Generative AI and Teachers’ Perspectives on Its Implementation in Education

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While artificial intelligence (AI) has been integral in daily life for decades, the release of open generative AI (GAI) such as ChatGPT has considerably accelerated scholars’ interest in the impact of GAI in education. Both promises and fears of GAI have been becoming apparent. This quantitative study explored teachers’ perspectives on GAI and its potential implementation in education. A diverse group of teachers (N = 147) completed a validated survey sharing their views on GAI technology in terms of its use, integration, potential, and concerns. Overall, the teachers express positive perspectives towards GAI regardless of their teaching style. The findings of the study suggest that the more frequently teachers used GAI, the more positive their perspectives became. The teachers believed that GAI could enhance their professional development and could be a valuable tool for students. Although
no guarantee exists that teachers’ perspectives translate into actions, previous research shows that technology integration and diffusion is highly dependent on teachers’ initial views. The findings of this study have implications on how GAI may be integrated in teaching and learning practices.

INTRODUCTION

Artificial intelligence (AI) emerged in computer sciences in the 1950s based on the work of John McCarthy, Alan Turing, and others (Cope et al., 2021). Since then, with the efforts of computer programmers, engineers, and data scientists, AI capabilities have been steadily advancing. Consequently, AI is now widely implemented across various domains such as business, finance, military, health, and medicine (Celik et al., 2022; Chen et al., 2023; Luckin & Cukurova, 2019; Schiff, 2021). AI tools, processes, and services have also surfaced in education, although educators’ willingness to adopt them has been perceived as slower than in other fields (Schiff, 2021). These tools include learning management systems, transcription and evaluation services, grammar checkers, and plagiarism detectors.

Several systematic reviews and content analyses have tracked studies of AI in the education context (Crompton et al., 2022; Feng & Law, 2021; Kabudi et al., 2021; Ouyang & Jiao, 2021; Tang et al., 2021; Zafari et al., 2022; Zawacki-Richter et al., 2019; Zhai et al., 2021), with at least one article tracing studies back to 2000 (Celik et al., 2022). Because of this growing interest in studying the impact of AI in education, AIED (i.e., AI in Education) has become an important acronym and database search term for identifying research in the field (Celik et al., 2022; Kabudi et al., 2021; Zafari et al., 2022).

Similar to AI itself, AIED uses have evolved over time. The earliest implementations of AI into teaching and learning environments used weak or narrow AI, so named due to its inability to function outside of pre-programmed parameters (Pham & Sampson, 2022). Weak AI demonstrates clear dependence on humans for programming and therefore offers users both less capacity to make unexpected discoveries, but also provides them with assurance that they have control over its processes.

As technologies and computer programmers’ skills advanced, coupled with exponential increases in interconnected data available online, another form of AI arose. This newer AI, referred to as strong or artificial general
prompts both excitement and trepidation because it can transfer knowledge among activities in different settings for the purpose of achieving aims that may continue to evolve (Goertzel, 2014; Pham & Sampson, 2022; Popenici & Kerr, 2017). Strong AI offers more capacity to identify previously undetectable relationships and patterns, but it also eliminates the need for much, if any, human involvement in the data preparation, programming, and processing phases (Goertzel, 2014; Pham & Samson, 2022; Popenici & Kerr, 2017). Machine learning (ML) underlies both types of AI, and when combined with other technologies, its power can be enhanced and its reliance on human direction decreased (Akgun & Greenhow, 2022). ML algorithms have been applied to achieve various goals including product or service recommendations, facial recognition, academic performance prediction, and disease detection (Akgun & Greenhow, 2022; Kabudi et al., 2021; Liu et al., 2022; Zhai et al., 2021).

Within the area of ML-powered AI, a range of capabilities have materialized. One of these capabilities is generative AI (GAI), which dates to the 1960s, but research on GAI received researchers’ attention only starting around 2014 (Gui et al., 2023). GAI is most broadly described as a type of AI that can produce new content based on the provided input (Pavlik, 2023). Generative adversarial networks (GANs), which are power-generative AI, use two network streams: the generator and the discriminator. The generator uses the ingested data to create new training data, while the discriminator distinguishes between the real data input and the approximations created. The process of training the model continues until the discriminator cannot determine which content items are real and which are AI-produced (Aldausari et al., 2022; Pavlik, 2023).

BACKGROUND

Generative AI - What is ChatGPT?

The release of GAI tools to the public, such as Stable Diffusion, DALL-E, and ChatGPT in 2022 has raised society’s awareness of the existence of AI and its potential impacts on how many everyday-life activities are conducted (Heaven, 2023; Lampropoulos et al., 2023; OpenAI, 2022). Image and video generation from users’ textual prompts are possible with Stable Diffusion and DALL-E. ChatGPT (Generative Pre-trained Transformer) is a chatbot capable of, for example, generating and summarizing texts, and language translation. ChatGPT is also able to respond to users’
queries with paragraphs of text, blocks of code, etc. These advanced machine-generated outputs have prompted users to both appreciate generative AI tools as valuable assistive technologies for problem-solving and content creation, and to raise concerns about the potential demise of human creativity and academic integrity (Ali, 2021; Cope et al., 2021; Pavlik, 2023; Popeneic & Kerr, 2017; Schiff, 2021; Sharples, 2022).

**Promises of AI for Education**

Educators in both K–12 and higher education face the challenge of demanding workloads. They are expected to manage students’ attendance and achievement data, offer personalized instruction and attention, track students’ performance over time, prepare students for assessments, and provide individualized and meaningful feedback on students’ work. Across all levels of education, students bring varying strengths, prior knowledge, life experiences, and motivation with them into the learning environment. Because of its proficiency in managing, analyzing, and detecting patterns among large numbers of disparate data points, AI has been proposed and implemented as a solution for addressing teachers’ challenges in meeting all the students’ needs. AI-powered adaptive and personalized learning systems use learner performance information, demographics, and behavioral data to guide students through content and learning activities that are tailored to their goals, interests, learning preferences, and skill- and knowledge levels (Capuano & Caballé, 2020; Li et al., 2012; Peng et al., 2019; Xiao et al., 2018). Additionally, AI and ML can process learner data in such systems to predict students’ course performance or completion (Bañeres et al., 2020; Xing & Du, 2019). These predictive approaches often provide learners with notifications and learner-facing dashboards to support student success.

AI chatbots, such as ChatGPT, Jasper, or Google Bard, are alternative ways with which learners can receive real-time support. They can engage with students in interactive, conversational ways and provide immediate answers to questions, which minimizes delays in learners’ progress due to waiting for teachers’ responses (Chen et al., 2023; Eicher et al., 2018; Goel & Joyner, 2017). Because users must consider the formulation of their questions to receive the desired guidance, chatbots can be seen as facilitators of self-directed learning. Since their early implementation beginning in 2014, in certain instances, educational chatbots have been sufficiently effective that they have successfully deceived students into perceiving them as human (Eicher et al., 2018; Goel & Joyner, 2017; Wu et al., 2020).
Research conducted by Chen et al. (2023) on students’ assessment of chatbots found both strengths and weaknesses, identifying the chatbots’ difficulties with conversational flow and responding appropriately to nuanced input from users. Wu et al. (2020) noted that students’ engagement with chatbots in online learning reduced the percentage of students reporting persistent loneliness by more than 30%, suggesting that responsive chatbots can benefit affective aspects of learning and mental health. This finding aligns with the overview by Dhimolea et al. (2022) on AI conversational chatbots, virtual assistants, and socially assistive robots to promote social and emotional well-being.

Challenges in AIED Implementation

While AI presents opportunities for improving education at scale, challenges are evident. For instance, technological limitations of some advanced tools cause chatbots to respond problematically, such as in the examples of Microsoft Bing’s chatbot generating hostile and derogatory responses (Allyn, 2023) and ChatGPT’s hallucinations; that is, ideas and information which initially seem to make sense, but later are discovered to be incongruous (Schardt, 2023). In addition to the technological challenges, educators face other obstacles that impede the effective development and integration of AI applications in educational settings. These obstacles include questionable data privacy (Ifenthaler & Tracey, 2016; Shin et al., 2022; Zeide & Nissembaum, 2018) and reduced learner agency (Berendt et al., 2020). Another major concern is the black box, which is a hidden and sometimes uninterpretable nature of AI processes (Fiok et al., 2021; Prinsloo, 2020; Srinivasan, 2022). Teachers’ and society’s perceptions may be strongly influenced by representations of AI in popular culture which are rarely reflective of real AI applications (Hermann, 2023). Finally, teachers’ knowledge levels and readiness to use AI tools may be limited (An et al., 2022; Antonenko & Abroamowitz, 2023; Celik et al., 2022; Lampropoulos et al., 2023; Nazaretsey et al., 2022).

Teachers’ Perceptions of AIED

Ally (2019) argued that the rapid progression of education into the digital age, with the emphasis on emerging technologies, AI, and the Internet of Things (IOT), requires substantial changes in teachers’ instructional practices and their understanding of their role in the learning process. To concep-
tualize the types of skills that teachers would need to meet the demands of future-focused education, Ally (2019) conducted interviews and written responses from 34 educational technology experts representing six countries. Based on those data, a Competency Profile for the Digital Teacher (CPDT) 2030 was drafted to include nine broad areas encompassing 105 specific competencies. Among those competencies were comfort working in virtual environments, digital literacy, the ability to create and adapt digital learning resources, strong communication skills, personal flexibility, open-mindedness, willingness to learn about and use assistive, multimedia technologies.

Educators’ use of computers and related technologies in instruction has been studied since the 1960s (Parker & Davey, 2014). While early forms of educational technology tended to have singular and well-established purposes, the relative newness of AI, inherent complexity, and wide-ranging potential applications distinguish AI from former technology applications. Celik et al. (2022) examined research going back to 2000 and found the earliest studies of teachers’ active involvement in AI use for instructional purposes beginning in 2004, with the greatest uptick of studies happening in 2018. While there has been a push for integration from commercial and nonprofit entities, researchers have raised concerns about educators’ perspectives being excluded from the broader conversations happening around AIED (Celik et al., 2022; Cope et al., 2021; Zawacki-Richter, 2019).

Because research on educators’ attitudes toward the use of AIED has begun to emerge since 2020, as of July 2023, the number of studies in this area is still limited. Wang et al. (2021) used a modified Technology Acceptance Model (TAM) framework (cf. Davis, 1989) to study Chinese faculty members’ attitudes toward AI applications for higher education. To the original TAM scale, they added two constructs. The modified scale therefore included the following original factors: perceived usefulness, perceived ease of use, attitudes toward use, behavioral intention to use, and the new factors of anxiety and self-efficacy (Davis, 1989; Wang et al., 2021). Two major findings using the new scale were that anxiety, self-efficacy, perceived usefulness, perceived ease of use, and attitudes toward use together explained 70.4% of changes in behavioral intention to use, and of these, attitude toward use had the highest determining power. Wang et al. (2021) recommended professional development to improve educators’ attitudes toward use and consequently their intention to use AI technologies.

Another study involved surveying K–12 teachers in Serbia to determine their levels of AI knowledge, their active efforts to use AI as a teaching tool, and their perceptions of AI in relation to their expectations (Kuleto et al., 2022). The data analyses revealed a positive correlation between teachers’ opportunities to experience AIED and their opinions about it, which in turn
influenced their behavioral intentions to implement AI in their own teaching. These correlations suggest that providing more professional development for teachers that allow them to actively use AI may lead to their increased willingness to adopt AI into their regular practices.

Wang and Cheng (2021) conducted a case study involving two public K–12 schools in Hong Kong. The two schools had both been identified as award-winning in the areas of technology-enhanced learning and were in the process of adopting AIED initiatives. Interviews and focus group interviews with teachers and principals intended to identify barriers of AIED integration into instructional programs. The researchers analyzed the data based on the existing framework consisting of: Learning about AI, Learning from AI, and Learning with AI. They also categorized the challenges expressed by participants into first-order and second-order barriers, with first-order barriers generally being external to the teachers, while second-order barriers were internal. The internal barriers aligned with other studies’ findings and included incomplete understanding of AI and its pedagogical uses, disagreements about how AI should be taught or integrated, as well as limited confidence or enthusiasm for using AI.

The research described so far has involved educators actively engaged in K–12 and higher education and involved AI applications generally. Because ChatGPT is generative AI in the form of a chatbot, and because AI chatbots are continuing to evolve, it is relevant to address the topic among in-service and pre-service teachers who will be entering the profession during the coming years. Yang and Chen (2022) suggested that pre-service teachers’ beliefs and their learning experiences during their training influence their future classroom practices. Their study involved 26 pre-service information technology teachers in Taiwan and collected data from questionnaires, interviews, and chatbot usage logs. During the study, the participants had the option to learn through the LMS or using the chatbot. The analysis of behavioral and interview data indicated that pre-service teachers used the chatbots for organizing understandings, searching for content, and for conversation unrelated to the course materials. Yang and Chen concluded that the pre-service teachers’ experiences with using chatbots may influence their choice of activities to include or exclude from an LMS.

In summary, systematic review evidence has shown an interest in AIED dating back to the early 2000s. As new AI capabilities have emerged, the number of studies exploring how these more powerful tools might impact teaching and learning in both K–12 and higher education is also increasing. GAI in the forms of ChatGPT and other tools, which have become widely available since the end of 2022, have sparked fresh ideas about AI-supported learning and creativity. The research on incorporating GAI into teaching
and learning is in its early stages but is likely to increase as people worldwide, regardless of professional role, become aware of and experiment with GAI applications.

## Study Purpose and Research Questions

Prior research highlights the importance of understanding teachers’ perspectives on the implementation of emerging technologies (Wozney et al., 2006) such as extended reality (Kaplan-Rakowski, Papin, & Hartwick, 2023) or virtual reality (Kaplan-Rakowski, Dhimolea, & Khukalenko, 2023; Khukalanko et al., 2022), with only a few studies focusing on the integration of GAI (for exceptions, see Kuleto et al., 2022; Wang & Cheng, 2021; Wang et al., 2021). Despite the growing popularity and accessibility of GAI tools, likely due to the relative novelty of this topic, little is known on how teachers perceive the integration of GAI such as Chat GPT in education (Celik et al., 2022). While it is uncertain that teachers will act based on their reported beliefs, past studies have demonstrated that the integration and diffusion of technology largely relies on teachers’ perceptions (Ismail et al., 2010; Sugar et al., 2004). If the initial phase of examining teachers’ attitudes towards GAI technology is skipped, the integration of this technology in education is likely to be unsuccessful. Therefore, this study is motivated by the following research questions:

1. What are teachers’ perceptions of GAI integration in education?
2. What is the relationship between teachers’ stages of GAI integration and the frequency of GAI use?
3. What is the relationship between teachers’ perceptions of GAI integration and their instructional approaches?

## METHODS

### Context

To ensure compliance with ethical guidelines for human subjects research, this study obtained ethical approval from the Institutional Review Board (IRB) at the University of North Texas. The survey was hosted on Qualtrics (https://www.qualtrics.com), which is a cloud-based platform for conducting online surveys. The dissemination of the survey took place us-
ing SurveyCircle (https://www.surveycircle.com), which is an online platform devoted to the recruitment of survey participants. Teachers were invited to participate through Facebook, Twitter, LinkedIn, and through word of mouth. The survey was open for four weeks in March-April 2023. No compensation was available for participation.

Participants’ Characteristics

To be eligible to participate in the study, respondents needed to be teachers who used any GAI tool at least once, as verified at the beginning of the survey. Out of 155 respondents in the initial poll, eight were excluded because they did not meet the eligibility criteria, or they provided incomplete responses to the survey. As a result, responses from 147 participants were included in the analysis. As of 2023, determining the representativeness of this sample is not feasible, given the impossibility of calculating the margin of error. Although estimates of the total number of teachers worldwide exist, data on the prevalence of GAI use among teachers remains unknown.

Most participants reported being female (95; 65%) which corresponds to the general population of teachers worldwide (World Bank, 2021). Forty-seven (32%) participants reported being male, and five (3%) participants preferred not to reveal their gender. The largest country represented was the USA (45; 31%), followed by the UK (21; 14%), and Canada (19; 13%). Participants taught a variety of subjects, including languages (46; 31%), social sciences (22; 15%), business (20; 14%), early school education (7; 5%), art (4; 3%), physical education (3; 2%). Most participants (63; 43%) taught at the tertiary level. Other participants represented elementary (30; 20%), secondary (25; 19%), extracurricular (19; 13%), and preschool (7; 5%) teachers. The distribution of the duration of teaching was (in the descending order): up to 2 years (46; 31%), 3-5 years (32; 22%), over 20 years (26; 18%), 16-20 (16; 11%), 11-15 years (15; 10%), 6-10 years (12; 8%). The largest reported age groups were participants in the 20-39 year-old (90; 61%) and between 40-59 year-old (48; 33%), while a small number of participants reported being over 60 (7; 5%), and two participants were under 20. Collaborative learning (111; 76%) and project-based learning (100; 68%) were the most frequently selected instructional strategies followed by reading materials (77; 52%), and learning by making (of student-created materials; 78; 53% each).
**Instrument**

The instrument in this study was an online survey that was partially based on a previously validated survey by Wozney et al. (2006). The original survey contained five sections, which were reduced to three, to align with the context of the current study. We also added several items to enhance the scope of the inquiry. The survey was designed to be short (about 5 minutes) to increase chances for a full survey completion. Once the participants read the consent form and confirmed meeting the two criteria for participation; that is, of being a teacher and having used ChatGPT at least once, the core survey questions followed. First, out of the six stages of technology integration (i.e., awareness, learning, understanding, familiarity, adaptation, and creative application), the participants were to select one that best described their progress with GAI.

Second, the participants were asked to rate the level of agreement (from 1: *strongly disagree* to 6: *strongly agree*) on statements regarding the perceptions of GAI implementation in education (e.g., “ChatGPT is effective because I believe I can implement it successfully”). This part of the survey was adapted from Wozney et al. (2006). That is, the Wozney et al. survey had 33 items addressing teachers’ perceptions of implementing technology in the classroom. We reduced that number to 15 and reworded some of the statements to make the survey more relevant within the context of this study on GAI technology. A team of content experts specializing in educational technology reviewed the operationalized survey items and provided feedback. After three rounds of revisions, the panel of experts confirmed the face and content validity of the instrument.

Third, the survey asked whether the participants used GAI specifically for teaching and if they did, they needed to indicate the frequency of its use (ranging from 1: *never* to 5: *always*). The likelihood of the intention to use GAI for teaching constituted the next question (with options ranging from 1: *very likely* to 5: *very unlikely*). Finally, those participants who confirmed the likelihood of using GAI for their teaching were to indicate what they would use it for; the choices were: test/exam creation, ideas for classroom activities, correcting exams or assignments, and prompt creation.

The last section of the survey encompassed items capturing background characteristics of the sample which included gender, age group, years of teaching, subject taught, preferred teaching approach, and major instructional strategies used. At the end, an open-ended question invited respondents to leave any additional comments they would like to leave.
Data analysis

The quantitative data analysis involved using SAS/STAT Software. Descriptive statistics yielded findings to Research Question 1. Research Questions 2 and 3 were answered using Spearman rank-order correlations. The survey also yielded limited qualitative data based on open-ended comments. These written responses were analyzed using an open coding technique: the emerging codes were placed under two main categories (perceived benefits and challenges of GAI for education) for subsequent content analysis. Due to their limited number of comments, the need to calculate the percentage of peer-rater agreement did not arise.

FINDINGS

Teachers’ Perceptions of GAI Integration in Education

Fifteen Likert-scale items measured teachers’ perceptions on the use of GAI for education. A rating system consisting of 6-point-scale allowed to express respondents’ level of agreement or disagreement with the statements ranging from 1 (strongly disagree) to 6 (strongly agree). The internal consistency of the new, operationalized instrument was verified using the calculations of Spearman-Brown stepped-up coefficient. Its value was considered “good” (α = 0.81; DeVellis & Thorpe, 2021).

Means (M) and standard deviations (SD) of all 15 items are provided in Table 1. Four items (2, 12, 13, 14) were negatively oriented and marked in italics (Table 1). In sum, the analysis of descriptive statistics revealed that teachers had relatively positive perceptions of the implementation of GAI in education as they positively agreed with 14 out of 15 statements. Only one item, “GAI results in students neglecting important traditional learning resources (e.g., library books)”, produced a mean value below three (M = 2.65, SD = 1.22), with 77.55% of respondents reporting positive perceptions by answering slightly agree, agree, or strongly agree. Another relatively small percentage of respondents (38.78%; M = 3.15, SD = 1.27) agreed to item 4, expressing that “GAI promotes student collaboration.”
Table 1

Teachers’ Perceptions of GAI in Education

<table>
<thead>
<tr>
<th>Statement</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Increases academic achievement (e.g., grades).</td>
<td>3.84</td>
<td>1.23</td>
</tr>
<tr>
<td>2. Results in students neglecting important traditional learning resources (e.g., library books).</td>
<td>2.65</td>
<td>1.22</td>
</tr>
<tr>
<td>3. Is effective because I believe I can implement it successfully.</td>
<td>4.01</td>
<td>1.13</td>
</tr>
<tr>
<td>4. Promotes student collaboration.</td>
<td>3.15</td>
<td>1.27</td>
</tr>
<tr>
<td>5. Promotes the development of communication skills (e.g., writing skills, presentation skills).</td>
<td>3.23</td>
<td>1.39</td>
</tr>
<tr>
<td>6. Is a valuable instructional tool.</td>
<td>4.24</td>
<td>1.08</td>
</tr>
<tr>
<td>7. Makes teachers feel more competent as educators.</td>
<td>3.56</td>
<td>1.27</td>
</tr>
<tr>
<td>8. Is an effective tool for students of all abilities.</td>
<td>3.81</td>
<td>1.31</td>
</tr>
<tr>
<td>9. Enhances my professional development.</td>
<td>4.20</td>
<td>1.21</td>
</tr>
<tr>
<td>10. Eases the pressure on me as a teacher.</td>
<td>3.72</td>
<td>1.45</td>
</tr>
<tr>
<td>11. Motivates students to get more involved in learning activities.</td>
<td>3.65</td>
<td>1.28</td>
</tr>
<tr>
<td>12. Should reduce the number of teachers employed in the future.</td>
<td>4.20</td>
<td>1.46</td>
</tr>
<tr>
<td>13. Will increase the amount of stress and anxiety students experience.</td>
<td>3.86</td>
<td>1.32</td>
</tr>
<tr>
<td>14. Requires extra time to plan learning activities.</td>
<td>3.56</td>
<td>1.38</td>
</tr>
<tr>
<td>15. Improves student learning of critical concepts and ideas.</td>
<td>3.62</td>
<td>1.34</td>
</tr>
</tbody>
</table>

Average: 3.69 1.29

Note: Items in italics were reverse-coded.

The highest agreement items corresponded to items 6, 9, and 12. Item 6 was the highest with 82.31% of respondents agreeing that GAI is a “valuable instructional tool for students” ($M = 4.24$, $SD = 1.08$). A total of 75.51% respondents agreed that AI “enhances professional development” ($M = 4.20$, $SD = 1.21$). Another high rate of respondents (66.67%) agreed that “GAI should not reduce the number of teachers employed in the future” ($M = 4.20$, $SD = 1.46$).
Teachers’ Stages of GAI Integration and the Frequency of GAI Use for Teaching

The analysis involved running correlations between two measures. One measure involved the stages of teachers’ GAI integration, and another measure involved the frequency of GAI use for teaching. Teachers selected their stage of GAI integration out of six categories (as adapted from Wozney et al., 2006):

1. **Awareness**: I am aware that the technology exists but have not used it – perhaps I’m even avoiding it. I am anxious about the prospect of using ChatGPT.
2. **Learning**: I am currently trying to learn the basics of ChatGPT. I am sometimes frustrated using ChatGPT and I lack confidence when using it.
3. **Understanding**: I am beginning to understand the process of using ChatGPT and can think of specific tasks in which it might be useful.
4. **Familiarity**: I am gaining a sense of self-confidence in using ChatGPT for specific tasks. I am starting to feel comfortable using ChatGPT.
5. **Adaptation**: I think about ChatGPT as an instructional tool to help me and I am no longer concerned about it as technology.
6. **Creative application**: I can apply what I know about ChatGPT in the classroom. I am able to use it as an instructional aid and have integrated ChatGPT into the curriculum.

Descriptive statistics show that most participants (76; 52%) were at the third (understanding, 50; 34%) and fourth (familiarity, 26; 18%) stages of GAI integration. Sixteen (11%) participants indicated being at the fifth stage (adaptation) and 21 (14%) participants indicated being at the most advanced stage (creative application). The two earliest stages of integration (awareness and learning) were represented by 34 (23%) participants.

The analysis of descriptive statistics revealed the frequency of GAI use in teaching among respondents with the following metrics: *never* (62; 42%), *rarely* (40; 27%), *when necessary* (30; 20%), *often* (9; 6%), and *always* (3; 2%). The analysis using Spearman’s rank-order correlations showed a moderate (Dancey & Reidy, 2017) relationship between teachers’ GAI levels of integration and the frequency of its use, $r_s(147) = .37, p < .05$. 
Teachers’ Perceptions of GAI Integration and their Instructional Approaches

To determine the relationship between teachers’ perceptions of GAI integration and instructional approaches, correlations were run taking under consideration two measures. The first measure (i.e., teachers’ perceptions of GAI integration) involved a combined 15-item instrument (see Table 1). The mean of the 15 values was used to determine the average perceptions. That value was correlated with the measure involving instructional approaches.

Teachers’ selection of instructional approaches was adapted from Wozney et al., 2006, and were represented by five categories:

1. Teacher-centered,
2. More teacher-centered than student-centered (teacher in the center of a class, leading lectures and discussions),
3. Balance between teacher-centered and student-centered approaches,
4. More student-centered than teacher-centered,
5. Mainly student-centered (cooperative learning, discovery learning).

The largest group of participants (63; 43%) expressed being in the middle; that is, having balance between student-centered and teacher-centered approach. The next group (33; 22%) showed a greater inclination toward student-centered than teacher-centered approach. The groups that followed were student-centered (25; 17%), more teacher-centered than student-centered (20; 14%), and teacher-centered (6; 4%). Spearman’s rank-order correlations determined a positive, significant but weak relationship between teachers’ GAI levels of integration and their instructional approaches, $r_s(147) = .23, p < .05$.

DISCUSSION

In their editorial commenting on the impact of ChatGPT for teacher education, Trust et al. (2023) argued for an inclusive rather than dismissive approach to the integration of GAI technology. They justify this position and argue how teaching has persisted despite the integration of technologies in the past, such as the calculator. Although challenges exist, the integration of GAI allows for opportunities to create, innovate, and shift educational practices (Celik et al., 2022). Survey results from this study support this
approach. Rather than dismissing AI, such as ChatGPT, the survey respondents seem to be likely to use AI and integrate it into their teaching.

### Teachers’ Perceptions of GAI Integration in Education

Social media data analysis by Lampropoulos et al. (2023) revealed positive sentiments toward GAI. Likewise, the teachers in this study expressed relatively positive perceptions of GAI, with 54% reporting that they are *likely* or *very likely* to integrate AI in their teaching. These findings suggest that teachers might be willing to learn and adapt to internal barriers more readily. Ertmer (1999) describes internal barriers as teachers’ hesitancy toward and unwillingness to put effort into learning and adapting to new technologies. Given the high likelihood that teachers will use ChatGPT for their teaching, teachers in this study might be more willing to learn and adapt, making the internal barriers less inhibiting.

This willingness to learn and adapt may also be due to fewer external barriers associated with GAI. Ertmer (1999) describes external barriers as independent from teachers; they include such factors as a lack of financial resources, IT support, or professional development. For instance, in a study pertaining to VR integration, educators expressed reluctance due to barriers associated with cost, equipment requirements, and the steep learning curve faced by new users before they become effective practitioners (Kaplan-Rakowski, Papin, & Hartwick, 2023). In the context of ChatGPT, because it is an open-source tool and it is easy to use, teachers may not have been extensively concerned about the cost or a high learning curve, consequently more ready to adopt. For those teachers who have not used ChatGPT, the main barrier would be the lack of awareness with respect to how effortless and quick it is to learn how to use GAI (personal communication, 2022). Professional development efforts should solve this issue among teachers (Nazarovsky et al., 2022).

Another interesting finding is that only a third of respondents were concerned that GAI would replace the number of teachers. Firat’s (2023) small-scale study investigating perceptions of scholars at the post-secondary level also found respondents were not concerned about the future of work and employability. Instead, they expressed optimism and commented on the benefits of GAI, such as improved opportunities for self-directed learning. Still, almost a quarter of respondents expressed concerns that GAI will result in students neglecting important traditional learning resources. This concern likely relates to challenges associated with AI and GAI, such as in-
creased plagiarism and lack of academic integrity (Perkins, 2023; Sharples, 2022).

The teachers’ positive attitude toward GAI contradicts some existing literature with respect to technology integration in teaching. A systematic review of teachers’ use of AI by Celik et al. (2022) suggested that teachers are generally reluctant to integrate emerging technologies in their teaching due to the complexity and range of new technologies, and they may lack some of the competences identified in Ally’s (2019) CPDT, such as comfort and open-mindedness. The contradictory findings of the current study may be due to the fact that ChatGPT has fewer external barriers and because more than 50% of our sample reported having some experience already – less than six months after ChatGPT was launched, in November 2022 (Lampropoulos et al., 2023). Further, the rapid emergence and prevalence of ChatGPT have prompted educators to carefully examine this AI tool (Firat, 2023; Lampropoulos et al., 2023; Reuters, 2023). Frequent media coverage of ChatGPT and other AI tools combined with the fast-paced advances in the tools themselves may lead to increased use and integration by educators.

Teachers’ Stages of GAI Integration and the Frequency of GAI Use for Teaching

The findings suggest that the more teachers are aware of GAI, the more often they use it (barring restrictions from their school). This is in line with previous research showing that the more exposure teachers have to AI, the more likely they are to trust this technology (Nazaretsky et al., 2022) and incorporate it into their practice (Kuleto et al., 2022). Approximately half of our sample reported that they can already think of specific tasks to use AI (the understanding stage), or that they were comfortable using AI (the familiarity stage). Assuming increased awareness leads to increased use, it is reasonable to expect that these averages will move toward the higher integration levels, namely, the stages of adaptation and the creative applications of AI over time.

These reported stages of integration (i.e., understanding and familiarity) are further supported by teachers’ responses regarding the perceived value of AI as an instructional tool and its expected ease of implementation. At the level of understanding and familiarity, teachers are thinking of how to use GAI for specific tasks and with confidence. The perceived usefulness and ease with which GAI, such as ChatGPT, can be integrated in educational settings may help explain some of the positive attitudes. These two
Factors—usefulness and ease of use—were previously identified as influencing educators’ acceptance of technology (Wang et al., 2021). As noted, over 80% of the surveyed teachers see ChatGPT in education as a “valuable instructional tool for students.”

Perceived value and ease of integration help to support the assumption that teachers are encouraged and likely to integrate GAI. ChatGPT is web-based, easy to use by simply creating an account, and it requires no peripheral equipment. In addition, as of July 2023, ChatGPT has a free version. These features may help explain the positive attitudes and anticipated frequency of implementation. At this early stage in 2023, it seems that teachers are ready to integrate GAI. This is encouraging given the challenges reported in earlier studies on the integration of AI, where teachers expressed a lack of readiness for its implementation (An et al., 2022; Antonenko & Abroamowitz, 2023; Celik et al., 2022; Nazaretsky et al., 2022).

### Teachers’ Perceptions of GAI Integration and their Instructional Approaches

This study found a weak correlation between teachers’ positive perceptions of GAI integration in education and their teaching approaches. That is, teachers viewed GAI in a positive way regardless of whether they were more student-oriented or teacher-centered. The fact that GAI began to attract media attention only five months prior to the study could explain this result. Several teachers, regardless of their perceptions of GAI, may indeed have had insufficient time to test its potential and forge an opinion (positive or negative) about its integration in education. This hypothesis is supported by the fact that while several respondents (50; 34%) declared that they understood AI, the highest level of AI integration (i.e., creative application; 21; 14%) was underrepresented in the survey. Given the novelty of GAI tools such as ChatGPT, the lack of professional development opportunities on AIED so far (Nazaretsky et al., 2022) may also explain such results.

The qualitative analysis of the survey’s open-ended question (n = 18) also corroborates the aforementioned findings. That is, regardless of their exact perceptions, teachers identified both advantages and challenges regarding GAI integration in education. On the positive side, respondents emphasized the ease of use of GAI and its ability to “save time” for both teachers and students. Also transcending teaching approaches was another respondent’s perception that “GAI would shake up the traditional way that we assess.” Such a comment aligns with Zhai’s (2022) prediction that the
wide-scale availability of GAI could encourage educators to remove certain types of assessments, such as essays, from their curriculum.

Meanwhile, several challenges were identified. For example, one respondent believed that it “is not wise to let ChatGPT fulfill the role of the student (completing essays, etc.)” – a view shared by five other respondents (inclined to either teacher or student-centered approaches), who deemed that ChatGPT could make learners “lazy” or “indolent.” According to three respondents, using ChatGPT could indeed hinder the development of valuable skills, such as critical thinking – a concern also raised by Zhai (2022). These perceived challenges, or obstacles, were noted in earlier studies (An et al., 2022; Antonenko & Abroamowitz, 2023; Celik et al., 2022). Similarly to positive perceptions, these negative comments were not made in relation to a specific teaching approach, which is more likely influenced by the teaching style or philosophy (Heimlich & Norland, 2002). For instance, a teacher who advocates for self-directed learning (a student-centered approach) might have negative perceptions of GAI if they consider that ChatGPT prevents students from thinking for themselves. On the other hand, that same teacher could value the integration of ChatGPT if they felt GAI could be used to support learners’ autonomy in self-directed learning settings.

Implications

An editorial by Trust et al. (2023) points to GAI potential uses and opportunities for teachers and students, further identifying its potential risks and misuses. The authors also include assumptions about plagiarism as well as the trustworthiness, accuracy, and the inherent cultural biases in the generated texts. The current study helps provide empirical evidence to support some of the claims made by Trust et al., further suggesting the importance of supporting, informing, and educating teachers on the merits of ChatGPT. Given that ChatGPT still is unavailable in all countries (Tate et al., 2023), such awareness-raising activities would benefit from being conducted in inclusive settings (e.g., easily accessible online conferences) to avoid widening the digital divide.

The results of this study have important implications in terms of the need for pre-service teacher training and professional development in education – which can increase educators’ trust in GAI (Nazaretsky et al., 2022). Akin to earlier technologies, a lack of teacher training and preparation leads to trepidation and fear in terms of integrating technologies and AI
in practice (Ally, 2019; Wang et al., 2021, Yang & Chen, 2022). However, as Kuleto et al. (2022) suggested, by being increasingly exposed to AI (e.g., through professional development training), educators might become more confident and therefore eager to incorporate AI into their teaching practice. Teachers need not fear that technology will replace them, but they should be keenly aware of the implications of adopting emerging technologies in education. New technologies should transform teaching in creative and innovative ways. Many educators currently possess a moderate level of awareness regarding GAI. However, by elevating this collective level of understanding, it is possible to mitigate certain initial apprehensions.

The survey used in this study collected data on teachers’ perspectives, however, perspectives do not necessarily guarantee corresponding actions. Nevertheless, previous research has consistently demonstrated that the implementation of educational technologies is frequently influenced by teachers’ initial beliefs on certain technologies (Ismail et al., 2010; Sugar et al., 2004). This study contributes to the establishment of baseline data and understanding about teachers’ knowledge, perceptions, and intended usage of GAI in educational settings. If these past findings on initial perceptions and technology adoption hold true relative to GAI, then the current study suggests that many educators will embrace ChatGPT and other generative tools in their instruction.

LIMITATIONS, FUTURE RESEARCH, AND CONCLUSIONS

Several limitations need to be outlined. First, although the respondents taught in different contexts worldwide, the relatively small sample size prevents us from making generalizations. Second, as a condition of participating in the survey was having tried ChatGPT at least once, results are reflective of teachers with a higher degree of mastery and familiarity of GAI thus leading to an overrepresentation of favorable perceptions. Third, perceptions may change and there is no guarantee that they will result in actions. Last, while correlative analysis shed light on the relationship between the teachers’ professional background and their perceptions of GAI, determining causality was beyond the scope of the current study.

Given the rapid pace at which AI chatbots evolve and become mainstream, researchers should be familiar with the potential for GAI in education. As ChatGPT continues to be integrated into education, future perception studies will better determine if, similarly to previous new technologies, a normalization (Bax, 2003) will occur. With some educational institutions and countries (e.g., Italy) banning ChatGPT in 2023 (McCallum, 2023; Re-
Kaplan-Rakowski, Grotewold, Hartwick, and Papin, 2023), it is possible that at the time of this study, GAI might not have seemed acceptable to some teachers, who may have been wary of the consequences of using it.

Moreover, researchers could move beyond perceptions and examine self-reported teaching practices to identify promising pedagogical uses of ChatGPT in education. It will also be interesting to observe how the increasing popularity of ChatGPT will impact educators’ assessment practices, and how they will cope with the challenges posed by AIED which have been identified in the current study (i.e., perceived threat to development of critical thinking, plagiarism).

Due to the relative novelty of GAI such as ChatGPT, we would expect that the results from studies such as the current one will share some noteworthy results in terms of anticipated implementation practices. These results may be premature considering a limited duration of ChatGPT availability, making it difficult to determine whether positive perceptions truly lead to widespread use. While the study suggests ChatGPT is perceived positively, it is still unclear how and why it will be integrated in future practice. These are topics for future studies. Researchers should be aware that the rapid evolution of ChatGPT functionalities since November 2022 and the predictable rise of ChatGPT rivals (e.g., Google Bard) will also likely influence educators’ level of AI technology integration and thus reshape their perceptions and use of GAI.

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