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Exploring Teachers' Awareness and Perceptions of ChatGPT in K–12 STEM Education

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Abstract

Despite AI's potential as an effective educational tool, there are still unresolved questions about teachers' awareness of and perception regarding the impact of AI tools such as ChatGPT for teaching STEM content in a meaningful, ethical, and effective manner. This study explored teachers' awareness and perceived impact of ChatGPT on teaching STEM content in K-12 and how these factors are related to their years of teaching experience. The study used secondary data sourced from a reputable online database. After the cleaning and selection process, only data from fifty-seven K-12 educators who met the inclusion criteria were identified and drawn from the larger dataset comprising 321 educators at all levels. The study revealed that most STEM teachers are aware of ChatGPT, but only a few use it extensively. They perceived ChatGPT's impact and support for teaching STEM content as minimal. Additionally, the study showed that there was no significant relationship between teachers' years of teaching experience and their awareness and perception of the impact of ChatGPT for teaching STEM content. The study recommends the need for professional development to strengthen teachers' ethical and pedagogical use of ChatGPT, thereby supporting more positive perceptions of its impact in STEM education.

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Introduction

Recently, the upsurge of Artificial Intelligence (AI) has increasingly influenced many industries (Balahadia et al., 2023), particularly the education industry. Given ChatGPT's usefulness, educators continue to explore its integration into teaching and learning (Kim & Kim, 2022). However, there remains a significant gap in teachers' knowledge of AI applications, since only a few teachers are trained and prepared to use and offer AI education (Lee & Perret, 2022). Research shows diverse perceptions about ChatGPT's impact on teaching and learning in the present and future. While some considered it as having no impact different from that of a human instructor or having a negative impact on the future of our educational system (Luan et al., 2024; Rahman & Watanobe, 2023), others perceived ChatGPT as a powerful tool to positively influence Science, Technology, Engineering, and Mathematics (STEM) teaching and learning (Adeshola & Adepoju, 2024; Alneyadi & Wardat, 2023; ElSayary, 2024; Vasconcelos & Santos, 2023). While this debate is ongoing, ChatGPT appears to be gaining ground in the educational system rapidly, as the use of AI tools has increased for teaching and learning lately, particularly after the coronavirus outbreak (Adeyele & Ramnarain, 2024; Alneyadi & Wardat, 2023).

Despite AI tools' potential as effective educational tools, there are still unresolved questions about teachers' awareness and perceptions of their support for teaching STEM content in a meaningful and effective manner (Kim & Kim, 2022). Existing studies have provided substantial information regarding the general benefits, challenges, and applications of AI in education and other specific disciplines, such as economics and humanities (Lo, 2023; Kim & Kim, 2022). However, few studies have examined the level of awareness and how elementary, middle, and high school teachers, who are the facilitators of foundational STEM education, perceive the usefulness of AI tools such as ChatGPT in teaching and learning.

Park et al. (2023) emphasized that the first stage of teachers integrating new technology into classroom instruction is awareness of its requirements, implementation roles, and potential usefulness. Also, several studies have reported the level of teachers' awareness of ChatGPT as an educational tool (Adeyele & Ramnarain, 2024; Balahadia et al., 2023; Egara & Mosimege, 2024). Despite this growing awareness, little is known about how teachers' years of teaching experience relate to awareness and perception of ChatGPT's usefulness in STEM instruction. It remains unclear whether there is a significant relationship between teachers' experience and their awareness and perceived impact of ChatGPT on teaching STEM content. In the face of evolving AI adoption into education, there is a need to understand K-12 teachers' levels of awareness and perception, as this may influence their preparation to integrate new technologies into STEM instruction. The purpose of this study is to investigate teachers' awareness and perceptions regarding the impact of ChatGPT on STEM content teaching in K-12 classrooms and how these forms of awareness and perception are associated with their years of teaching experience.

This study focused on K-12 classroom teachers only. We included international data from three main countries, namely, Australia, the United States, and China, drawn from a publicly available ChatGPT dataset. This study examines only two aspects of ChatGPT use addressed in the entire dataset: teachers' awareness of ChatGPT and their perceived impact of ChatGPT on STEM content teaching. In this study, we define awareness as teachers'

general knowledge about ChatGPT's potential usefulness for classroom instruction in STEM, such as familiarity with the tool and level of use, while perception refers to teachers' beliefs and opinions about the potential usefulness or adoption of ChatGPT in STEM classroom instruction. Other aspects of ChatGPT use, such as frequency of use, classroom implementation, assessment use, or student outcomes, were outside the scope of this study.

Research Questions

The main research question that guided the study was: How do teachers' years of teaching experience relate to their awareness and perceptions regarding the impact of ChatGPT on teaching STEM content at the K-12 grade level?

Specifically, three research questions were addressed in the study.

I. What is the level of teachers' awareness of ChatGPT as a tool for teaching STEM content at the K-12 grade level?
II. How do teachers perceive the impact of ChatGPT on teaching STEM content at the K-12 grade level?
III. What is the relationship between teachers' years of teaching experience and their awareness and perception of ChatGPT's impact on teaching STEM content at the K-12 grade level?

Theoretical Background

AI is a computer program with intelligence that can perform tasks that require human intelligence (Kim & Kim, 2022). AI in STEM education refers to the application of generative AI, such as ChatGPT, to enhance teaching, learning, or decision-making processes in the classroom (Bakti et al., 2023; Kim & Kim, 2022) and not necessarily as a substitute for the role of a teacher (Chan & Tsi, 2024). This study uses the concern-based adoption model and technology acceptance theory to examine teachers' awareness and perception of AI's impact on STEM teaching in K-12. Hall's (1974) Concerns-Based Adoption model suggests that teachers' level of engagement in implementing a new pedagogical approach progresses through three broad stages: Stages of Concern (ranging from awareness to refocusing), Levels of Use (from non-use to sophisticated, integrated use), and Innovation Configuration (mapping how the innovation is used across the system). The model focuses on how individuals (teachers, administrators, and other stakeholders) progress through identifiable stages of concern and levels of use as they engage with a new innovation.

Park et al. (2023) used this theory to explore how AI was integrated into science lessons. According to Park et al. (2023), the first stage of integrating a new technology is the awareness of its requirements, the teacher's roles, and its usefulness. Secondly, the teacher is concerned about the management and implementation of the new approach. Finally, he focuses on the impact and integration into his classroom. This model suggests that teachers' perception of ChatGPT's usefulness for teaching STEM content may develop alongside growing awareness of its usefulness in STEM education. Also, the technology acceptance theory suggests that perceived ease of use and perceived usefulness are the factors that determine the use of Technology (Silva, 2015). This theory suggests that in STEM education, teachers' perceived usefulness of technological tools shapes their acceptance, integration, or

implementation and perception of the impact of ChatGPT in teaching and learning practices.

Literature Review

Teachers' Awareness of Artificial Intelligence and ChatGPT for Teaching STEM Content

Artificial Intelligence (AI) has evolved into one of the most transformative innovations in education, shaping instruction, assessment, and learning personalization across K–12 classrooms. Recent systematic reviews demonstrate that AI applications in education extend far beyond generative tools like ChatGPT, encompassing intelligent tutoring systems, adaptive assessments, learning analytics, and predictive algorithms that guide curriculum decisions (Apata et al., 2025; Crompton et al., 2024). Within K–12 STEM education, AI has been associated with improvements in students' problem-solving ability, supporting inquiry-based learning, and providing teachers with actionable data for differentiation and feedback (Semwaiko et al., 2024).

However, studies continue to reveal wide differences in teachers' awareness of AI technologies and their practical integration in classrooms. For example, Li et al. (2025) found that K–12 mathematics teachers recognize the potential of AI to improve teaching efficiency but often lack sufficient exposure to and pedagogical training in integrating it effectively. Similar findings were reported by Arranz-García et al. (2025), who revealed that while teachers show enthusiasm for AI's potential to personalize learning, their practical knowledge and institutional support remain limited (Arranz-García et al., 2025). These patterns indicate that awareness alone may not be sufficient for effective AI adoption.

Against this backdrop of uneven AI awareness and limited classroom integration, ChatGPT has emerged as a particularly salient tool that is shaping current discussions about AI literacy in K-12 education. A systematic review by Zhang and Tur (2024) synthesized thirteen empirical studies and concluded that ChatGPT enables teachers to automate curriculum design, generate instructional materials, and provide differentiated learning experiences. However, these benefits coexist with concerns about academic integrity and the reliability of AI-generated content (Zhang & Tur, 2024). Similarly, researchers observed that teachers' early uses of ChatGPT often focused on efficiency rather than pedagogical innovation, suggesting that deeper integration requires targeted professional development (Albadarin et al., 2024).

In line with these observations about ChatGPT, awareness is closely linked to exposure, institutional policies, and cultural context. Broader evidence from STEM education also indicates that teacher preparation and access to resources influence the integration of technology. For example, in a high school physics setting, teachers' qualifications and the availability of instructional materials were connected to student performance (Apata, 2019). Although this earlier research did not focus on AI, it supports the idea that teachers' capacity and access to resources can impact their willingness to adopt new tools. A global study of educators across 14 countries similarly found that, while 92 percent of teachers are familiar with AI tools, their use varies by factors such as access to infrastructure and policy clarity (Delello et al., 2025). These patterns highlight the importance of examining K-12 STEM teachers' awareness of and perceptions of ChatGPT, as well as the factors that influence their interpretation of its instructional potential.

Teachers' Perceptions of AI and ChatGPT in Teaching STEM Content

Teachers' perceptions of AI tools can influence how, when, and why they are incorporated into classroom practice. According to Crompton et al. (2022), teachers' positive attitudes toward AI are often linked to their belief in its potential to improve personalization and engagement, whereas negative perceptions stem from concerns about bias, ethics, and the loss of pedagogical control. These perceptions are shaped by previous experiences, access to training, and the level of institutional support.

Within K–12 STEM education, recent research shows that educators perceive AI as a supportive tool for decision-making, lesson planning, and fostering student inquiry. The work of Loke and Radloff (2024) emphasized that STEM teachers view AI as a mechanism to enhance engagement and personalize instruction, yet remain cautious about technical complexity and ethical use. In related work, Dimeli and Kostas (2025) found that while educators acknowledge ChatGPT's potential to improve critical thinking and creativity, they emphasize the need for ethical guidelines and teacher-student collaboration to avoid misuse. These mixed views suggest that teachers' perceptions are not only instructional, but also emotional and value-based.

Studies on teachers' perceptions also highlight the psychological and emotional dimensions of AI adoption. Some teachers experience anxiety or skepticism about AI, particularly regarding plagiarism detection and content bias (Delello et al., 2025). Conversely, others express relief at AI's ability to reduce administrative workload and provide timely student feedback. These mixed perceptions demonstrate that while teachers generally value AI's efficiency, their enthusiasm is moderated by ethical, cultural, and contextual considerations.

In STEM education, Li et al. (2025) observed that teachers perceive AI tools as useful for visualizing abstract mathematical and scientific concepts, which may support students' understanding and motivation. However, the study also noted a need for clearer guidelines on aligning AI with curriculum standards and assessment practices. The research by Ali et al. (2024) extended these findings by demonstrating that ChatGPT promotes accessibility and inclusion, particularly for learners with different abilities; however, its reliability and academic authenticity remain contested in some contexts.

Influence of Teaching Experience on Teachers' Awareness and Perceptions of AI Tools

Teaching experience has long been recognized as a factor influencing technology adoption. Research grounded in the Technology Acceptance Model suggests that experience shapes teachers' self-efficacy, confidence, and adaptability to emerging technologies (Songkram & Osuwan, 2022). Within AI education, empirical findings are mixed. According to Li et al. (2025), mid-career teachers exhibit the highest levels of AI integration in mathematics instruction, possibly due to a combination of technological literacy and pedagogical maturity. In contrast, teachers with fewer years of experience tend to display caution, while more experienced teachers are sometimes constrained by established routines and limited exposure to new technologies (Unal & Unal, 2024). These patterns align with Ayanwale et al. (2024), who found that early-career teachers were less likely to integrate AI tools into their classrooms due to limited training opportunities and perceived complexity.

Furthermore, Delello et al. (2025) demonstrated that teaching experience influences not only AI usage but also emotional responses to it. Experienced teachers often report reduced anxiety because of familiarity with evolving technologies, while less experienced educators express both excitement and apprehension. Such emotional differences matter because confidence or anxiety can shape whether teachers are willing to try new AI tools and persist with them long enough to see instructional benefits. The study concluded that targeted mentorship and continuous AI literacy programs could bridge the experiential divide in AI adoption.

This emphasis on support and emotional preparedness aligns with evidence that teachers play a key role in shaping whether GenAI is used productively. Research showed that ChatGPT improved engagement and learning among university STEM students, while emphasizing the teacher's role in moderating AI use to ensure better understanding rather than superficial reliance (Ilić et al., 2024). Translating these findings to K-12 settings suggests that teachers' professional experience and openness to innovation may influence the extent of AI's pedagogical impact.

Method

This study employed a quantitative, cross-sectional survey research design to examine K–12 STEM educators' awareness and perceptions of ChatGPT and to explore how these factors relate to their years of teaching experience. This design is considered appropriate because the study aims to assess teachers' self-reported awareness and perceptions regarding the use of ChatGPT in teaching STEM in K-12. Furthermore, we chose this design because it allows us to examine statistical associations between variables rather than to infer causal relationships.

The secondary data used in this study were sourced from a reputable online database accessible through (10.25949/24123306.v1), which provides raw data from over 321 K-12 educators on ChatGPT applications in education across several countries. Specifically, the public dataset is from the project "Teacher Attitudes Towards Generative AI Tools – The ChatGPT Survey" led by Bower et al. (2023) at Macquarie University. Reanalyzing secondary data allows researchers to apply new analytical methods and explore specific findings or aspects of the original study in greater depth (Dufour & Richard, 2019; Jessup, 2023). This secondary dataset was selected because it offers access to a diverse, international sample that would be difficult to collect independently; the dataset includes items that directly align with the variables of interest in this study; the survey instrument is ethically approved and validated by subject-matter experts, increasing confidence in data quality.

The participants in the study include educators across a range of teaching levels (University =70%, secondary =26%, and primary 4%), subject areas included but not limited to economics, history, psychology, art, mathematics, physics, English, etc.), and their years of teaching experience ranging from 1-42 years. These participants were from several countries around the world, with the top 10 countries represented in the global data, including: the United States (40.8%), followed by New Zealand (12.6%), India, South Africa, Canada, Ireland, England, the United Kingdom, the Netherlands, and Australia. For the present study, only K-12 educators are included because this is the scope our study seeks to cover. The demographic information of the included

participants is shown in Table 1.

The primary instrument used for the data collection was the ChatGPT Teacher Survey (Bower et al., 2023). The instrument comprises six major sections. Section one includes demographic variables (such as Age, Gender, country, institution, years of teaching experience, teaching level, and discipline). In section two, teachers were required to answer follow-up questions on a short video on AI accessible at "https://youtu.be/92y_oOXvj6c". Section three consists of items on the use of ChatGPT with past assessment questions, followed by items on the trial of ChatGPT with past assessment questions, and then items on Teaching, Assessment, Support, and Follow-up questions. There are 29 items altogether on the survey.

The variables extracted and used for this study are teachers' awareness of ChatGPT, teachers' perception of the impact of ChatGPT on teaching STEM, and years of teaching experience. The dependent variables of the study are Teachers' awareness of ChatGPT and teachers' perception of the impact of ChatGPT, scored from 1-4 on a 4-point Likert scale. Teachers' awareness of ChatGPT was assessed by item 10 on the general survey: "How aware were you of OpenAI tools such as ChatGPT that could be used by students and teachers to provide answers to general questions? Never heard of or seen them (1), Knew of them but had not seen or used any first-hand (2), Had briefly tried them (3), Extensive experience with them (4)" (Bower et al., 2023, p.4). Teachers' perception of the impact of ChatGPT was measured with the item (18), "I believe that openAI tools such as ChatGPT: Do not impact on what I should be teaching my students (1), Have a minor impact on what I should be teaching my students (2), Have a major impact on what I should be teaching my students (3) and Have a profound impact on what I should be teaching my students (4)" (Bower et al., 2023, p.5). The independent variable, years of teaching experience, was continuous data, which was converted to a categorical variable at four levels (1–10 years, 11–20 years, 21–30 years, and above 30 years) to simplify interpretation in line with previous studies (Opesemowo, 2025). Also, years of teaching experience were recategorized so the data can be at the same ordinal level as other variables for easy analysis.

The dataset was cleaned to remove any inconsistencies, irrelevant data, and missing data. We removed the participants with missing demographic or key variables of the study. Data included in the study must meet the following inclusion criteria: respondents must teach at the K–12 level, respondents must report their teaching discipline, allowing identification of STEM educators, and respondents must provide complete responses to key variables of the study (Awareness of ChatGPT, Perceived impact of ChatGPT on teaching, and Years of teaching experience).

After the cleaning and selection process, only 57 data points of K-12 educators who met the inclusion criteria were identified and drawn from the larger dataset comprising 321 educators at all levels. We filtered the sample to include only K–12 educators who taught STEM-related subjects and provided complete responses to key survey items, while excluding non-STEM disciplines (e.g., humanities, arts, social sciences). After cleaning, the relevant data were analyzed using the R statistical package. Descriptive statistics were used to analyze research questions one and two, and inferential statistics (Spearman rho correlation) were used to analyze research question three to identify significant relationships and draw conclusions. We chose Spearman's rho (ρ) due to the ordinal nature

of the Likert scale items and the non-normal distribution of responses. Spearman's rho is a non-parametric measure that does not require the data to meet assumptions of normality or interval-level measurement, making it more appropriate for detecting monotonic associations between ranked variables.

Results

Participants' Demographics

Table 1 shows the demographic information of the participants included in the study. A total of 57 participants were included.

Table 1. Frequency and Percentage of Participants' Demographics

Variable	Category	N	Percentage (%)
Age group	21–30 years	5	8.8
	31–40 years	21	36.8
	41–50 years	17	29.8
	51–60 years	8	14.0
	>60 years	6	10.5
Gender	Male	30	52.6
	Female	27	47.4
Country of residence	Australia	35	61.4
	United States	19	33.3
	China	2	3.5
	Not specified	1	1.8
Teaching level	Elementary	6	10.5
	High School	51	89.5
	1–10 years	25	43.9
Years of Teaching	11–20 years	22	38.6
Experience	21–30 years	6	10.5
	Above 30 years	4	7.0

The age distribution showed that 8.8% of participants were between 21–30 years old, 36.8% were between 31–40 years old, 29.8% were between 41–50 years old, 14.0% were between 51–60 years old, and 10.5% were older than 60. In addition, 52.6% of the participants identified as male, while 47.4% identified as female. Furthermore, participants who met the inclusion criteria and were included in this study were located across three countries. The majority resided in Australia (61.4%), followed by the United States (33.3%), and a smaller proportion from China (3.5%), while only 1.8% of the geographical location was not specified. Regarding teaching level, most participants reported teaching at the high school level (89.5%), whereas 10.5% taught at the elementary school level. Moreover, the majority of the teachers (43.9%) have years of teaching experience ranging from 1-10 years, 11–20 years (38.6%), 21-30 years (10.5%), and only 7.0% have years of teaching experience above 30 years.

Research Question 1: What is the level of teachers' awareness of ChatGPT as a tool for teaching STEM content at the K-12 grade level?

Table 2 and Figure 1 present the frequency distribution and percentage of teachers' awareness of ChatGPT as a teaching tool for STEM content in K-12 education. The results reveal that none of the teachers reported never having heard of or seen ChatGPT, indicating that most are aware of it. However, 18 (31.6%) knew of them but had not seen or used any first-hand, 23 (40.40%) had briefly tried them, and only 16 (28.10%) had extensive experience with them. This result shows that although virtually all teachers know about ChatGPT, only a few use it extensively in teaching STEM content. This suggests a gap between general awareness and the extensive firsthand experience with the tools.

Table 2. Level of STEM Teachers' Awareness of ChatGPT

Awareness	Frequency	Percent
Never heard	0	0.00
Heard, not used	18	31.60
Briefly tried them	23	40.40
Extensive experience	16	28.10
Total	57	100.0

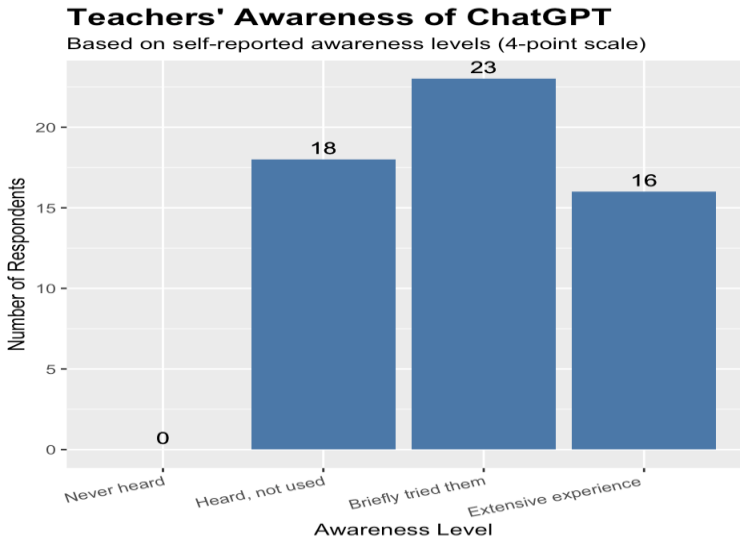

Figure 1. Teachers' Awareness of ChatGPT

Research Question 2: How do teachers perceive the impact of ChatGPT on teaching STEM content at the K-12 grade level?

Table 3 and Figure 2 show the frequency distribution and percentage of teachers' perceptions of ChatGPT's impact on teaching STEM content in K-12. The result reveals that only 1 (1.80%) of the teachers did not perceive ChatGPT to have an impact on teaching STEM content in K-12. Also, most teachers, 29 (50.90%), believed that ChatGPT has a minor impact on teaching STEM content, 18 (31.60%) believed that it has a major impact, while

only 9 (15.80%) perceived ChatGPT to have a profound impact and support for teaching STEM content in K-12. This result suggests that while many teachers believe that ChatGPT has some level of impact on teaching STEM, they do not believe it has a major or profound impact.

Table 3. Perception of ChatGPT's Impact for Teaching STEM

Perceived impact	Frequency	Percent
Do not impact	1	1.80
Minor impact	29	50.90
Major impact	18	31.60
Profound impact	9	15.80
Total	57	100.00

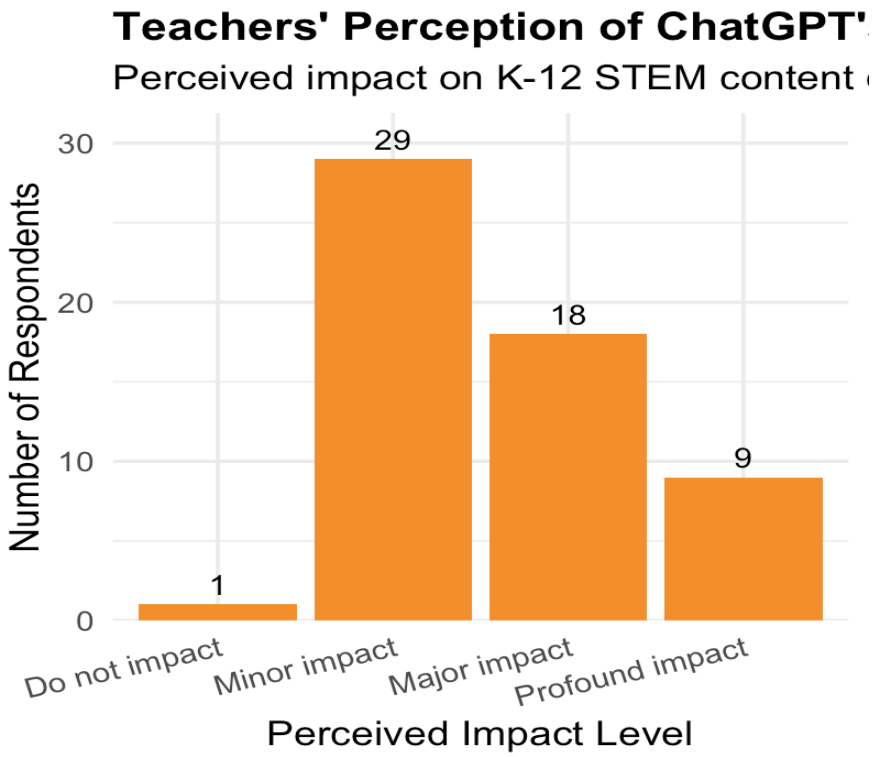

Figure 2. Teachers' Perception of ChatGPT's Impact

Research Question 3: What is the relationship between teachers' years of teaching experience and their awareness and perception of ChatGPT's impact on teaching STEM content at the K-12 grade level?

In Table 4, the relationship between years of teaching experience and teachers' awareness of ChatGPT, as well as the relationship between years of teaching experience and perceived impact of ChatGPT on teaching STEM content in K-12, were investigated using Spearman's rho correlations. There was a very weak, positive correlation between teachers' years of teaching experience and their awareness of ChatGPT, $\rho = .107$, $n = 57$, $p > .05$. However, this relationship was not statistically significant, indicating that years of teaching experience were not meaningfully associated with teachers' awareness of ChatGPT. Furthermore, the results showed a very weak,

negative correlation between teachers' years of teaching experience and their perceived impact of ChatGPT on teaching STEM content, $\rho = -.096$, $n = 57$, $p > .05$. Although teachers with more years of teaching experience tended to report slightly lower perceived impact, this relationship was not statistically significant, indicating that years of teaching experience were not meaningfully associated with teachers' perceptions of ChatGPT's impact on teaching STEM content.

Table 4. Spearman's rho Correlation

		Years of experience	Awareness of ChatGPT	Perceived Impact of ChatGPT
Years of experience	Correlation Coefficient	1.000		
Sig. (2-tailed)		-		
N		57		
Awareness of ChatGPT	Correlation Coefficient	.107	1.000	
Sig. (2-tailed)		.428	-	
N		57	57	
Impact of ChatGPT	Correlation Coefficient	-.096	.118	1.000
Sig. (2-tailed)		.479	.380	-
N		57	57	57

Discussion

This study investigated teachers' awareness and perceived impact of ChatGPT on STEM teaching, and how teachers' years of teaching experience relate to awareness level and perceptions. The findings reveal several important patterns that align with and extend current research on AI awareness and its perceived impact on STEM instruction. The study found that while nearly all educators are aware of ChatGPT, very few use it extensively in STEM instruction. This finding is in tandem with Whalen et al. (2025), who found that most K-12 educators are aware of the tool, but there was limited adoption in teaching and learning in the United States. Although Egara and Mosimege (2024) reported limited awareness of ChatGPT among mathematics teachers, contrary to the findings of this study, their study agrees with the findings of this study regarding limited active use of the tool, highlighting limitations in practical integration despite high awareness. This finding is in line with Hall's concerns-based adoption model, which suggests that teachers' adoption of a new technology begins with their awareness of its usefulness (Hall, 1974). Also, Park et al. (2023) noted that the first stage of integrating a new technology is the awareness of its requirements, the teacher's roles, and its usefulness. Teachers' infrequent use of ChatGPT despite their awareness of its use may reflect ethical concerns relating to ChatGPT, such as data privacy, academic integrity, and bias, as noted in previous literature (Apata et al., 2025; Espinoza Vidaurre et al., 2024; Delello et al., 2025), which may constitute a major setback for the adoption of AI in STEM education (Simhadri & Swamy, 2023). For instance, a study conducted in rural East Tennessee revealed that STEM educators have negative attitudes toward implementing AI in the classroom because of ethical or bias concerns surrounding its use (Robinson, 2024).

Even in technologically advanced countries like Japan, where there is a wide acceptance of AI in education, there are concerns about technological dependency and the possibility of AI replacing the human role in education (Arbulú Ballesteros et al., 2024; Toyokawa et al., 2023). Such concerns have major implications for how educators accept and adopt new technologies such as ChatGPT. Also, the fact that most open AI, such as ChatGPT-3, is trained in English may limit awareness and, consequently, be a drawback for educators in non-English-speaking countries when implementing the tool (Zeeshan et al., 2024). Overall, while most educators are aware of ChatGPT, the actual integration of the tool remains limited. Hence, there is a need for targeted professional development in order to equip teachers with the skills and ethical understanding required to effectively integrate AI into STEM education (Sendawula et al., 2024).

The results of this study show that while nearly all STEM educators perceived ChatGPT to have some level of impact, a higher percentage described it as having minor impacts, while only a few believed it had a profound impact on STEM instruction at the K-12 grade level. This finding suggests that in STEM, especially in Mathematics, educators perceive the impact of ChatGPT as minor. In line with the findings of this study, Lo (2023) found that ChatGPT has a notable impact on subjects like economics but less on some STEM subjects like mathematics. This suggests that while ChatGPT can be a powerful tool in teaching some subjects, its perceived impact is not uniformly significant across all STEM subjects. For instance, research has shown that ChatGPT does not adequately support understanding geometry (Wardat et al., 2023). Also, while Zeeshan et al. (2024) highlighted several ways STEM educators can utilize ChatGPT in the classrooms, such as *answering questions, problem-solving practice***,** generating explanations, simulations, or feedback, they acknowledged ethical concerns, content reliability and validity, and lack of training as barriers to its full integration. Similarly, studies have shown that ChatGPT outputs are sometimes inconsistent and incorrect (Goto & Katanoda, 2023; Valentini et al., 2024; Wang et al., 2024), necessitating the application of external and internal methods to establish its credibility (Ou et al., 2024).

Teachers' perceived minor impact of ChatGPT on STEM instruction may be related to factors such as technological pedagogical knowledge and ease of use. This is consistent with the technology acceptance theory, which suggests that perceived ease of use and perceived usefulness are the factors that determine the use of technology (Silva, 2015). Lee and Perret (2022) had earlier stated that only a few teachers are trained and prepared to use and teach AI education, which has significantly hindered its implementation in STEM Education. It appears that there has yet to be a significant improvement in this situation, leaving many educators with limited knowledge and consequently a low perceived impact of the tools.

Furthermore, this study found weak and non-significant relationships between teachers' years of teaching experience and both their awareness of ChatGPT and perceptions of its impact on teaching STEM content. Although the correlation values suggested a slight positive association between years of teaching experience and awareness, and a slight negative association between years of teaching experience and perceived impact, these patterns were not statistically meaningful. This aligns with Opesemowo (2025), who also reported that teaching experience does not significantly influence teachers' attitudes toward using ChatGPT. These results suggest that years of teaching experience alone may not be a strong determinant of teachers' awareness or perceptions of AI

tools. Rather, other factors may play a more influential role. Existing studies indicate that variables such as professional development, ease of use, social influence, privacy concerns, and access to resources correlate more strongly with teachers' perceptions of technology (Al-kfairy, 2024). Similarly, Li et al. (2025) and Kim and Kim (2022) highlight the importance of opportunities for hands-on experience, pedagogical support, and contextual integration when examining teachers' use of AI tools. These findings suggest that structural and contextual supports may better explain teachers' awareness and perceptions of ChatGPT than years of teaching experience. Consistent with Zeeshan et al. (2024), technology know-how and related competencies may be key factors influencing teachers' readiness to adopt AI tools in STEM education.

STEM teachers' awareness and perceived impact of ChatGPT can influence their willingness to adopt the tool, a relationship supported by both the Concerns-Based Adoption Model and the Technology Acceptance Model. Hence, educational stakeholders need to invest continuously in professional training to increase awareness and ensure that STEM educators are equipped to integrate AI technologies into instruction responsibly and ethically.

Conclusion

This study investigated teachers' awareness and perceptions of ChatGPT's impact on teaching STEM content in K-12 and how these relate to teachers' years of teaching experience, using published online secondary data. The result revealed that while most teachers know about ChatGPT, only a few of them have extensive experience with it. This suggests that high awareness does not necessarily correspond with high experience with ChatGPT. Similar results have been reported in studies such as that of Whalen et al. (2025), who found high awareness but limited integration of ChatGPT among teachers in the United States. Also, the study found that although most STEM educators viewed the tool as potentially beneficial, many perceived it as having a limited impact on STEM teaching. The majority rated the tool as having a minor impact, while only a few teachers rated it as having a major impact. Moreover, the study examined how years of teaching experience relate to ChatGPT's awareness and perception. A weak, positive but not statistically significant correlation was found between years of teaching experience and awareness, while a similarly weak negative, but not statistically significant, correlation emerged between teachers' years of teaching experience and perceived impact of the technology tool.

The findings of this study have important implications for policymakers, curriculum developers, STEM teachers, and future research. Policymakers can play a key role in supporting teachers by designing targeted professional development programs that build technological and pedagogical knowledge related to AI tools. Such training may help teachers make informed decisions about how AI can support STEM instruction. In addition, the growing concerns discussed in the broader literature, such as academic integrity, algorithmic bias, and data privacy, highlight the importance of developing clear guidelines for the ethical use of AI tools, including ChatGPT, in K–12 settings, as such concerns may influence teachers' perceived impact of the tool.

Access to adequate resources and infrastructure remains a persistent challenge in many educational contexts. Although this study did not measure infrastructure directly, previous research indicates that limited access can hinder teachers' awareness and ability to explore emerging technologies (Apata, 2019). Therefore, educational

authorities may consider prioritizing resource availability, particularly in underserved or rural areas, to ensure more equitable opportunities for AI-supported learning.

For curriculum developers, this study underscores the value of integrating AI literacy into both teacher preparation programs and K–12 STEM curricula. Introducing students and teachers to foundational concepts about how AI works, its affordances, and its limitations can support their awareness, positive perception, and more thoughtful and responsible classroom use. For STEM teachers and practitioners, professional development should also emphasize how ChatGPT can serve as a supplementary support tool—rather than a primary source for instructional content—allowing teachers to maintain pedagogical control while enhancing lesson planning and student engagement. Studies have shown that psychological and emotional factors, such as anxiety or skepticism about AI, and content bias, result in a negative perceived impact of the tool (Delello et al., 2025).

Future research should investigate potential differences across STEM subject areas, as perceptions of ChatGPT's impact may vary by discipline. Mixed-methods approaches, classroom observations, and interviews would provide deeper insight into how teachers understand and experience AI tools in practice. Additionally, expanding the sample size and including more diverse educational contexts would strengthen the generalizability of findings and provide a more comprehensive picture of AI awareness and perceptions among K–12 STEM teachers.

Incorporating Hall and Hord's Concerns-Based Adoption Model and Davis's Technology Acceptance Model provides a valuable insight for interpreting the findings of this study. These frameworks suggest that teachers' awareness and perceptions play an important role in the early stages of technology adoption. Although the present study did not directly measure adoption behaviors or the TAM constructs, the results indicate that K–12 STEM teachers reported high levels of awareness of ChatGPT and a generally minimal perceived impact of the tool for STEM content teaching. These findings are consistent with theoretical assumptions that awareness and perceptions shape readiness for technological innovation. In summary, this study contributes to the growing body of research on AI in STEM education by documenting levels of awareness and perceived impact of ChatGPT among K–12 STEM teachers and examining how these perceptions relate to years of teaching experience. Understanding K–12 STEM teachers' awareness and perceptions is essential for designing effective AI integration models and teacher preparation programs. This study contributes empirical insight into the readiness of STEM educators to adopt generative AI tools.

Limitations of the Study

While this study provides important findings on teachers' awareness of ChatGPT and perceptions regarding its impact on teaching STEM in K-12, we acknowledge some limitations of the study. The sample size is relatively small. The larger secondary dataset used in this study consists of only 321 sample sizes collected from teachers across various countries of the world, of which only 57 were drawn, which is extremely small. Furthermore, only 57 samples met the inclusion criteria for the present study. This relatively small sample size and geographic concentration limit the generalizability of the findings to broader educational contexts. Also, we acknowledge that the use of self-reported data may also introduce bias resulting from social desirability, memory inaccuracies,

or misinterpretation of survey items. Moreover, self-selection bias could be present, given the nature of voluntary online surveys.

In addition, the larger study was conducted around September 2023; therefore, new developments in teachers' awareness and perception of ChatGPT may have emerged since then. The insufficiency of quantitative data alone in capturing the depth of teachers' perception of ChatGPT's impact on STEM education is another limitation. Some qualitative methods, such as focus group interviews and key informant interviews, might provide better insight into teachers' perceptions of integrating ChatGPT into STEM education. This might be a gap to be filled by future researchers. The use of mixed-method research might allow researchers to capture the length and depth of perception of ChatGPT's impacts.

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