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Chatgpt Acceptance and Use For Generation Z Pre-Service Science Teacher: A Survey Study

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Abstract
Over recent decades, AI in education has evolved into adaptive, personalized tools like ChatGPT. For Generation Z pre-service science teachers, ChatGPT supports lesson planning, reflection, and simulation. Using TPB and UTAUT2, this study explores factors influencing ChatGPT acceptance and use, offering insights to inform future teacher education programs. This study used a quantitative, cross-sectional survey design with 221 pre-service science teachers. Data were collected online using a validated instrument based on UTAUT and TPB constructs. Statistical analysis involved descriptive statistics, Pearson correlation, t-tests, and ANOVA to examine ChatGPT acceptance and use patterns. The study found that Generation Z pre-service science teachers generally hold neutral to slightly positive attitudes toward ChatGPT, recognizing its ease of use and potential benefits. However, social influence, habit formation, and actual usage remain weak. Descriptive and correlation analyses show that habit, facilitating conditions, and hedonic motivation are the strongest predictors of behavioral intention and use. These results suggest that institutional support and strategies to increase habitual and enjoyable use are key to enhancing ChatGPT adoption in educational settings.
Keywords: *ChatGPT; Generation Z, Preservice science teacher, Theory of Planned Behavior, the Unified Theory of Acceptance and Use of Technology 2*

INTRODUCTION

Over the past few decades, the integration of technology in education has undergone a remarkable transformation, evolving from basic computer-assisted instruction to highly interactive and personalized digital learning environments (Yang, Chen, He, Sun & Salas-Pilco, 2024). Educational technology has progressed far beyond static tools such as slide presentations and learning management systems, toward intelligent and adaptive technologies capable of responding to individual learner needs. At the forefront of this development is the increasing incorporation of artificial intelligence (AI), which has significantly reshaped educational delivery, engagement, and assessment practices (Guo, Zheng, & Zhai, 2024). AI-powered applications are now being used to personalize learning, support automated feedback, and enhance learner autonomy. A particularly transformative advancement within this domain is the emergence of generative AI—tools that can create content, generate dialogue, and simulate human-like interaction through natural language processing (Afzaal, Shanshan, Yan & Younas, 2024).

Among the most impactful generative AI tools is ChatGPT, developed by OpenAI. ChatGPT is built on the Generative Pre-trained Transformer (GPT) architecture and has

rapidly gained widespread use in education, business, and research (Sağın, Özkaya, Tengiz, Geyik, & Geyik, 2024). In educational settings, it is increasingly employed to assist learners in comprehending complex concepts, provide real-time responses to academic inquiries, and support educators in preparing instructional materials (Jia, Sun, & Looi, 2024; Qudratuddarsi, Fauziah, Agung, & Yanti, 2025). ChatGPT's ability to generate coherent, relevant, and contextually sensitive responses has opened new possibilities for both teaching and learning (Dewi, Qudratuddarsi, Ningthias & Cinthami, 2024). Its applications span from answering factual questions and summarizing texts to providing feedback on writing and simulating academic discussions. These capabilities are particularly relevant for science education, where content is often abstract and where inquiry-based learning requires dynamic support and explanation (Strielkowski, Grebennikova, Lisovskiy, Rakhimova & Vasileva, 2024).

For pre-service science teachers, the utility of ChatGPT is multifaceted. It can serve as an always-available assistant capable of supporting lesson planning, explaining scientific phenomena, generating assessment items, and modeling teacher-student interactions (Vartiainen, Valtonen, Kahila, & Tedre, 2025). It can also aid in fostering critical reflection, providing pre-service teachers with an interactive partner for exploring alternative instructional strategies and deepening content knowledge (Yu, 2024). Furthermore, ChatGPT can simulate student misconceptions or offer different perspectives, allowing future teachers to prepare for diverse classroom scenarios. These affordances position ChatGPT as a promising tool for initial teacher education. However, the actual implementation and sustained use of ChatGPT in educational practice depend on users' readiness to adopt and engage with the technology, making it vital to explore how pre-service teachers perceive and interact with such tools (Lee, & Zhai, 2024).

Understanding pre-service teachers' acceptance and use of AI tools is essential for several reasons. First, attitudes and behavioral intentions formed during teacher preparation often carry over into future teaching practice (ElSayary, 2024). If pre-service teachers develop confidence and familiarity with educational AI, they are more likely to adopt it effectively in their future classrooms. Second, as AI tools become more prevalent, teacher education programs must ensure that future educators are not only proficient in using them but also capable of evaluating their pedagogical value and ethical implications. (Arguello, Banda, Chamorro & Jiménez, 2024). Without such understanding, there is a risk of superficial use or resistance to potentially transformative tools. Studying acceptance patterns among pre-service teachers also helps teacher educators identify perceived barriers, such as concerns over misinformation, over-reliance, or data privacy—common themes that often accompany the use of generative AI (Bhaskar, Misra, & Chopra, 2024).

Focusing on Generation Z pre-service science teachers adds a timely and relevant dimension to this inquiry. Generation Z, typically defined as individuals born between 1997 and 2012, represents the first cohort of digital natives to enter the teaching profession. Having grown up with constant access to the internet, smartphones, and social media, they are generally considered comfortable with digital technologies and are accustomed to fast, intuitive, and responsive digital experiences (Qudratuddarsi, Hidayat, Nasir, Imami, & bin

Mat Nor, 2022). However, their comfort with technology does not automatically translate to effective or critical educational use. On one hand, Generation Z pre-service teachers may be more willing to experiment with tools like ChatGPT; on the other, they may also express skepticism regarding its limitations, such as generating incorrect information or lacking contextual awareness. Investigating this group offers insights into how digital fluency, educational values, and professional identity intersect in shaping AI adoption in teacher education (Biloš, & Budimir, 2024).

The present study is grounded in two well-established theoretical frameworks: the Theory of Planned Behavior (TPB) and the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2). The TPB posits that an individual's behavior is primarily influenced by their attitude toward the behavior, the perceived social pressure to perform it (subjective norms), and the perceived ease or difficulty of performing it (perceived behavioral control). This model provides a useful lens for examining how pre-service teachers' beliefs, peer influences, and self-efficacy affect their intentions to use ChatGPT (Jasrai, 2025). Complementing TPB, the UTAUT2 framework expands the analysis by incorporating constructs such as performance expectancy, effort expectancy, social influence, facilitating conditions, hedonic motivation, and habit. While originally developed for consumer technology contexts, UTAUT2 has proven useful in educational technology research due to its emphasis on behavioral intention and use behavior. By integrating TPB and UTAUT2, this study adopts a comprehensive approach to explore both psychological and contextual factors influencing ChatGPT adoption (Yakubu, David, & Abubakar, 2025).

Despite the growing interest in educational applications of AI, there is a notable gap in empirical research focusing on generative AI, particularly in the context of science teacher education. Most existing studies emphasize general educational technology use or explore AI from a technical or ethical perspective, with limited attention to how generative tools like ChatGPT are perceived and utilized by future educators. Moreover, while several studies have applied TPB or UTAUT2 to examine technology acceptance, few have combined these models to investigate generative AI use among pre-service teachers. Even fewer studies have considered how demographic variables, such as gender and year of study, might influence acceptance patterns in this context. Addressing these gaps is essential to inform teacher education programs aiming to prepare future educators for AI-enhanced teaching environments.

This study aims to contribute to the existing literature by exploring the acceptance and use of ChatGPT among Generation Z pre-service science teachers using an integrated TPB and UTAUT2 framework. Specifically, it seeks to answer the following research questions: (1) How do Generation Z pre-service science teachers perceive the acceptance and use of ChatGPT based on the constructs of TPB and UTAUT2? (2) What is the relationship between the key constructs of TPB and UTAUT2 in predicting the acceptance and use of ChatGPT among Generation Z pre-service science teachers? (3) To what extent do gender and year of study influence the acceptance and use of ChatGPT among Generation Z pre-service science teachers? By addressing these questions, the study aims to

offer empirical insights that can guide curriculum development, professional training, and educational policy related to the integration of AI tools in teacher preparation.

METHODS

Research Design

This study employed a quantitative research approach using a cross-sectional survey design. A cross-sectional survey involves collecting data from a population or a representative subset at a single point in time. This design is commonly used in social science and educational research to examine the current status of attitudes, behaviors, opinions, or characteristics across a sample (Qudratuddarsi, Ramadhana, Indriyanti, & Ismail, 2024; Watson, 2015). The reason for choosing a cross-sectional survey is to efficiently gather data from a large group of Generation Z pre-service science teachers regarding their acceptance and use of ChatGPT. Given the exploratory nature of this study—focusing on perceptions, behavioral intentions, and usage patterns—a survey allows for the systematic collection of standardized responses that can be quantitatively analyzed using statistical methods such as descriptive statistics, correlation analysis, t-tests, and ANOVA (Jafar, 2018).

Subject of the study

Participants were recruited through convenience sampling, with the consideration that research could be carried out effectively and efficiently as they were students enrolled in courses taught by the researchers. Table 1 presents the demographic distribution of the study participants, consisting of 221 Generation Z pre-service science teachers. In terms of gender, the majority of respondents were female, totaling 157 individuals (71.04%), while male participants accounted for 64 individuals (28.96%). Regarding the year of study, 82 participants (37.10%) were in their first year, 63 participants (28.51%) were in their second year, and 76 participants (34.39%) were in their third year. This distribution indicates a relatively balanced representation across different academic levels, with a higher proportion of female participants in the sample.

Table 1. Distribution of sample

Sample	N	Percentage
Gender		
Male	64	28.96%
Female	157	71.04%
Year of study		
First year	82	37.10%
Second year	63	28.51%
Third year	76	34.39%
Total	221	100 %

Instrument

The main instrument employed in this study was adapted from a previously validated tool developed by Habibi et al. (2024), which investigated user acceptance of ChatGPT as a technology-enhanced educational platform. Since the original instrument was already available in Bahasa Indonesia and had been featured in high-impact academic

journals, no translation was required. This preserved both the semantic accuracy and the contextual appropriateness of the items. The tool was considered relevant for the current study due to its foundation in well-established technology acceptance frameworks, particularly the Unified Theory of Acceptance and Use of Technology (UTAUT), which aligns closely with the research objective of exploring the integration of virtual laboratories in science education.

To ensure content validity, the adapted instrument underwent evaluation by two experts in science education assessment. Their input helped confirm that the items accurately reflected constructs pertinent to the target group—pre-service teachers—and were suitable for measuring technology use within the context of virtual chemistry experiments (Heale, & Twycross, 2015). The questionnaire encompassed several key constructs, each representing a distinct aspect of technology adoption: (1) Performance Expectancy (4 items), (2) Effort Expectancy (4 items), (3) Social Influence (3 items), (4) Facilitating Conditions, (5) Hedonic Motivation (4 items), (6) Habit (5 items), (7) Attitude (4 items), (8) Perceived Behavioral Control (3 items), (9) Behavioral Intention (BI), and (10) ChatGPT Use (GPTU). Collectively, these constructs offered a comprehensive framework for evaluating the perceptions and acceptance of virtual laboratories among future science educators. Employing a rigorously validated, theoretically grounded instrument strengthened the methodological integrity of the research.

Data Collection

Data collection was carried out online using Google Forms, aligning with the study's environmentally friendly approach by minimizing paper usage. Utilizing a digital platform allowed for more efficient data handling, better organization, and a reduction in potential errors associated with manual data entry. To maintain data quality and ensure participants fully understood the survey, the researcher directly supervised the data collection process (Hidayat, Lestari, & Qudratuddarsi, 2022). Participants were encouraged to ask questions if they needed clarification on any survey item, which helped prevent misunderstandings and improved the reliability of the responses. This hands-on approach also fostered a supportive setting, encouraging thoughtful and accurate engagement. Participation was completely voluntary, and students were clearly informed that their responses would not impact their academic evaluations. Emphasis on confidentiality was also provided to encourage honest responses and minimize social desirability bias. These ethical measures were crucial to upholding the integrity of the study and ensuring the authenticity of the participants' perspectives on virtual laboratory tool usage.

Data Analysis

After all participants completed the survey, the responses were compiled and initially organized using Microsoft Excel for data cleaning and preparation. The cleaned dataset was then imported into SPSS version 25.0 for comprehensive statistical analysis. Descriptive statistics—such as mean, median, mode, standard deviation, skewness, and kurtosis—were calculated to explore the central tendencies and distribution patterns of the variables. To examine the strength and direction of linear relationships among the constructs, Pearson correlation analysis was conducted, utilizing Pearson's correlation

coefficient as a measure of association (Schober & Schwarte, 2018). In addition, an independent samples t-test was performed to assess whether gender had a significant effect on ChatGPT acceptance and use. A one-way ANOVA was also carried out to evaluate the influence of year of study on the acceptance and use of ChatGPT among Generation Z pre-service science teachers.

RESULTS AND DISCUSSION

Table 2 presents the detailed item analysis of the pre-service teachers' responses regarding their acceptance and use of ChatGPT, measured using a Likert scale ranging from "Very Disagree" to "Very Agree." Each item corresponds to specific constructs related to acceptance, such as performance expectancy, effort expectancy, social influence, facilitating conditions, hedonic motivation, habit, attitude, perceived behavioral control, behavioral intention, and actual use of ChatGPT. The table displays the frequency (n) and percentage (%) of respondents selecting each level of agreement for every survey item. This comprehensive breakdown allows for an in-depth understanding of the distribution of perceptions and attitudes among the sample, highlighting areas of strong agreement as well as uncertainty or disagreement regarding ChatGPT acceptance and usage in their educational context.

Table 2. Item Analysis of Pre-service teacher ChatGPT acceptance and use

Item	Likert Scale									
	Very Disagree		Disagree		Neutral		Agree		Very Agree	
	n	(%)	n	(%)	n	(%)	n	(%)	N	(%)
PE1	11	4.97%	26	11.76%	92	28.95%	64	28.95%	28	12.67%
PE2	10	4.53%	25	11.31%	109	23.52%	52	23.53%	25	11.31%
PE3	10	4.53%	45	20.36%	104	17.64%	39	17.65%	23	10.41%
PE4	10	4.53%	37	16.74%	106	17.91%	47	21.26%	21	9.50%
EE1	13	5.88%	32	14.47%	76	34.38%	56	25.33%	44	19.90%
EE2	12	5.43%	30	13.57%	107	48.41%	46	20.81%	26	11.76%
EE3	7	3.17%	23	10.41%	86	38.91%	68	30.71%	37	16.74%
EE4	15	6.78%	29	13.12%	94	42.53%	53	23.98%	30	13.57%
SI1	15	6.78%	37	19.90%	106	46.15%	47	17.19%	21	9.95%
SI2	40	18.1%	44	32.57%	102	34.38%	38	9.50%	22	5.43%
SI3	27	12.22%	72	21.27%	76	44.34%	21	16.28%	12	5.88%
FC1	12	5.43%	24	10.86%	91	41.17%	56	25.34%	38	17.19%
FC2	12	5.43%	26	11.76%	109	49.32%	51	23.07%	23	10.40%
FC3	12	5.43%	25	11.31%	116	52.48%	40	18.09%	28	12.66%
FC4	11	4.97%	33	14.93%	97	43.89%	53	15.38%	27	12.21%
HM1	13	5.88%	20	9.05%	109	49.32%	52	23.53%	27	12.22%
HM2	13	5.88%	20	13.57%	105	47.51%	49	22.17%	24	10.86%
HM3	15	6.78%	27	12.21%	115	52.04%	43	19.45%	21	9.50%
H1	35	15.84%	56	25.33%	91	41.17%	22	9.95%	17	7.69%
H2	27	12.21%	66	29.86%	89	40.27%	18	8.14%	21	9.50%
H3	25	11.31%	44	19.91%	112	50.67%	24	10.85%	16	7.24%
H4	34	15.38%	57	25.79%	93	42.08%	24	10.85%	13	5.88%
H5	27	12.21%	68	30.76%	85	38.46%	28	12.67%	13	5.88%
AT1	14	6.33%	24	10.86%	105	47.51%	52	23.53%	26	11.76%
AT2	14	6.33%	31	14.02%	104	47.05%	49	22.17%	23	10.40%
AT3	16	7.24%	22	9.95%	82	37.10%	64	28.95%	37	16.74%

Item	Likert Scale									
	Very Disagree		Disagree		Neutral		Agree		Very Agree	
	n	(%)	n	(%)	n	(%)	n	(%)	N	(%)
AT4	16	7.24%	52	23.53%	82	37.10%	45	20.36%	26	11.76%
PBC1	9	4.07%	43	19.45%	92	41.63%	47	21.26%	30	13.57%
PBC2	10	4.52%	38	17.19%	107	48.42%	39	17.65%	27	12.22%
PBC3	11	4.97%	45	20.36%	85	38.46%	45	20.36%	35	15.83%
BI1	13	5.88%	46	20.81%	110	49.77%	40	18.10%	12	5.43%
BI2	12	5.43%	41	18.55%	98	44.34%	49	22.17%	21	9.50%
BI3	27	12.21%	56	25.33%	96	43.43%	31	14.03%	11	4.97%
BI4	23	10.41%	44	19.91%	106	47.96%	33	14.93%	15	6.78%
GPTU1	20	0.09%	54	24.43%	97	43.89%	34	15.38%	16	7.24%
GPTU2	44	19.91%	73	33.03%	75	33.93%	20	9.05%	9	4.07%
GPTU3	23	10.40%	61	27.60%	96	43.43%	27	12.22%	14	6.33%

The results of the Likert-scale analysis show that the majority of respondents tend to provide neutral to "agree" responses across most items. This suggests that while there is an initial interest in using ChatGPT, there remains a level of hesitation or uncertainty regarding its full integration into their learning or teaching practices. For the Performance Expectancy (PE) construct, most responses were neutral or positive (e.g., PE1: 28.95% Neutral and 28.95% Agree), indicating that while students perceive some potential benefits of ChatGPT, they are not fully convinced of its performance enhancement. In terms of Effort Expectancy (EE), respondents generally found ChatGPT to be relatively easy to use, with high percentages in the Neutral to Agree and Strongly Agree categories (e.g., EE3: 38.91% Neutral, 30.71% Agree, 16.74% Strongly Agree), suggesting good usability perceptions.

However, for Social Influence (SI), many respondents remained neutral or disagreed (e.g., SI2: 32.57% Disagree), implying that encouragement or support from peers, instructors, or institutions may still be lacking in motivating students to use ChatGPT. This suggests that the social environment surrounding the use of AI tools in education has not yet fostered a strong culture of acceptance or endorsement. Strengthening institutional or peer advocacy could be key to increasing engagement and trust in the technology.

The Facilitating Conditions (FC) dimension showed that while some students felt they had the necessary support or resources, most responses hovered around the Neutral and Agree categories, showing moderate confidence in external support availability. Regarding Hedonic Motivation (HM), more than 50% of respondents gave Neutral responses (e.g., HM3: 52.04%), indicating that the use of ChatGPT is not yet perceived as particularly enjoyable or intrinsically motivating. The Habit (H) construct revealed that for many students, using ChatGPT has not yet become a routine part of their academic behavior, with high Neutral responses and considerable disagreement (e.g., H5: 30.76% Disagree, 38.46% Neutral).

Attitude (AT) toward ChatGPT is generally positive, with most students showing Neutral to Agree responses (e.g., AT3: 37.10% Neutral, 28.95% Agree, 16.74% Strongly Agree), indicating openness but also some uncertainty. Perceived Behavioral Control (PBC) results suggest that students feel relatively capable of using ChatGPT (e.g., PBC3: 38.46%

Neutral, 20.36% Agree, 15.83% Strongly Agree), although the confidence is not yet strongly established. Looking at Behavioral Intention (BI), the majority of students reported Neutral responses with some inclination to Agree (e.g., BI1: 49.77% Neutral, 18.10% Agree), indicating that while they are not opposed to using ChatGPT, the intention is still forming and not firmly committed. Lastly, actual Use Behavior (GPTU) is still relatively low. A significant portion of respondents selected Disagree or Neutral for these items (e.g., GPTU2: 33.03% Disagree, 33.93% Neutral), suggesting that despite moderate interest, ChatGPT is not yet regularly or widely used among these pre-service teachers.

Overall, the findings indicate that Generation Z pre-service science teachers have a moderately positive attitude toward ChatGPT and recognize its usefulness and ease of use. However, social influence, habit formation, and actual usage behavior remain relatively weak, highlighting the need for further support and structured interventions (such as training or curriculum integration) to enhance confidence and promote more active and habitual use of ChatGPT in educational settings.

Correlation Analysis

Correlation analysis is used to examine the strength and direction of linear relationships between two variables. In the context of technology acceptance research, such as this study on *ChatGPT Acceptance and Use for Generation Z Pre-Service Science Teachers*, correlation analysis helps reveal how different psychological and contextual factors (e.g., effort expectancy, habit, attitude) relate to behavioral intention and actual use of the technology. Before conducting correlation analysis, it is essential to first understand the basic characteristics of the data through descriptive statistics. Descriptive statistics provide a summary of the dataset by presenting key information such as mean, standard deviation, skewness, and kurtosis. These indicators help in identifying the central tendency, variability, and distribution shape of each variable. Ensuring that variables exhibit suitable statistical properties—such as approximate normality and adequate variability—is crucial for the validity of subsequent analyses.

Table 3. Descriptive Statistics

	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
Variable	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
PE	1.00	5.00	3.2048	.87691	-.053	.164	.396	.326
EE	1.00	5.00	3.3269	.92489	-.097	.164	-.254	.326
SI	1.00	5.00	2.7919	.86627	.340	.164	.565	.326
FC	1.00	5.00	3.2602	.85124	-.175	.164	.351	.326
HM	1.00	5.00	3.1946	.93574	-.119	.164	.108	.326
H	1.00	5.00	2.7186	.93724	.422	.164	.036	.326
AT	1.50	4.75	3.2093	.68717	-.032	.164	-.330	.326
PBC	1.33	5.00	3.1946	.72394	.398	.164	.132	.326
BI	1.00	5.00	2.9253	.89002	.141	.164	.067	.326
GPTU	1.00	5.00	2.6938	.88891	.246	.164	.060	.326

Table 3 presents the descriptive statistics for the key variables in this study, which include Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), Facilitating Conditions (FC), Hedonic Motivation (HM), Habit (H), Attitude (AT), Perceived Behavioral Control (PBC), Behavioral Intention (BI), and ChatGPT Use (GPTU). The mean scores range from 2.69 (GPTU) to 3.33 (EE), indicating that participants generally responded with moderate agreement on most items. Notably, lower mean scores were observed for Habit (2.72), Social Influence (2.79), Behavioral Intention (2.93), and ChatGPT Use (2.69), suggesting that students may not yet be fully accustomed to or motivated toward regular use of ChatGPT in their academic routines. The standard deviation values, ranging between 0.69 and 0.94, demonstrate a reasonable spread of responses, with higher variability seen in constructs such as Hedonic Motivation and Habit. Skewness values for all variables fall within the acceptable range of ±1, indicating that the distribution of responses is approximately symmetrical, with a slight positive skew observed in variables like Habit and Social Influence—implying more participants leaned toward lower ratings. Similarly, kurtosis values also lie within a normal range, suggesting no extreme peaks or flatness in the data distributions. Overall, these descriptive statistics support the assumption of approximate normality and indicate that the data is suitable for further parametric analyses, such as correlation and regression. The results also hint at areas for improvement, particularly in fostering stronger habits and social encouragement around ChatGPT use among Generation Z pre-service science teachers.

Table 4 presents the Pearson correlation coefficients between key constructs derived from the TPB and UTAUT 2 frameworks and two main dependent variables: Behavioral Intention to use ChatGPT and Actual ChatGPT Use among Generation Z pre-service science teachers. These correlation values provide insight into the strength and direction of the relationship between each factor and the acceptance or usage of ChatGPT in an educational context. Asterisks (**) indicate statistically significant correlations at the 0.01 level, highlighting meaningful associations that warrant further discussion.

Table 4. Correlation Value of Each Variable

No.	Independent Variable	Dependent Variable	
		Behavioral Intention	ChatGPT Use
1	Performance Expectancy	0.699**	0.633**
2	Effort Expectancy	0.702**	0.603**
3	Social Influence	0.657**	0.580**
4	Facilitating Conditions	0.742**	0.625**
5	Hedonic Motivation	0.732**	0.645**
6	Habit	0.890**	0.859**
7	Attitude	0.616**	0.542**
8	Perceived Behavioral Control	0.488**	0.492**

The correlation analysis reveals that all independent variables are significantly and positively correlated with both Behavioral Intention to use ChatGPT and Actual ChatGPT Use, indicating that the constructs from TPB and UTAUT 2 are valid predictors of AI acceptance and usage in this context. Among these, Habit shows the strongest correlation with both Behavioral Intention ($r = 0.890^{**}$) and actual ChatGPT Use ($r = 0.859^{**}$),

suggesting that the more frequently and routinely students have interacted with similar technologies, the stronger their intention and actual behavior in using ChatGPT. This emphasizes the importance of forming usage habits as a gateway to sustained engagement with AI tools.

Facilitating Conditions (r = 0.742** with Behavioral Intention and r = 0.625** with Use) and Hedonic Motivation (r = 0.732** and r = 0.645**) also show strong correlations, indicating that access to resources and the perceived enjoyment of using ChatGPT significantly influence both intention and behavior. These results underline the need for supportive learning environments and engaging technological experiences to foster technology acceptance.

Other constructs such as Effort Expectancy (r = 0.702**, 0.603**) and Performance Expectancy (r = 0.699**, 0.633**) also exhibit moderately strong correlations, supporting the idea that perceived ease of use and usefulness remain critical components in shaping students' willingness to adopt new technologies. Social Influence (r = 0.657**, 0.580**) and Attitude (r = 0.616**, 0.542**) are also significant, though relatively less influential, suggesting that peer and societal encouragement plays a role but may not be as pivotal as internal factors like habit or perceived enjoyment.

Interestingly, Perceived Behavioral Control (PBC) has the weakest yet still significant correlation with both Behavioral Intention (r = 0.488**) and Use (r = 0.492**), indicating that while students feel somewhat in control of their ability to use ChatGPT, this factor may not be as decisive compared to others. This could reflect either a lack of confidence or insufficient experience with similar technologies.

Overall, the findings support the relevance of both TPB and UTAUT 2 in explaining ChatGPT acceptance and use, while highlighting habit formation, access, and intrinsic motivation as critical levers to promote broader adoption of AI in teacher education. Interventions aimed at increasing habitual use and creating more enjoyable experiences may be especially effective in strengthening behavioral intention and actual usage of ChatGPT among pre-service science teachers.

The effect of gender on ChatGPT Acceptance and Use

To explore whether gender plays a significant role in the acceptance and use of ChatGPT, an independent samples t-test was conducted to compare male and female respondents across all key variables derived from the TPB and UTAUT 2 frameworks. These variables include performance expectancy, effort expectancy, social influence, facilitating conditions, hedonic motivation, habit, attitude, perceived behavioral control, behavioral intention to use ChatGPT, and actual ChatGPT use. The t-test results are summarized in Table X and provide insight into whether male and female pre-service science teachers differ significantly in their perceptions and behaviors related to ChatGPT usage. This analysis is important for identifying any gender-based disparities that may inform more inclusive strategies for promoting AI-assisted learning tools.

Table 5. t-test result

No.	Variable	t-test	
		t	Sig
1	Performance Expectancy	0.948	0.344
2	Effort Expectancy	0.428	0.510
3	Social Influence	0.642	0.642
4	Facilitating Conditions	0.113	0.355
5	Hedonic Motivation	-0.087	0.425
6	Habit	1.106	0.135
7	Attitude	0.085	0.741
8	Perceived Behavioral Control	0.161	0.475
9	Behavioral Intention to use GPT	0.870	0.314
10	ChatGPT Use	1.405	0.272

As shown in Table 5, the independent samples t-test revealed no statistically significant differences between male and female respondents across all measured variables related to ChatGPT acceptance and use. All p-values (Sig.) were greater than the conventional threshold of 0.05, indicating that gender does not significantly influence students' perceptions regarding performance expectancy ($t = 0.948$, $p = 0.344$), effort expectancy ($t = 0.428$, $p = 0.510$), social influence ($t = 0.642$, $p = 0.642$), facilitating conditions ($t = 0.113$, $p = 0.355$), hedonic motivation ($t = -0.087$, $p = 0.425$), habit ($t = 1.106$, $p = 0.135$), attitude ($t = 0.085$, $p = 0.741$), perceived behavioral control ($t = 0.161$, $p = 0.475$), behavioral intention to use ChatGPT ($t = 0.870$, $p = 0.314$), and actual ChatGPT use ($t = 1.405$, $p = 0.272$).

These findings suggest that gender does not play a decisive role in shaping the acceptance and use of ChatGPT among Generation Z pre-service science teachers. This aligns with recent research showing that when it comes to digital technologies, especially among digital natives, gender-based differences are becoming less pronounced. The relatively uniform perceptions across genders may reflect the equal exposure and access both male and female students have to digital tools and AI-based platforms in their academic environments. Therefore, interventions aimed at increasing ChatGPT adoption do not necessarily need to be gender-specific but can instead focus on other influential factors such as habit formation, facilitating conditions, and social encouragement.

The Effect of year of study on ChatGPT Acceptance and Use

To examine whether the year of study influences students' acceptance and use of ChatGPT, a one-way ANOVA was conducted. This statistical test is used to compare the means of three or more independent groups—in this case, different year levels of pre-service science teachers—to determine if there are any statistically significant differences in their perceptions or behaviors toward ChatGPT. The variables analyzed include performance expectancy, effort expectancy, social influence, facilitating conditions, hedonic motivation, habit, attitude, perceived behavioral control, behavioral intention to use ChatGPT, and actual ChatGPT use. This analysis provides insights into whether students' academic maturity or experience level has an impact on their engagement with AI tools in educational contexts.

Table 6. one-way ANOVA test result

No.	Variable	ANOVA test	
		F	sig
1	Performance Expectancy	1.758	0.175
2	Effort Expectancy	0.883	0.415
3	Social Influence	1.128	0.325
4	Facilitating Conditions	0.036	0.965
5	Hedonic Motivation	2.127	0.122
6	Habit	1.053	0.351
7	Attitude	1.839	0.162
8	Perceived Behavioral Control	1.634	0.198
9	Behavioral Intention to use GPT	0.428	0.653
10	ChatGPT Use	0.746	0.476

As presented in Table 6, the results of the one-way ANOVA showed that none of the variables demonstrated a statistically significant difference across different years of study. All p-values were greater than 0.05, with the lowest observed for hedonic motivation ($F = 2.127$, $p = 0.122$) and attitude ($F = 1.839$, $p = 0.162$), which were still not statistically significant. This indicates that students' year level does not significantly affect their perceptions of or interactions with ChatGPT in terms of performance expectancy ($F = 1.758$, $p = 0.175$), effort expectancy ($F = 0.883$, $p = 0.415$), social influence ($F = 1.128$, $p = 0.325$), facilitating conditions ($F = 0.036$, $p = 0.965$), and other measured factors.

These findings suggest that the acceptance and use of ChatGPT are relatively consistent across different academic years among Generation Z pre-service science teachers. This could reflect a general familiarity with digital tools among this cohort, regardless of whether they are in the early or later stages of their studies. The lack of significant variation may also imply that exposure to or training in AI tools is not yet systematically integrated into the curriculum in a way that differentiates across year levels. As such, interventions to promote ChatGPT usage might benefit more from focusing on specific motivational or structural factors (e.g., improving facilitating conditions or building habits) rather than tailoring strategies based on year of study.

CONCLUSION

This study investigated the acceptance and use of ChatGPT among Generation Z pre-service science teachers using constructs adapted from the Theory of Planned Behavior (TPB) and the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2). The results reveal a generally moderate level of acceptance and intention to use ChatGPT, with most participants responding neutrally or positively across constructs such as performance expectancy, effort expectancy, and attitude. Despite recognizing ChatGPT's potential benefits and ease of use, students' actual use remains limited.

Descriptive analysis indicates that while constructs like Effort Expectancy, Performance Expectancy, Facilitating Conditions, and Hedonic Motivation are positively perceived, Habit, Social Influence, and Behavioral Intention scored comparatively lower, suggesting hesitancy and lack of routine engagement. These findings are reinforced by correlation analysis, which shows all constructs are significantly related to Behavioral Intention and

actual Use, with Habit emerging as the strongest predictor of both (r = 0.890** and r = 0.859**, respectively). The weak but significant correlation between Perceived Behavioral Control and both Behavioral Intention and Use suggests that confidence in using ChatGPT exists but does not substantially drive usage behavior. Moreover, the relatively low scores for Social Influence and Habit indicate a gap in external encouragement and habitual integration of ChatGPT into daily academic tasks.

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