained limited (Fitria and Suwono, 2023; Redmond *et al.*, 2021). Teachers primarily relied on self-directed learning, institutional encouragement, and informal exposure to AI tools. Respondents reported a high level of perceived challenges in AI adoption ( $M = 3.02$ ). Key concerns included data privacy, ethical risks, unreliable AI-generated assessments, limited infrastructure, and insufficient institutional policies (UNESCO, 2023; OECD, 2023). These findings highlight that despite positive attitudes, structural and ethical concerns continue to hinder full AI integration in science education. These results align with prior literature emphasizing that while teachers recognize the pedagogical value of AI, successful integration is constrained by technical, ethical, and institutional barriers (Zawacki-Richter *et al.*, 2021; UNESCO, 2023; Chiu *et al.*, 2023b).

### Correlation between AI Adoption Variables

Pearson correlation analysis revealed significant positive relationships among key variables influencing AI adoption

among science teachers. Data in Table 2 indicate that perceived competence has a stronger association with perceived usefulness compared to professional development. This suggests that teachers who feel more confident in using AI are more likely to recognize its instructional value. This finding is consistent with Self-Efficacy Theory (Bandura, 1997), which posits that individuals' belief in their capabilities significantly influences their behavior and adoption of technology. Similarly, Chiu et al. (2023a) emphasized that teacher self-efficacy is a strong predictor of successful AI integration in instructional contexts. The weaker but significant relationship between professional development and perceived usefulness suggests that training contributes to positive perceptions, although its effect depends on relevance, quality, and practical application in classroom contexts (Tiba and Condy, 2021; Redmond et al., 2021).

**Table 2. Correlation Analysis of AI Adoption Variables**

Variables	r-value	p-value	Decision	Interpretation
Perceived Competence vs Perceived Usefulness	0.52	0.005	Reject Ho	Significant, Moderate Positive Relationship
Professional Development vs Perceived Usefulness	0.31	0.001	Reject Ho	Significant, Weak Positive Relationship

N = 113;  $\alpha = 0.05$

### Predictors of Perceived Usefulness of AI

Table 3 presents the multiple regression analysis model, which explains 55% of the variance in perceived usefulness, indicating strong explanatory power. Among the predictors, perceived competence emerged as the strongest predictor, suggesting that teachers' self-efficacy in using AI plays a central role in shaping their perception of its usefulness (Bandura, 1997). This supports findings from Zawacki-Richter et al. (2021), who emphasized that AI adoption is primarily driven by user confidence rather than system availability. Professional development also significantly predicted perceived usefulness, reinforcing the role of structured training in improving AI literacy and instructional readiness (Fitria and Suwono, 2023; Redmond et al., 2021). Overall, the results confirm that AI adoption in science education is primarily driven by psychological readiness (competence) and institutional support (training exposure).

**Table 3. Multiple Regression Analysis Predicting Perceived Usefulness of AI**

Predictor	B	$\beta$	t	p-value	Interpretation
Professional Development	-	0.31	3.52	0.001	Significant
Perceived Competence	-	0.45	5.10	<0.001	Significant

n=113

#### Model Summary

R	R <sup>2</sup>	Adjusted R <sup>2</sup>	F	p-value
0.74	0.55	0.53	42.70	<0.001

### Differences across demographic profiles

The analysis revealed no significant differences in perceived usefulness of AI across gender, age, educational attainment, academic rank, and teaching experience ( $p > 0.05$ ). This suggests that AI acceptance among science teachers is

relatively uniform regardless of demographic characteristics. Instead, adoption appears more strongly influenced by cognitive and professional factors such as competence and training. This aligns with Zawacki-Richter et al. (2021), who found that demographic variables do not significantly predict AI acceptance among educators. Similarly, OECD (2023) emphasized that teacher training and digital literacy are more influential than age or experience in shaping technology integration outcomes.

### Conclusion

This study examined science teachers' perceptions, competence, professional development, and perceived barriers in the integration of Artificial Intelligence (AI) in science education in Loon Districts, Philippines, as well as the determinants of perceived usefulness. Findings indicate that teachers hold a very positive perception of AI usefulness, particularly in enhancing instructional quality, engagement, and efficiency. However, their AI competence remains developing, while professional development opportunities are moderate and largely informal. Teachers also reported a high level of perceived barriers, particularly regarding data privacy, ethical concerns, infrastructure limitations, and institutional support. Correlation and regression analyses revealed that perceived competence and professional development significantly predicted perceived usefulness, with competence as the strongest predictor, and no significant differences were found across demographic variables. Overall, the findings suggest that AI adoption in science education is primarily driven by teacher competence and professional learning rather than demographic factors. Accordingly, it is recommended that education authorities implement structured, practice-oriented AI training, strengthen continuous professional development and collaborative learning systems, improve digital infrastructure, and establish clear ethical and data governance policies to support responsible AI integration in science education. Future research may examine student learning outcomes, institutional readiness, and long-term impacts of AI integration across diverse educational contexts.

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