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ChatGPT and Education: Bhutanese Teachers' Knowledge, Perceptions, and Practices

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ABSTRACT

The increasing research on ChatGPT in education shows the need for more studies to fully understand its potential. This mixed-method study collected data using surveys and open-ended questions to examine the knowledge, perceptions, and practices of 214 Bhutanese in-service teachers regarding the use of ChatGPT in education. The descriptive analysis of the quantitative data showed that teachers were highly knowledgeable, held positive perceptions, and actively used ChatGPT for various educational purposes, while the thematic analysis of the qualitative data explained why participants felt informed, viewed ChatGPT positively, and engaged with it. Teacher participants demonstrated knowledge about ChatGPT, reporting awareness of its potential benefits and drawbacks in education. Their positive perceptions stemmed from the belief that its benefits outweigh its drawbacks in the educational context. Reported benefits of ChatGPT included reducing teachers' workloads, enhancing teaching effectiveness, supporting personalized learning experience, increasing students' motivation and engagement, and contributing to their professional development, among other benefits, while drawbacks included risks of over-dependence, risk of inaccurate information, lack of emotional intelligence, and potential negative impacts on the creativity and critical thinking skills of teachers and students. Finally, participants stated that they used ChatGPT for lesson planning, content creation, understanding complex concepts, developing educational materials, generating assessment questions, and providing student feedback. The study concludes that teacher participants held positive views toward the use of ChatGPT for educational purposes. They specifically mentioned that ChatGPT is easily accessible and user-friendly. Based on the current findings, practical implications and recommendations for future research are provided.

Keywords: Bhutan, Generative AI, ChatGPT, teachers' knowledge, teachers' perceptions, teachers' practices

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INTRODUCTION

In recent years, Generative Artificial Intelligence (GAI, hereafter) tools have increasingly become a focal point in education. One such innovative GAI tool is ChatGPT, a language model developed by OpenAI, designed to understand and generate human-like text (Nah et al., 2023). Since its release in November 2022, educators worldwide have been interested in exploring its potential for educational practices (Nah et al., 2023). To this day, ChatGPT is widely recognized for its numerous benefits in the context of teaching and learning. ChatGPT was found particularly helpful for students and teachers. Regarding students, ChatGPT is believed to help them ease the search for information associated with their classroom tasks and assignments, respond to inquiries about subjects, and improve writing quality in several languages (Chan & Hu, 2023; Nah et al., 2023). Similarly, ChatGPT has become a resource of information for teachers. It was found beneficial for teachers, especially in designing lesson plans and teaching materials (e.g., scripts, slides, and quizzes), evaluating and grading students' assignments, and giving feedback to students (Mizumoto & Eguchi, 2023; Nah et al., 2023). All these advantages offered by ChatGPT are believed to have helped enhance the effectiveness of teaching and learning (Baidoo-Anu & Ansah, 2023). The benefits of ChatGPT in education were further reinforced by several previous studies conducted in different educational contexts (Chan & Hu, 2023; Kasneci et al., 2023). The integration of ChatGPT into education, however, is not without limitations. The literature highlights several concerns, including content bias, privacy issues, data security, academic integrity, and the potential for plagiarism (Bolukbasi et al., 2016; Lavidas et al., 2024; Swiecki et al., 2022; Zhai, 2022).

It is interesting to learn how the introduction of ChatGPT into education has helped transform the teaching and learning experiences of students and teachers in many countries. Wangdi and Rigdel (2024) pointed out that "scholars are still debating whether ChatGPT should be integrated into education" (p. 1). They further mentioned that educational policymakers and stakeholders, especially in Bhutan, currently lack proper knowledge of the possible integration of ChatGPT into education, indicating the necessity for a thorough examination of ChatGPT's potential usage in Bhutan. To this end, this study examines the knowledge, perceptions, and practices of in-service Bhutanese teachers regarding the use of ChatGPT in education. Teachers' perspectives were considered in this study because teachers are often viewed as key agents of change that shape students' interaction with AI in the classroom (Aravantinos et al., 2024). Teachers also play a significant role in ensuring the effectiveness of pedagogical practices and technological tools (Wangdi et al., 2023). In other words, the effectiveness of the integration of ChatGPT, for instance, cannot be fully realized without understanding teachers' existing knowledge, perceptions, and practices. The significance of the need

to understand teachers' views and how they embrace technological shifts in the era of AI was also underscored by Nah et al. (2023).

In light of this significance, while several studies have been conducted in other contexts exploring teachers' knowledge (Kaplan-Rakowski et al., 2023; Kohnke et al., 2023; Kuleto et al., 2022), perceptions (Kohnke et al., 2023) and their practices (Nah et al., 2023; Kasneci et al., 2023), none have been found in Bhutan. Bhutan is a unique context because teachers sparingly integrate technology into teaching and learning due to inadequate facilities, poor infrastructure, and unreliable internet connections (Wangdi & Rai, 2022). Therefore, understanding three key aspects—knowledge, which refers to the general functionality of ChatGPT; perception, encompassing the perceived benefits and drawbacks of using ChatGPT in education; and practices, referring to the current use of ChatGPT by teachers in a context of technological disadvantage would be valuable. Exploring their experiences will allow educators to develop strategies for effectively implementing AI tools to improve teaching and learning, especially with limited resources. Most importantly, drawing from the practices of Bhutanese teachers, the findings of the study are expected to offer some evidence-based practical recommendations to educators beyond the research context.

Research Questions

1. How informed are Bhutanese in-service teachers about the general functionality of ChatGPT?
2. What are the perceived benefits and drawbacks of using ChatGPT in education, according to Bhutanese teachers?
3. How do Bhutanese teachers use ChatGPT in their teaching and learning practices?

Theoretical Framework of the Study

The present study is based on Mishra and Koehler's (2006) Technological Pedagogical Content Knowledge (TPACK) and Davis' (1989) Technological Acceptance Model (TAM). These theories are believed to help researchers understand different aspects of educational stakeholders' views on the use of technology in education. These theories were found suitable for the current study because, on the whole, they cover all aspects of what this research was looking for, such as teachers' knowledge, perception, and practices of a certain technology in teaching and learning. TPACK is a theoretical framework developed by Mishra and Koehler (2006) that originated in the field of education, particularly in the context of integrating technology into teaching practices. TPACK is an intersection of three primary forms of knowledge essential for effective teaching: technological knowledge (TK), pedagogical knowledge (PK), and content knowledge (CK). TK refers to teachers' knowledge and ability to use various technologies, technological tools, and related resources. PK is teachers' deep knowledge about the processes and practices or teaching and learning methods. CK refers to teachers' knowledge of the subject matter

(Koehler & Mishra, 2009). The knowledge of TPACK, in general, aids educators in selecting the most suitable and efficient technological tools for teaching (Wangdi et al., 2023).

Likewise, the Technological Acceptance Model (TAM) theory aims to understand users' acceptance and adoption of new technologies based on their perceived usefulness and perceived ease of use. Davis (1989) suggested that individuals are more likely to adopt a technology if they perceive it as useful and easy to use. TAM also considers subjective norms and perceived behavioral control as factors influencing users' attitudes and intentions to use technology. Therefore, guided by TAM, we anticipated that investigating teachers' practices of ChatGPT for teaching and learning, influenced by factors such as perceived usefulness, ease of use, and behavioral intention to use, may provide insights into the possibility of integrating ChatGPT into education.

Study Context

Bhutan is one of Asia's smallest and least populated countries, with a population of over 750,000. Bhutan has historically been isolated from the rest of the world because of its geographical location. For this reason, from educational and technological points of view, Bhutan is still at the infancy level compared to other countries, including its immediate neighboring countries like India, Nepal, and China. More than 55% of Bhutanese people live in rural areas, and their children attend schools with inadequate infrastructure and learning facilities (World Bank, 2019). While the first modern school was established in Bhutan around 1914, Bhutan has historically been known as the last nation in Asia to receive technological facilities such as television, computers, mobile phones, and the internet (Wangdi & Rai, 2022; Wangdi et al., 2023). For this reason and due to insufficient technological and subsequent pedagogical knowledge, not many Bhutanese educators prefer to use technologies in the classroom (Dhendup & Wangdi, 2023) despite being aware of their benefits in teaching and learning. The sparing use of technology in Bhutanese education was evidenced by Wangdi and Rai (2022), who underscored the predicaments faced by teachers and students during the COVID-19 pandemic due to the lack of hands-on experience with technologies and facilities in Bhutanese institutions.

Although one of the recent changes in the Bhutanese education system is to encourage the use of ICT in educational institutions for teaching and learning purposes (see Bhutan Education Blueprint: 2014–2024 [Ministry of Education, 2014]) in line with the 21st-century skills, mobile phones and other portable gadgets in classrooms are still banned at policy levels. Such restrictions from policy levels in Bhutan, despite being aware of the numerous benefits of ICT tools, mobile learning, and, more recently, ChatGPT in teaching and learning, raise questions about Bhutanese policymakers' views on allowing ChatGPT. Do Bhutanese policymakers and educators see ChatGPT as an opportunity to improve

the quality of the Bhutanese education system? Will ChatGPT ever be integrated into Bhutanese education? In what ways can ChatGPT benefit Bhutanese educators and students? Further questions arise in light of Bhutan's historical inclination to observe and integrate technological tools only when they have proven effective, as evidenced by its being the last country in the world to introduce television and preserve its unique culture, tradition, and environment. Therefore, this study was deemed necessary to provide a foundation for Bhutanese policymakers and to guide Bhutanese educators on whether to use ChatGPT in education and, if not, to provide some useful pedagogical practices because ChatGPT has crossed all borders, including Bhutan.

Literature Review

Teachers' Knowledge of ChatGPT

The successful integration of ChatGPT into education significantly depends on teachers' familiarity with ChatGPT. The literature has established a direct correlation between teachers' levels of knowledge about Generative AI tools and the effectiveness of their practices. Theoretically, this argument partially reflects the theory of TPACK (Mishra & Koehler, 2006) in that teachers' pedagogical knowledge positively influences teachers' intention to use technological tools (Wangdi et al., 2023) and then the success of integrating them into education. Empirically, Baidoo-Anu and Ansah (2023) and Kohnke et al. (2023) found that educators with higher levels of awareness of GAI tools exhibited a greater capacity to integrate them more effectively into teaching and learning. Also, studies show that teachers who understand ChatGPT better are more likely to use it effectively (Kohnke et al., 2023; Reiss, 2021). Recently, a study by Aravantinos et al. (2024), which reviewed 35 Scopus-indexed empirical studies, concluded that teachers play an important role in facilitating students' interaction with AI tools. It emphasized that teachers need to be skilled and knowledgeable to effectively use AI tools for educational purposes. The literature reviewed thus far suggests that teachers should cultivate a strong understanding of ChatGPT to effectively integrate it into their educational practices.

In response to this significance, several studies (e.g., Kaplan-Rakowski et al., 2023; Kohnke et al., 2023; Kuleto et al., 2022) have been conducted, all of which reported high levels of AI knowledge among teachers in their respective contexts. For example, in a study examining the preparedness of 12 instructors at a Hong Kong university to use generative AI for educational purposes, Kohnke et al. (2023) concluded that the participants were familiar with generative AI tools and had a basic understanding of some of their functions. In another study by Kuleto et al. (2022), which examined the AI knowledge of 152 kindergarten teachers in Serbia, the findings revealed that teachers in their context possess a high level of AI knowledge, particularly among younger teachers and those working in modern, technology-rich schools. Their findings

highlighted two important aspects: first, the potential generational shift in digital literacy, and second, the need for AI-focused infrastructure across institutions to enhance teachers' knowledge of AI. Teachers are more likely to use GAI tools such as ChatGPT and report a higher level of understanding if institutions provide adequate AI infrastructure. In this context, Kaplan-Rakowski et al. (2023), who surveyed 147 teachers from the USA, UK, and Canada, noted that those who used GAI more frequently reported greater knowledge and understanding of GAI tools. Overall, the existing literature indicates that teachers may have high levels of knowledge about GAI, such as ChatGPT. However, most reports on teachers' knowledge of GAI come from technologically advanced countries (e.g., Hong Kong, the USA, the UK, and Canada). There is a noticeable gap in the literature regarding teachers' knowledge of ChatGPT in technologically underdeveloped countries like Bhutan, highlighting the need to explore the understanding of Bhutanese teachers in this context. Understanding Bhutanese teachers' knowledge of ChatGPT is crucial because Shabbir et al. (2024) noted that GAI tools like ChatGPT will likely play important roles in economically disadvantaged regions.

Teachers' Perceptions Toward ChatGPT

Concerning teachers' perceptions of ChatGPT as a potential educational tool, some earlier studies focused primarily on the perceived benefits and drawbacks of integrating it into educational practices. Nevertheless, the findings presented in the literature appeared inconclusive. In the sense that while some studies suggested that teachers hold favorable perspectives about integrating ChatGPT into education (ElSayary, 2024; Kaplan-Rakowski et al., 2023; Kuleto et al., 2022), others presented contrasting views (Fontao et al., 2024; Iqbal et al., 2022), highlighting a need for further study. The conflicting claims in the literature about ChatGPT's integration may stem from its double-edged nature. As previously mentioned, ChatGPT offers benefits and drawbacks. ChatGPT is reported to help teachers create lesson plans, prepare teaching activities, develop assessments, and provide feedback (ElSayary, 2024; Kaplan-Rakowski et al., 2023). Moreover, Aravantinos et al. (2024) asserted that teachers perceive AI tools as transformative tools for enhancing teaching and learning across subjects and appreciate their role in promoting active learning and fostering higher-order thinking skills.

However, a qualitative study conducted by Iqbal et al. (2022) in Pakistan revealed that teachers held negative perceptions of integrating ChatGPT into education. Teachers in their context expressed concerns that ChatGPT increases the risk of cheating and plagiarism within the educational context. Fontao et al. (2024) similarly noted that pre-service teachers in Spain were concerned about the risk of academic dishonesty associated with using ChatGPT in education. They further mentioned that pre-service teachers expressed concern that overusing ChatGPT might limit teachers'

and students' creativity, critical thinking, and problem-solving abilities. A similar concern was raised by Kasneci et al. (2023). The literature discussed thus far on teachers' perceptions of using ChatGPT in education is confounding, giving this study a reason to conduct.

Teachers' Practices

Teachers use ChatGPT for various purposes, driven by expected performance, habit, enjoyment, facilitating conditions, perceived usefulness, and ease of use (Lavidas et al., 2024; Wangdi & Rigdel, 2024). For example, they used to create exam papers, search information on subjects, design teaching and learning activities and lesson plans, review and grade assignments, and provide feedback (Nah et al., 2023); create educational content, personalized learning experiences, and improve student engagement (Kasneci et al., 2023), and many more. While teachers' practices in other educational contexts have been discussed extensively in the literature, not many have disturbed the Bhutanese context, and there is a gap in knowledge on how teachers use ChatGPT for educational purposes in Bhutan. Koehler and Mishra (2009) and Wangdi et al. (2023) suggested that teachers' technological pedagogical knowledge, which derives from their practices, plays a pivotal role in selecting the most suitable and efficient technological tools for their classrooms. Therefore, there was a need to investigate how ChatGPT is being used in the context of the study to effectively integrate ChatGPT into education. Furthermore, understanding teachers' practices helps concerned educational stakeholders realize the need for workshops and training on ChatGPT among teachers. Montenegro-Rueda et al. (2023) divulged that teachers require extensive training to successfully integrate ChatGPT into education. Furthermore, it should be noted that ChatGPT's efficiency cannot be fully realized unless it is practiced and evaluated through hands-on experience. The findings on teachers' practices in this study may serve as a stepping stone toward integrating ChatGPT into education, particularly within the context of the study.

METHOD

Research Design and Participants

This study employed an explanatory sequential mixed method design (Ivankova et al., 2006), combining quantitative (survey questionnaire) and qualitative (open-ended questions) data to obtain a comprehensive understanding of Bhutanese teachers' knowledge, perceptions, and practices regarding ChatGPT in education. This study adopted a mixed-method approach because it helps researchers gain a deeper understanding of the phenomenon under investigation by combining the breadth and depth of information, which is impossible with a singular approach (Almalki, 2016). In this study, simple random sampling was employed to select Bhutanese teachers. A sampling frame was created using publicly available teacher databases, ensuring a diverse representation of educators

from various school levels and regions. This method ensured that the sample was representative of the broader teaching population.

Another benefit of random sampling is that it enhances internal validity in research by minimizing selection bias and ensuring an even distribution of characteristics (e.g., teaching experience, gender), which leads to more reliable results (Robinson, 2013). Similarly, random sampling improves external validity by obtaining a representative sample, allowing the findings to be generalized beyond the sample (Ferguson, 2004). Participants were selected using a random number generator, giving each teacher an equal opportunity to be chosen. Invitations were sent via online platforms, and out of the more than 500 teachers invited, only 214 completed the survey. The low participant turnover may be attributed to the voluntary nature of this study. It could also be due to teachers' time limitations and other responsibilities. In Bhutan, teachers are often burdened with additional tasks alongside their heavy teaching loads.

A total of 214 Bhutanese teachers participated and completed the survey. Most respondents were male, constituting 52.3%, while females made up 47.7%. The age distribution shows a diverse range of respondents from 31 to over 46 years. The respondents' teaching experiences are diverse, with the greatest experience level being those with 6 to 10 years (30.4%), closely followed by those with 11 to 15 years (26.2%). Most respondents were from Higher Secondary Schools, constituting 39.3%. Universities and Middle Secondary Schools also have notable representation, with 16.8% and 20.1%, respectively. The subjects taught are diverse, with a significant percentage involved in teaching Humanities (23.4%), English (22.9%), and Mathematics (22%). Other subjects, including Science, Business Studies, and Dzongkha, also have representation. The detailed information about the respondents is presented in Table 1.

Table 1
Demographic information participants

Characteristics	**N**	**Frequency**	**Percent**
Gender	Male	112	52.3
	Female	102	47.7
	Total	214	100
Age	21–25	28	13.1
	26–30	34	15.9
	31–35	77	36
	36–40	50	23.4
	41–45	21	9.8
	Above 46	4	1.9
	Total	214	100

Table 1 (continue)

Characteristics	N	Frequency	Percent
Teaching Experiences	Less than 1 year	21	9.8
	1–5 years	35	16.4
	6–10 years	65	30.4
	11–15 years	56	26.2
	More than 16 years	37	17.3
	Total	214	100
Institutions	University	36	16.8
	Vocational college	6	2.8
	Higher Secondary School	84	39.3
	Middle Secondary School	43	20.1
	Lower Secondary School	26	12.1
	Others	19	8.9
	Total	214	100
Subject(s) Taught	English	49	22.9
	Mathematics	47	22
	Science	45	21
	Dzongkha	2	.9
	Humanities	50	23.4
	Business studies	7	3.3
	Others	14	6.5
	Total	214	100

Research Instruments

The present study collected data using a single research instrument divided into two sections. The first section comprised a survey questionnaire with seven demographic questions (such as gender, age, and teaching experience) and 33 modified 5-point Likert scale items ranging from 1 (strongly disagree) to 5 (strongly agree). In comparison, the second section included four open-ended questions for follow-up inquiries. The survey questionnaire consisted of six items assessing teachers' knowledge (adapted from Chan & Hu, 2023), 15 items investigating their perceptions (adapted from Kaplan-Rakowski et al., 2023), and 12 items probing their practices (adapted from Nah et al., 2023). The researchers developed four questions with expert input for the open-ended questions, aligning them with the research objectives.

The four open-ended questions were: (1) Do you know ChatGPT? If so, what is your opinion of it? (2) What factors would influence your decision to use or not use ChatGPT in education? Please explain your reasoning. (3) Can you describe a specific event where you used ChatGPT for educational purposes? (4) Do you have any additional thoughts on the potential use of ChatGPT in education? Please explain. The survey and open-ended questions were

assessed for their reliability and validity. The Cronbach's Alpha coefficient value for the survey questionnaire was 0.949, while the open-ended questions were reviewed by two qualitative research experts and pilot-tested. Potential modifications were made, particularly for the open-ended questions, based on expert feedback and pilot analysis. It is important to note that results from the pilot analysis were not included in the final analysis.

Data Collection Procedure

The data was gathered from in-service teachers across Bhutan using online platforms such as Facebook, Telegram and Messenger. These teachers were teaching in different public schools. For ethical purposes, embedded with the electronic survey questionnaire, informed consent was obtained from all participants by requesting them to choose either 'Yes, I am willing to participate' or 'No, I am not willing to participate.' In doing so, all those who participated in the survey consented. Additionally, participants were informed of the voluntary nature of their participation, and the option was given not to respond if they were uncomfortable. Despite reaching out to over 500 teachers, only 214 responded. The entire process of data collection took researchers almost three months.

Data Analysis

In this study, data analysis was carried out in two phases. Before starting the analysis, two researchers collaboratively cleaned the quantitative and qualitative data. Following this data cleaning, the first analysis phase involved a descriptive examination of the quantitative data, utilizing means and standard deviations. The survey results were then interpreted using the mean interpretation scale adapted from Orlanda-Ventayen and Ventayen (2017) as follows: 1 to 1.80 as 'very low,' 1.81 to 2.60 as 'low,' 2.61 to 3.40 as 'moderate,' 3.41 to 4.20 as 'high,' and 4.21 to 5 as 'very high.' The entire process of quantitative analysis was conducted using SPSS version 26.

The second phase of the analysis focused on the qualitative data collected using open-ended questions. The qualitative data was thematically analyzed following the six-step process outlined by Braun and Clarke (2006): (1) familiarizing oneself with the data, (2) initial coding, (3) identifying themes, (4) reviewing themes, (5) defining and naming themes, and (6) producing the final report. The thematic analysis yielded themes corresponding to the research questions through a systematic process. First, the researchers familiarized themselves with the data and then conducted initial coding by identifying patterns related to teachers' knowledge, perceptions, and practices. These codes were grouped into broader themes, ensuring they aligned with the research questions. For example, knowledge about ChatGPT formed the theme of **Teachers' Knowledge,** addressing the first question. The themes were refined, reviewed, and presented clearly, ensuring they directly answered the research questions and were supported by participant responses. Subsequently, the researchers compiled

transcriptions, codes, and themes and then forwarded them to some participants for member checking.

Creswell and Miller (2000) noted that member checking is an important aspect of creating trustworthiness in a study that involves qualitative data because it helps improve the credibility of the research process. Additionally, to further establish the transferability and dependability of the study, which is often referred to as trustworthiness, researchers diligently followed the Nowell et al. (2017) step-by-step approach in conducting thematic analysis. To enhance confirmability, the researchers documented the entire study process, particularly the steps involved in data analysis, which a qualitative research expert audited.

RESULTS

The results of the study are presented in two phases. The first phase involves quantitative findings, while the second phase concentrates solely on substantiating quantitative results using qualitative data.

Teachers' Knowledge of ChatGPT

To ensure data accuracy in this study, only participants who confirmed their awareness of ChatGPT and reported actively implementing it in their teaching and learning practices were considered. Demographic insights revealed that most respondents (98.6%) were acquainted with ChatGPT, while a minimal fraction (1.4%) indicated they were unaware of it. Moreover, 86.9% of participants acknowledged using ChatGPT for educational purposes, while only a few (13.1%) stated they had not yet used it for teaching and learning purposes.

The average mean (M = 3.66, SD = 1.04) presented in Table 2 shows that participants held high levels of knowledge regarding ChatGPT. Out of 6 items, item 1, "I understand ChatGPT have limitations in their ability to handle complex tasks," was rated the highest with an average mean of 3.99 (SD = 0.90). This suggests that teacher-participants are cognizant regarding the limitations of ChatGPT performing complex tasks and its shortcomings. Item 4, "I understand ChatGPT can exhibit biases

Table 2
Teachers' knowledge of ChatGPT

Items	Mean	SD	Levels
1. I understand ChatGPT has limitations in handling complex tasks.	3.99	0.90	High
2. I understand ChatGPT can generate factually inaccurate output.	3.59	1.07	High
3. I understand ChatGPT can generate output that is out of context or inappropriate.	3.49	1.13	High
4. I understand ChatGPT can exhibit biases and unfairness in its output.	3.44	1.15	High
5. I understand that ChatGPT may rely too heavily on statistics, which can limit its usefulness in certain contexts.	3.64	0.98	High
6. I understand that ChatGPT has limited emotional intelligence and empathy, which can lead to insensitive or inappropriate output.	3.82	1.05	High
Average mean	3.66	1.04	High

and unfairness in their output," was rated lowest with a mean of (M = 3.44, SD = 1.15). Overall, participants appeared to be highly knowledgeable about ChatGPT.

Teachers' Perceptions Toward ChatGPT

The participants held a high level of agreement on ChatGPT's potential benefits in education. The analysis results are illustrated in Table 3. The average mean (M = 3.52, SD = 1.03) indicates a positive view of using ChatGPT in teaching and learning. Among many, item 16, "The use of ChatGPT in teaching and learning eases the pressure on me as a teacher," was rated the highest (M = 3.95, SD = 0.97). This suggests that incorporating ChatGPT eases some of the pressure teachers experience. Further,

Table 3
Teachers' perception toward ChatGPT

Items	Mean	SD	Levels
7. The use of ChatGPT in teaching and learning increases academic achievement (e.g., grades).	3.85	0.92	High
8. The use of ChatGPT in teaching and learning results in students neglecting important traditional learning resources (e.g., library books).	4.11	0.96	High
9. The use of ChatGPT in teaching and learning is effective because I believe I can implement it successfully.	3.83	0.92	High
10. The use of ChatGPT in teaching and learning promotes student collaboration.	3.38	1.19	High
11. The use of ChatGPT in teaching and learning promotes the development of communication skills (e.g., writing and presentation skills).	3.58	1.16	High
12. The use of ChatGPT in teaching and learning is a valuable instructional tool.	3.85	0.92	High
13. The use of ChatGPT in teaching and learning makes teachers feel more competent as educators.	3.83	1.01	High
14. The use of ChatGPT in teaching and learning is an effective tool for students of all abilities.	3.59	1.10	High
15. The use of ChatGPT in teaching and learning enhances my professional development.	3.85	0.87	High
16. The use of ChatGPT in teaching and learning eases the pressure on me as a teacher.	3.94	0.97	High
17. The use of ChatGPT in teaching and learning motivates students to get more involved in learning activities.	3.63	1.04	High
18. The use of ChatGPT in teaching and learning should reduce the number of teachers employed in the future.	3.18	1.38	Moderate
19. The use of ChatGPT in teaching and learning will increase the amount of stress and anxiety students experience.	2.35	1.08	Low
20. The use of ChatGPT in teaching and learning requires extra time to plan learning activities.	2.24	1.01	Low
21. The use of ChatGPT in teaching and learning improves students' learning of critical concepts and ideas.	3.56	1.04	High
Average Mean	3.52	1.03	High

the low levels of concern about increased student stress (M = 2.35, SD = 1.08) and the need for additional planning time (M = 2.24, SD = 1.01) suggest an overall positive perception of incorporating ChatGPT into education. In sharp contrast, item 8, "The use of ChatGPT in teaching and learning results in students neglecting important traditional learning resources (e.g., library books)," was also rated high (M = 4.11, SD = 0.96). This shows that participants are highly concerned that using ChatGPT may lead to students neglecting traditional learning resources.

Teachers' Practices

The result presented in Table 4 indicates that teacher participants in the context use ChatGPT extensively for teaching and learning (M = 3.56, SD = 1.12). The item analysis revealed that teacher participants had a high level of agreement in using ChatGPT for lesson planning (M = 3.42, SD = 1.24), content creation (M = 3.64, SD = 1.11), personalization (M = 3.71, SD = 1.04), and improving their understanding of complex concepts (M = 3.90, SD = 1.01). Interestingly, it was also observed that educators in this context make moderate use of ChatGPT when it comes to tasks associated with grading and providing feedback (see items 29 and 30).

Qualitative Findings

The qualitative data, comprising responses to open-ended questions, underwent thematic analysis and is presented below. The findings are presented based on three major themes: teachers' knowledge of ChatGPT, teachers' perceptions toward ChatGPT,

Table 4
Teachers' practices

Items	Mean	SD	Levels
22. I use ChatGPT to plan my lesson.	3.42	1.24	High
23. I use ChatGPT to create educational content for teaching and learning.	3.64	1.11	High
24. I utilize ChatGPT to develop personalized learning materials.	3.71	1.04	High
25. I use ChatGPT to adapt teaching materials to meet diverse student needs.	3.56	1.11	High
26. I utilize ChatGPT to enhance student engagement in the classroom.	3.47	1.18	High
27. I find ChatGPT easy to integrate into lesson plans.	3.71	1.01	High
28. I use ChatGPT to better understand complex teaching and learning concepts.	3.90	1.01	High
29. I find ChatGPT helps in the effective grading of assignments.	3.39	1.18	Moderate
30. I use ChatGPT to provide timely and constructive feedback to students.	3.29	1.22	Moderate
31. I use ChatGPT to create a more interactive and dynamic classroom environment.	3.52	1.17	High
32. I use ChatGPT to facilitate brainstorming and the generation or refinement of solutions in problem-solving.	3.53	1.12	High
33. I utilize ChatGPT to enhance the overall teaching and learning experience in the classroom.	3.59	1.05	High
Average Mean	3.56	1.12	High

and teachers' practices, each containing several sub-themes. A frequency count (number of participants responding to the same sub-themes) for open-ended questions was performed to provide a comprehensive understanding of the identified themes and sub-themes. Additionally, excerpts from open-ended questions were incorporated to substantiate these themes.

Teachers' Knowledge of ChatGPT

When asked about their knowledge and understanding of ChatGPT, most participants demonstrated a high level of knowledge regarding ChatGPT. This finding was consistent with the quantitative finding. In general, participants regard ChatGPT as a text-based AI communication tool (86 references), a convenient source of information (77 references), and a valuable AI tool for teaching and learning (43 references). Nonetheless, participants acknowledged the potential risk of inaccuracies in the information generated through ChatGPT. They advised caution (22 references) when incorporating ChatGPT into education and emphasized the importance of actively monitoring and verifying the information generated through ChatGPT (23 references).

> *ChatGPT is like a computer program that talks to you like a smart chat buddy. It uses a bunch of information it learned from the internet to answer your questions and have conversations with you. It is really good, but remember, it is just a machine, not a real person.* (P29)

Teachers' Perceptions Toward ChatGPT

Most participants who responded to open-ended questions (102 references) positively perceived ChatGPT. They stressed that ChatGPT is available 24/7 (76 references) and offers numerous benefits in teaching and learning. Participants specifically underscored that ChatGPT is user-friendly (34 references), resourceful (46 references), and a helpful tool for creating educational content, such as lesson plans and assessments (75 references). Other benefits of ChatGPT in education pointed out by participants included ChatGPT's potential to support personalized learning experiences (63 references), provide academic solutions, especially in academic writing (39), facilitate language learning (12 references), generate ideas (23), promote interactive learning and critical thinking (54 references), provide immediate feedback and assistance (68), help understand complex concepts (96), reduce workload (33), increase students' motivation and engagement (46), enhance knowledge and skills of teachers and students (73). Below are excerpts that support the present findings.

> *It can simplify some concepts; the search can be narrowed to save time for other useful work.* (P34)

> *It is easy to locate and get the required information. We can save time. It gives all the details and is easier to edit and modify in our context.* (P105)

On the other hand, although most participants acknowledged a myriad of

benefits that ChatGPT has for teachers themselves and students, many of them were aware of the possible drawbacks of ChatGPT within educational settings. Participants highlighted teachers and students being over-dependence on ChatGPT (33 references), the risk of inaccurate information (37 references) since ChatGPT lacks emotional intelligence (56 references), the potential to generate biased or inappropriate content (46 references), the chance of losing creativity and critical thinking abilities among teachers and students (20 references), and finally the concern regarding academic integrity, especially plagiarism (74 references).

> *ChatGPT may make mistakes in its responses due to its probabilistic nature or lack of verification. ChatGPT may also mislead by providing inaccurate information.* (P45)

> *Sometimes, the information we tend to excavate may not be that useful. Moreover, it doesn't serve the purpose of responding to all levels of learning abilities. Too much reliance on ChatGPT might negatively impact learners' creativity and critical thinking abilities.* (P135)

Teachers' Practices

Another finding revealed that most teachers (196 references) in Bhutan use ChatGPT in diverse ways to enhance their teaching and learning experiences. These participants reported using ChatGPT to develop and design lesson plans and classroom activities (103 references), explore new pedagogical ideas, and understand complex concepts of textbooks (83 references). Furthermore, participants reported using ChatGPT to generate questions for assessments and assignments, develop educational content such as reports, summaries, and presentation materials (89 references), and offer feedback on assignments, grading, editing, and grammar checking (23 references).

> *ChatGPT helps me to prepare effective lesson plans. I also use it for grading assignments and designing assignment questions.* (P22)

> *I used ChatGPT to generate supplementary learning resources, such as quiz questions, study guides, and additional reading materials. This saves time for teachers and provides students with more tailored resources.* (P166)

DISCUSSION

In light of TPACK (Mishra & Koehler, 2006) and TAM (Davis, 1989), the present study sought to investigate the knowledge, perceptions, and practices of 214 in-service Bhutanese teachers regarding using ChatGPT in education. To this end, this study employed a mixed-method approach, and the data was collected using the survey and open-ended questions. The descriptive analysis of the quantitative data presented that teachers were highly knowledgeable, held positive perceptions, and actively used ChatGPT for various educational purposes, while the thematic analysis of the qualitative data elucidated why participants

felt informed, viewed ChatGPT positively, and engaged with it.

Based on the quantitative data, it was found that the current participants were highly knowledgeable about ChatGPT, a finding that was later corroborated by their responses to open-ended questions. These findings of a high level of cognizance of ChatGPT were consistent with teachers in other contexts, such as Serbia (Kuleto et al., 2022), the USA, the UK, Canada (Kaplan-Rakowski et al., 2023), and Hong Kong (Kohnke et al., 2023). The teachers' high level of knowledge about ChatGPT in this context is likely a result of their frequent use of ChatGPT (Kaplan-Rakowski et al., 2023), which is made possible by its user-friendly design. Participants stated in their qualitative responses that they used ChatGPT frequently. They also reported that ChatGPT was easier to access and use than other educational tools. Theoretically, Davis (1989) suggested that individuals are more likely to adopt a technology if they perceive it as easy to use. Next, the quantitative data revealed that participants were highly aware of several limitations associated with ChatGPT, such as its potential to generate factually inaccurate output, exhibit biases, and lack of emotional intelligence and empathy. While acknowledging these limitations, the qualitative data disclosed that participants viewed ChatGPT as a convenient source of information and a valuable resource for teaching and learning.

Quantitative data indicated that Bhutanese teachers held positive perceptions toward ChatGPT. The qualitative responses expanded on this, identifying key reasons for their positive views. Teachers' positive perceptions of ChatGPT seemed to derive from their anticipation of the positive impact it could have on both students and teachers. In the qualitative data, participants noted that, in addition to ChatGPT's 24/7 availability and user-friendly interface, it is resourceful and helpful for creating educational content, such as lesson plans and assessments. Further, they highlighted that ChatGPT offers personalized learning experiences, provides academic solutions, facilitates language learning, generates ideas for brainstorming, promotes learning and critical thinking, and delivers immediate feedback and assistance. Additionally, participants pinpointed that ChatGPT aids in understanding complex concepts in a short time, reduces teachers' workloads, increases student motivation and engagement, and enhances the knowledge and skills of teachers and students. These findings were largely in tune with the findings of previous studies conducted in other educational contexts (Baidoo-Anu & Ansah, 2023; Kaplan-Rakowski et al., 2023; Kasneci et al., 2023; Mizumoto & Eguchi, 2023). The overall findings on the perceived benefits of using ChatGPT in education indicated that Bhutanese teachers are willing and ready to adopt ChatGPT. Thus, policymakers and educational stakeholders are advised to look at the possibility of integrating ChatGPT into education in this context.

In addition to the perceived potential benefits of ChatGPT, participants identified some potential limitations of using ChatGPT

in education. To begin with, participants, in their responses to open-ended questions, emphasized that the use of ChatGPT in education could lead to teachers' and students' overreliance on the tool. This concern was similarly noted by Kasneci et al. (2023). Furthermore, in line with the findings of Lubowitz's (2023) study, the current participants raised worries about the potential inaccuracies in data acquired using ChatGPT. A potential explanation for this is the nature of how ChatGPT functions. ChatGPT depends completely on text and resources available on the internet, which may not always be contextually or culturally accurate. The participants also acknowledged that ChatGPT lacks emotional intelligence (cf. Zhai, 2022). This suggests to educational stakeholders and researchers that ChatGPT or any AI tool should not be equated with human teachers but rather should be regarded as supplemental. Consequently, the fear of human teachers being replaced by AI is questionable. Participants further expressed their concerns about the potential adverse impact on the creativity and critical thinking abilities of teachers and students. Most importantly, participants appeared concerned about academic integrity, especially plagiarism, if ChatGPT is allowed to integrate into education. This finding agrees with several other studies (Baidoo-Anu & Ansah, 2023; Swiecki et al., 2022; Zhai, 2022). Overall, it is suggested that policymakers and educators thoroughly assess the potential positive and negative aspects associated with the integration of ChatGPT into education before implementing it in their respective contexts.

One of the most significant findings of the present study was the specific practices underscored by participants. In quantitative and qualitative data, participants reported using ChatGPT extensively. The use of ChatGPT in technologically disadvantaged contexts, such as Bhutan, could provide significant insights and contribute to the existing research on the possible integration of ChatGPT into education. Although Bhutan is often considered underdeveloped in terms of technological infrastructure (Wangdi & Rai, 2022), it was surprising that most participants had used ChatGPT for various educational purposes. Participants in this study reported using ChatGPT to develop lesson plans, create educational content, and design personalized learning materials. This finding aligns with earlier studies (Nah et al., 2023; Mizumoto & Eguchi, 2023), which also reported that teachers in their contexts use ChatGPT for lesson planning, content creation, and designing personalized learning materials.

Furthermore, similar to Kasneci et al.'s (2023) findings, it appeared that participants in the setting employed ChatGPT to enhance student engagement and create a more engaging and dynamic learning environment. Additional hands-on uses of ChatGPT by Bhutanese teachers included grading assignments, providing feedback, and designing assessment questions. However, participants reported using ChatGPT only to a moderate extent for grading, assessment, and providing

feedback in their survey responses. This limited use is likely due to the newness of ChatGPT and a lack of training on how to use it for assessments. Nevertheless, the findings that teachers also use ChatGPT for assessments and provide feedback to students were in line with the findings reported by Nah et al. (2023) in their study. Further, participants mentioned that they use ChatGPT to learn about difficult concepts in their courses and explore new pedagogical approaches to enhance their instruction. This suggests that ChatGPT has the potential to help improve teachers' content knowledge and teaching effectiveness if used appropriately.

CONCLUSION

Implications

The integration of ChatGPT into education has been a subject of ongoing debate among researchers and educators in recent years. In other words, the future of education has become unpredictable, especially with the advent of AI such as ChatGPT. The literature demonstrates a need for more studies to fully understand the potential integration of ChatGPT into education (Wangdi & Rigdel, 2024). To this end, the present study investigated the knowledge, perceptions, and practices of Bhutanese in-service teachers regarding the use of ChatGPT in education. The overall findings of the current study indicate that teachers in the context were aware of ChatGPT and its potential impact on education. They recognized its positive and negative aspects. Despite these concerns, teachers held positive perceptions toward ChatGPT and reported using ChatGPT for various educational purposes. For example, teachers reported using ChatGPT for lesson planning, content creation, assessment development, grasping complicated topics, creating educational materials, generating questions, and providing feedback to students.

This trend of Bhutanese teachers using ChatGPT for different educational purposes indicates a significant shift toward ChatGPT-assisted teaching in Bhutan. To build on these practices, Bhutan's Ministry of Education and Skill Development (MoESD), policymakers, and educators should work together to provide more targeted training, increasing the effectiveness of ChatGPT's implications in Bhutanese education. For example, training teachers to create personalized learning materials that cater to the individual needs of students, develop inclusive resources for marginalized learners (including those with special needs), and promote autonomous learning would be highly beneficial for maximizing the advantages of ChatGPT. Similarly, it is recommended that efforts be made to address the concerns disclosed in this study, such as the potential loss of creativity, degraded critical thinking abilities, over-dependence, cheating, plagiarism, and other ethical issues. This could make ChatGPT integration in Bhutan more effective and advantageous. Therefore, policymakers are encouraged to create guidelines and structured policies that govern the use of ChatGPT in Bhutan's educational system.

More specifically, teachers' high level of knowledge about ChatGPT (including its benefits and drawbacks), positive perceptions, and extensive engagement with ChatGPT indicate their readiness to integrate ChatGPT for educational purposes and teaching. The MoESD, policymakers, institutional leaders, and other educational stakeholders are thus encouraged to consider strategies for integrating ChatGPT-assisted curricula and providing comprehensive training programs. It is important to note that institutions around the world, including those in economically challenged countries, are now including AI courses to equip students with fundamental skills for an AI-driven job market in the future (Shabbir et al., 2024). This suggests that Bhutan's learners could benefit immensely in the future from including AI-related courses in curricula. It is, therefore, recommended to take immediate action and work on integrating AI-related courses into curricula and training, and this can be started from teacher training institutes because, as stated earlier, teachers serve as key agents in shaping students' interactions with AI (Aravantinos et al., 2024) and ensuring the successful integration of technological tools in education (Wangdi et al., 2023).

Limitations and Recommendations

While this study offers valuable insights into the integration of ChatGPT into education from teachers' perspectives, it is important to acknowledge some limitations. First, the sample size may not represent all Bhutanese teachers. Therefore, we advise being careful before generalizing the findings presented in this study. Although our findings aligned with most previous studies, we cannot assure that they will be generalizable to other educational contexts. Second, the use of self-reported instruments, which often leads to response bias, may have influenced our present findings. First, future researchers are encouraged to conduct a more extensive, nationwide study that incorporates the perspectives of teachers, policymakers, educational stakeholders, and students to address these limitations. This broader approach would provide a comprehensive understanding of the feasibility, challenges, and potential benefits of integrating ChatGPT into Bhutanese education. Second, there is a need for empirical studies to confirm present findings and to comprehensively understand the potential integration of ChatGPT into education.

Future researchers are advised to conduct experimental studies on the impact of integrating ChatGPT into education because there is a huge gap in knowledge in this domain. This would address the current knowledge gap and provide data on how ChatGPT influences teaching methodologies, student engagement, and learning outcomes. Next, our findings revealed that teachers disagree with the fact that the integration of ChatGPT would increase learners' anxiety and stress. In line with this, since research on emotions in education is one of the emerging topics in the educational field, we suggest future researchers investigate the impact of the integration of GAI into education on

teachers' and learners' emotional states. Researching potential sources of positive (enjoyment, pride, joy, happiness, and love) and negative (anxiety, stress, boredom, and anger) emotions derived from using GAI and other chatbots and their impact on students' learning outcomes and teachers' and students' well-being would be interesting.

Despite limitations, the current study's findings hold significant relevance for the Bhutanese context. The study offers a fresh view of in-service Bhutanese teachers integrating GAI, such as ChatGPT, into education. Policymakers and leaders of institutions can use these current findings as baseline data to consider the possibility of integrating ChatGPT into the Bhutanese education system. The findings can also be beneficial for teachers in facilitating informed decision-making regarding the integration of ChatGPT into teaching and learning because they offer insights into both the potential benefits and drawbacks of using ChatGPT for educational purposes. Most importantly, this study outlines various evidence-based practices of ChatGPT for teaching and learning among teachers in the context. This can serve as a guideline for teachers within and beyond the context of the potential integration of ChatGPT in their classrooms. By offering practical guidelines and real-world applications of ChatGPT, this study not only contributes to the academic understanding of the potential integration of ChatGPT but also has the potential to enhance teaching efficiency and improve student learning outcomes within the community. This, in turn, may help teachers ease their workloads, which is one of the biggest challenges among teachers across the globe.

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