



Harnessing the Power of Generative AI to Support ALL Learners

Anya S. Evmenova¹ · Jered Borup¹ · Joan Kang Shin¹

Accepted: 19 April 2024
© The Author(s) 2024

Abstract

While generative AI such as ChatGPT has important drawbacks, it can potentially unlock new types of learning and support – specially for English learners and students with disabilities – by facilitating teachers’ Universal Design for Learning (UDL) efforts. As generative AI is quickly becoming an integral part of our lives (e.g., being incorporated into existing tools such as Google products), teachers will need to decide how they can use and benefit from this new technology. Our analysis of data collected during a summer teacher institute found that in Summer 2023 the majority of teachers had never used generative AI and were evenly split on whether it was a “friend” or “foe” in their teaching efforts. Overall, 43% of teachers reported, “ChatGPT and other generative AI will help make instruction more accessible for ALL learners,” while 32% of teachers were “undecided” indicating an opportunity to improve teacher perceptions. In this article we discuss strategies for using generative AI for improving UDL to benefit ALL learners brainstormed by the teachers. Practical implications for multilingual learners are discussed.

Keywords Generative AI · ChatGPT · English Language Teachers · Translanguaging · Universal Design for Learning

Generative artificial intelligence (AI) tools that are based on large language models can understand and respond to natural language inputs with human-like outputs (Radford et al., 2019). The most popular AI text generator is ChatGPT by OpenAI which experienced record-breaking growth by reaching 100 million users in less than two months (Hu, 2023). This popularity is a result of ChatGPT’s ability to “write most things, in most styles” (Borup, 2023, para. 3). The initial review of existing literature noted its potential for improving the efficiency of the teaching-learning process (e.g., enriching teaching and learning experiences, providing quick and personalized responses, offering immediate feedback, facilitating the understanding of complex concepts) as well as highlighted the importance of both student and teacher training (Montenegro-Rueda et al., 2023).

The full impact that ChatGPT and other generative AI will have on teaching and learning is unclear. Future teachers around the world seem to be excited about the potential of ChatGPT for their future teaching (especially for creating content and personalizing materials), despite the lack of knowledge about the tool (Lozano & Fontao, 2023). Generative AI has already shown some promise in education (Topsakal & Topsakal, 2022; van Dis et al., 2023; Zhai, 2021) including special education (Garg & Sharma, 2020; Marino et al., 2023; Zdravkova, 2022) and English language teaching (Koraishi, 2023; Sharadgah & Sa’di, 2022). Initial explorations suggest that the integration of AI has the potential to improve instruction and provide personalized feedback and interactions for underserved populations such as students with disabilities (Golinkoff & Wilson, 2023; Wilson, 2023) and English learners (Bin & Mandal, 2019; Haristiani, 2019; Ma, 2021). For instance, Ciampa et al. (2023) explained that generative AI can be especially helpful for learners with disabilities by making learning more accessible and helping to provide the types of accommodations commonly listed in individualized education plans. Additionally, Javier and Moorhouse (2023) highlighted pedagogical benefits of using generative AI for English learners such as providing personalized feedback, writing assistance, and providing a conversation partner. AI-based tutors, AI-enabled chatbots, and AI assistants can use data inputs to

✉ Anya S. Evmenova
aevmenov@gmu.edu

Jered Borup
jborup@gmu.edu

Joan Kang Shin
jshin23@gmu.edu

¹ George Mason University, 4400 University Dr., MS 1F2,
Fairfax, VA 22030, USA

provide personalized instruction, offer individualized feedback, and reduce cognitive load for students who may struggle to achieve learning outcomes in general education (Marino et al., 2023).

Current teachers' initial reactions to generative AI have also commonly included fears that students would use ChatGPT to cheat on assignments – fears that were soon shown to be true (Cotton et al., 2023; Trust et al., 2023). Other concerns center on ChatGPT outputs that contain reasoning, logical, and factual errors (Borji, 2023). ChatGPT would even “hallucinate” information entirely with convincing confidence (Alkaiissi & McFarlane, 2023; Montenegro-Rueda et al., 2023). Furthermore, ChatGPT can be biased and promote harmful stereotypes (Borji, 2023). This has produced fears from teachers about students' lack of criticality and critical thinking skills to interpret or evaluate output from ChatGPT (Rezende Junior & López-Simó, 2024). Many of these limitations have already improved and will continue to improve with future AI developments but are unlikely to be eliminated (Ray, 2023). For instance, when OpenAI previously released ChatGPT 4.0, the company's website boasted reduced bias, increased accuracy, and new capabilities such as image recognition and voice-to-voice communication (OpenAI, n.d.). While revising this manuscript (in February 2024), OpenAI's website also published news of Sora, a new generative AI tool that can turn text prompts into realistic video clips. Each new innovation comes with excitement and caution. This amazing pace of innovation makes it especially important to constantly examine how generative AI can positively and negatively impact practice, especially for those students who may need extra supports. Furthermore, given the novelty of generative AI tools like ChatGPT, teachers need more professional learning opportunities to support their uses of AI in education (AIED) that maximize the affordances and address the challenges (Kaplan-Rakowski et al., 2023; Nazaretsky et al., 2022).

Media will only meaningfully impact learning when it changes methods (Greenhow et al., 2022). As a result, regardless of its affordances and potential, generative AI will only have a meaningful impact on students if teachers use it to change their teaching practices. Instructional models can provide important frameworks for understanding the ways that generative AI can improve teaching and learning for students with disabilities and English learners. Specifically for this article we will focus on how generative AI can support the implementation of the Universal Design for Learning (UDL).

Universal Design for Learning

Guided by the UDL framework, generative AI has the power to support personalized learning experiences that address learner needs and preferences. The UDL framework reshapes

curriculum development in order to provide opportunities for students with various abilities and needs to engage and succeed in general education activities (Meyer et al., 2014; Rose & Meyer, 2002). The three UDL principles supported by research in neuroscience, learning sciences, education, and cognitive psychology allow for the redundancy of instruction (Evmenova, 2018; Rose et al., 2005). Thus, the learner variability is addressed through multiple means of engagement, representation, and action/expression (CAST, 2018). To further guide educators, three UDL principles are broken into nine guidelines and 31 checkpoints. Those offer suggestions on how instruction can be developed to motivate learners in different ways, to present content in various formats, as well as to allow learners to demonstrate their learning and understanding in a myriad of ways. As a result, personalized instruction removes barriers and ensures access and participation in an appropriately challenging curriculum for all students, decreasing the need to create individual modifications (Meyer et al., 2014).

The main premise of UDL is that all learners can learn if the instruction follows the intentional and proactive design (Evmenova, 2021). Even though UDL was originally developed to support students with disabilities, several more recent publications focused on using UDL to support multilingual learners. In 2017 Ralabate and Nelson suggested combining Culturally Responsive Teaching (CRT) and UDL frameworks to address the needs of English learners and ensure culturally responsive and inclusive instruction. A book by Torres and Rao (2019) introduces a myriad of UDL strategies and digital tools to support language learners in inclusive classrooms. Ideas for developing reading, writing, vocabulary, and integrated language across the curriculum in various content areas can benefit language learners. Eichhorn et al. (2019) described how they considered their English language learners' (ELL) characteristics, anticipated barriers, and increased engagement. The strategies focused on self-regulation and individual coping skills, providing guided practice and supports to sustain effort, and giving students various ways to achieve the same goal in a safe learning environment. UDL can be especially beneficial when English for Speakers of Other Languages (ESOL) instructional materials and assessments may present challenges for multilingual learners with or without comorbid learning disabilities (Delaney & Hata, 2020). While research supports the placement of these learners in general education classrooms where they can learn alongside their typical peers, UDL-based instruction can ensure that ELLs are successful in those placements (Cioè-Peña, 2022).

Some authors have already tackled the idea of integrating ChatGPT and other generative AI into the UDL framework (Barbetta, 2023). Horwitz (2022) discussed the differences between various AI tools and noted how both tools can

benefit the learners. While there is no consensus between educators as to how this technology should be used by and/or with students, referring to the UDL Design Cycle (Rao & Meo, 2016) may provide some guidance. Just like with generative AI, teachers often ask if it is fair to provide multiple options for their learners. UDL Design Cycle guides educators to carefully identify the goal and learning outcomes of the lesson. The skills and knowledge required to achieve the goal/learning objective and aligning the formative and summative assessments as well as the instructional methods and materials with that goal/learning objective will allow removing the barriers in the curriculum while maintaining the academic rigor (Rao & Meo, 2016). Similarly, generative AI such as ChatGPT forces us to reconsider if demonstrating learning one way (e.g., in writing) is the best way to assess learning outcomes (Horwitz, 2022).

Translanguaging Universal Design for Learning

UDL has been applied as an effective and socially just practice when working with multilingual English learners, particularly a Translanguaging Universal Design for Learning (TrUDL) approach that is inclusive and culturally responsive (Cioè-Peña, 2022). Translanguaging as a pedagogical practice encourages bi/multilingual students to use their entire linguistic repertoire flexibly to teach content and develop learners' language practices (Garcia, 2014). It focuses on the act of doing language rather than a static system of discrete rules and skills (Kim & Choi, 2021). This means affirming and leveraging students' diverse languages and communication levels in the teaching and learning process (Vogel & Garcia, 2017). When using TrUDL, the multiple means of representation, engagement, and action and expression should bring to the forefront of instruction learners' multilingual, multicultural, and multimodal communication practices (Cioè-Peña, 2022).

Purpose

While educators are still grappling with the future of education in the AI-enhanced world, the purpose of this study was to explore the perceptions of teachers working with multilingual students with and without disabilities on the ChatGPT applications in language learning in Summer 2023. Teacher perceptions are especially important because they form the foundation for practice. In fact, Ertmer (1999, 2005) explained that teacher perceptions and dispositions towards technology is a greater obstacle to change than is teacher knowledge and skills. As a result, by understanding teacher perceptions of ChatGPT researchers and teacher leaders can gain insights into how

teachers may choose to use or not use ChatGPT within their instruction. Specific research questions included:

- What are the overall perceptions of teachers working with multilingual English learners about ChatGPT perceived benefits and drawbacks?
- Based on teachers' perceptions, how can ChatGPT be used to support the implementation of the Universal Design for Learning framework in the language classrooms?
- What are teachers' perceptions about ChatGPT and UDL potential benefits for multilingual learners with and without disabilities?

Method

The data for this exploratory study were collected at the end of June 2023 during a professional development institute conducted with general, special, and English for Speakers of Other Languages (ESOL) teachers. While participants represented different teacher groups, all of them were working with multilingual learners with and without disabilities in suburban school districts in the Mid-Atlantic region. The summer institute focused on presenting and discussing research-based practices for teaching content to multilingual English learners, including translanguaging, multiliteracies, UDL, and generative AI.

Participants

Overall, 137 teachers participated in the PD. While the teachers were from a variety of schools in the Mid-Atlantic region, the majority of them came from one school district (82%). Twenty-three of the participants from this school district were also a part of a two-year program where they would earn a Graduate Certificate in TESOL for PK-12 Practitioners and for which the program was mandatory. For the rest of the teachers at the summer institute, the participation was voluntary and available to anyone who was interested in expanding their professional knowledge about contemporary teaching practices for teaching content and language to English learners. The participants included elementary grade teachers ($n=48$); content area secondary teachers (e.g., math, science, ELA, social studies, foreign language; $n=24$); ESOL teacher or specialist ($n=24$); pre-service teachers working to get their license to teach English as a Second Language ($n=16$); special education teachers ($n=8$); leaders and administrators ($n=10$); and other (e.g., librarian, instructional coach; $n=7$). All participants regardless of their primary role were teaching multilingual English learners. More than 91% ($n=125$) were female and almost 9% ($n=12$) were male.

Procedures and Data Sources

Data were collected in one large-group plenary session and four small-group workshops. After this initial survey of participants' experiences and perceptions in the plenary session, the participants attended the two workshops where they learned more about UDL and more about ChatGPT. Each workshop was offered twice with the same information presented to allow smaller groups. Two university professors co-presented during the plenary session. In addition, each facilitated two small-group workshops (on UDL and ChatGPT) according to their area of expertise. Data sources are summarized and explained in Table 1.

Plenary Session

During the plenary session with all participants in one large conference room, the concept of UDL was introduced. The brief introduction was followed by the discussion of ways innovative technology (including ChatGPT) can support UDL implementation. The two session facilitators mostly presented information using slides but also engaged participants in frequent interactive activities including whole-group Q&A, turn-and-talk activities, and polls. Specifically, the participants were asked to react to the following questions/statements using PollEverywhere:

1. How often have you used ChatGPT and other generative AI?
2. Is ChatGPT (and other generative AI) a "friend" or "foe" in your teaching?
3. What are the primary benefits of ChatGPT and other generative AI to your students' learning?
4. What are the primary drawbacks of ChatGPT and other generative AI to your students' learning?
5. I believe ChatGPT and other generative AI will help me make instruction more accessible for ALL learners (including those with disabilities).

The responses were collected anonymously to reduce response bias. Percentages generated by PollEverywhere were used to report teachers' responses to survey questions 1, 2, and 5; while word clouds were used to display the results from questions 3 and 4 asked during the plenary session. In addition, the responses from the word clouds were used to calculate the percentages (the number of a certain response divided by the total number of responses).

UDL Workshop

Two 60-minute sessions of UDL Workshop were offered to allow all summer institute attendees a chance to learn more about UDL. Led by the first author, an expert in

UDL, each workshop session started with the presentation about UDL principles and guidelines. Examples of how nine guidelines could be implemented in classrooms with multilingual English learners were shared. The following ideas were discussed:

- Multiple Means of Engagement
 - Provide options for recruiting interest: Choice boards, video notes and study guides for different subjects and/or literature
 - Provide options for sustaining effort: programs adjusting text readability (e.g., Rewordify, Text Compactor)
 - Provide options for self-regulation: self-monitoring checklists, self-assessments, reflections, progress charts, one-minute papers
- Multiple Means of Representation
 - Provide options for perception: free text-to-speech and captioning programs
 - Provide options for language, mathematical expressions, and symbols: content specific videos, providing text on different levels (e.g., NEWSLELA)
 - Provide options for comprehension: graphic organizers, picture symbols
- Multiple Means of Action and Expression
 - Provide options for physical action: virtual manipulatives, simulations, virtual field trips
 - Provide options for expression and communication: alternatives to writing (role plays, posters, creative book reports, presentations), programs to create books, comics, videos
 - Provide options for executive functions: technology-based graphic organizers with embedded self-regulated learning strategies

Throughout the presentation, attendees were asked to share their experiences or reactions to the presented examples either in a large group or among their small tables. In addition, the participants were asked to follow a link to multiple Google Slides that were set up to facilitate (1) writing one minute reflection on how they were already removing barriers for their learners (e.g., find a spot and write down one UDL strategy that you are already using in the classroom); (2) share web-based resources that they used to present content in multiple ways (e.g., what is your favorite website/tool to use to present content in multiple ways?); and (3) identify a UDL guideline that they would want to improve on in the upcoming year (e.g., move the star to the UDL guideline [using the UDL guidelines table: <https://>

Table 1 Study procedure and data sources

Session	Goals	Data collected
<p>Plenary Session: 60-minute session with all 137 participants</p>	<p>Presentation Goal:</p> <ul style="list-style-type: none"> • Introduce the concept of UDL and explore ways innovative technology (including ChatGPT) can support UDL implementation <p>Research Goal:</p> <ul style="list-style-type: none"> • Gain understanding of teachers' use of and perceptions of ChatGPT (generative AI) 	<p>Teachers responded to a poll with the following questions/statements:</p> <ol style="list-style-type: none"> 1. How often have you used ChatGPT and other generative AI? 2. Is ChatGPT a "friend" or "foe" in your teaching? 3. What are the primary benefits of ChatGPT and other generative AI to your students' learning? 4. What are the primary drawbacks of ChatGPT and other generative AI to your students' learning? 5. I believe ChatGPT and other generative AI will help me make instructional more accessible for ALL learners (including those with disabilities).
<p>UDL Workshop: Two 60-minute sessions with 45–50 participants each</p>	<p>Presentation Goal:</p> <ul style="list-style-type: none"> • Build teachers' understanding about UDL principles and guidelines (e.g., multiple means of engagement, representation, action/expression) <p>Research Goal:</p> <ul style="list-style-type: none"> • Gain understanding of how teachers apply UDL to their instruction 	<p>Teachers were asked to:</p> <ol style="list-style-type: none"> 1. Reflect on how they were already removing barriers for their learners. 2. Share web-based resources that they used to present content in multiple ways. 3. Identify a UDL guideline that they would want to improve on in the upcoming year.
<p>ChatGPT Workshop: Two 60-minute sessions with 45–50 participants each</p>	<p>Presentation Goals:</p> <ul style="list-style-type: none"> • Give teachers a chance to explore the use of ChatGPT, particularly to support English language learners • Apply use of ChatGPT to the UDL framework <p>Research Goal:</p> <ul style="list-style-type: none"> • Gain understanding of teachers' perspectives on how ChatGPT can support English language learners using a UDL framework 	<p>Teachers worked together in small groups to complete two activities:</p> <ol style="list-style-type: none"> 1. Create a poster with a table listing perceived benefits and drawbacks. 2. Categorize their perceived benefits and drawbacks aligning those with the UDL principles.

udlguidelines.cast.org/] which you wish to improve/implement in the upcoming year). Participants responses were summarized and discussed with the attendees at the end of the workshop to avoid bias. The percentages of teachers' responses to one minute reflection and identifying UDL guideline to focus on were calculated to report the results.

ChatGPT Workshop

Two sessions of ChatGPT Workshop were offered, each lasting 60 min. Both sessions took place after two sessions of the UDL workshop ensuring attendees' understanding of UDL principles before exploring application of ChatGPT. The workshops were designed to be constructivist in nature with minimal direct instruction and instead focused on guided exploration and discussion. It began with a short tutorial demonstrating how to use ChatGPT led by the second author, an expert in learning technology. Participants then organized themselves into groups using the tables in the room or floor space and were invited to sign into their existing ChatGPT 3.5 account or create a new account. Once logged in, participants explored ChatGPT's capabilities using a variety of prompts. In doing so, the activity was highly interactive with teachers assisting each other with the technology, brainstorming possible prompts, and sharing/discussing ChatGPT responses. The workshop facilitator asked the participants to prompt ChatGPT to (a) create lesson plans; (b) design tables; (c) generate responses to writing assignments that they have used previously; (d) create factual questions (including current events); and (e) provide feedback on writing. The facilitator also encouraged to refine ChatGPT's responses by changing their follow-up prompts in a variety of ways such as:

- Changing the response to be at a lower reading level
- Adding citations
- Refining their lesson plans to include more collaboration
- Translating the response to a different language

The goal of these activities was for teachers to see the possibilities (e.g., creating lesson plans, changing readability level, translating the response) and limitations (e.g., providing current factual information, adding citations) of the tool. For example, teachers were encouraged to ask about current events to highlight a known limitation of ChatGPT rather than an affordance.

Teachers spent the second half of the workshop discussing their perceived benefits and drawbacks of ChatGPT for ELLs. Each group was provided a large piece of paper and asked to make two lists: perceived benefits and drawbacks. Once their lists were created, participants revisited the UDL framework and asked to categorize their benefits and drawbacks. Triangulating data across multiple groups in

two different workshops as well as reviewing their artifacts with the attendees were used to avoid the bias. Teachers' responses were transcribed. Percentages of perceived positive and negative aspects were calculated. The ideas were reviewed by the authors, condensed to avoid replications across groups, and summarized below.

Findings and Discussion

Overall Experiences and Perceptions of ChatGPT

Among the participants, more than 75% had never used ChatGPT or other generative AI; 14% used it once or twice; 11% used it periodically or regularly (totaling at 25% of those teachers who used ChatGPT previously). The institute was conducted at the end of June, so these results represented teachers' experiences seven months after the launch of ChatGPT. While teachers' prior use of ChatGPT and other generative AI was low, it was higher than use rates of the general population in light of a Pew Research poll published in May that found that only 14% of U. S. adults had used ChatGPT (Vogels, 2023).

While we expected a more directional response, the most surprising finding was a 50%-50% split between the responses about ChatGPT and other generative AI being a "friend" or a "foe." It was especially interesting given that most of the participants had never tried this innovative technology. Figure 1 shows the word clouds that were generated in the plenary session highlighting the perceived benefits and drawbacks of ChatGPT and other generative AI. These perceived benefits and drawbacks were further refined after the participants had a chance to experiment with ChatGPT (as described later). As can be seen in Fig. 1, the most prominent perceived benefits include: time (20%), ideas (10%), information (10%), helping students (8%), and efficiency (7%). The most prominent perceived drawbacks included cheating (38%), lack of critical thinking (9%), and decreased creativity (7%). These findings are consistent with previous research (Borji, 2023; Cotton et al., 2023) which reported cheating, lack of critical thinking, and prompting harmful stereotypes among biggest teachers' fears. The importance of ethical AI use cannot be overstated. Implications for all students, but especially those with disabilities include bias, surveillance, autonomy, privacy, confidentiality, authorship, and consent (Marino et al., 2023; Trust et al., 2023). Educating teachers, students, and parents about the implications and potential risks of using generative AI technology is paramount.

When asked if "ChatGPT and other generative AI will help instruction be more accessible for ALL learners (including those with disabilities)," 43% agreed or strongly agreed that it can be beneficial, 23% disagreed or strongly disagreed, while 32% were undecided. It is important to

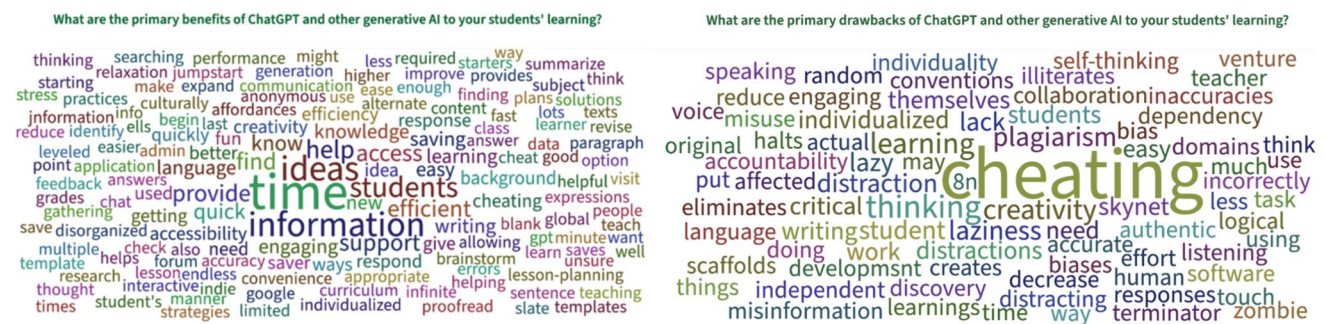


Fig. 1 Primary benefits and drawbacks of ChatGPT and other generative AI to students' learning

remember that these responses were given before the ChatGPT workshop.

ChatGPT to Support UDL Principles

After the participants learned more about UDL principles and guidelines during the workshop, they reported that many (42%) had already been using choice boards with multimodal options. When asked what UDL principle they would want to improve in the upcoming year, most selected multiple means of action and expression (45%), followed by multiple means of engagement (29%), and multiple means of representation (26%). Within the multiple means of action and expression, the participants wanted to focus on providing options for expression and communication (60%), providing options for physical action (22%), and providing options for executive functions (18%). So, how can ChatGPT help supporting these teachers in implementing UDL principles and guidelines?

Perceived ChatGPT Benefits

From the lists generated by the participants during the ChatGPT workshop, the teachers discussed more positive (54%) than negative (46%) aspects of using ChatGPT in their teaching. Table 2 demonstrates the results of the participants' brainstorming session focusing on the perceived benefits of ChatGPT for all learners regardless of their abilities and needs along with the ideas shared by the workshop facilitators. These ideas are organized by UDL principles and guidelines. It is up to the teacher if they want to limit students' access to ChatGPT and rather use it themselves to create the materials or to embrace this new technology and allow its use in the classroom. Either way, there are numerous ways to harness the power of generative AI to support ALL learners.

These ideas support the hypothesis that huge amounts of work traditionally associated with creating UDL materials, can now be addressed by the efficient generative AI tools (Lozano & Fontao, 2023). The UDL Design Cycle includes

six steps. After exploring the learner variability (including abilities and strength, backgrounds and experiences, preferences and interests, as well as the support needs) and clearly identifying the goal and learning objectives important for the lesson, teachers develop flexible assessments, instructional methods and materials. This is where generative AI can be especially helpful. The UDL Design Cycle concludes with implementing the UDL lesson and reflecting on any remaining barriers that should be further removed (Rao & Meo, 2016).

Perceived ChatGPT Drawbacks

In addition, the perceived drawbacks of ChatGPT were discussed and aligned with UDL principles and guidelines as well. Similar to earlier findings, the participants pointed out the following negative aspects of generative AI (themes that emerged from the brainstorming lists):

- Multiple means of engagement: lack of effort, user error in input, humanness, develop more resistance to work that requires sustained effort, no empathy, loss of stamina;
- Multiple means of representation: incorrect information based on old data, lack of nonverbal cues and oral language, limited understanding of content ("just copy and paste"), bias in responses; and.
- Multiple means of action and expression: cheating and plagiarism, limiting critical thought, inhibiting creativity, encouraging laziness.

Indeed, writing assignments may never look the same (Marino et al., 2023). In fact, some universities around the world have returned to pen and paper exams (Mahdawi, 2023). In turn, the students themselves suggest that teachers may change the homework they assign with more work being done in class and less at home to avoid AI-generated assignments (The Learning Network, 2023) – a variation of a flipped classroom. But as Marino et al. (2023) note, "these reactions mirror what occurred with the introduction

Table 2 Ways to use ChatGPT to support UDL principles and guidelines

UDL guidelines	Ideas to use ChatGPT
Multiple means of engagement	
Provide options for recruiting interest	<ul style="list-style-type: none"> • To recruit learners' interest especially for things they don't want to do • To use as a starting point to brainstorm ideas • To create real-life scenarios
Provide options for sustaining effort and persistence	<ul style="list-style-type: none"> • To reduce writer's block • To create materials with varying demands/levels • To generate personalized feedback • To efficiently generate content • To enable collaborative learning and teamwork • To reduce and complement human interaction (which might be important for some students) • To generate feedback for students' products
Provide options for self-regulation	<ul style="list-style-type: none"> • To compare products created by learners to AI-generated content and reflect on it • To generate ideas for self-assessment
Multiple means of representation	
Provide options for perception	<ul style="list-style-type: none"> • To create accessible materials (e.g., using the image analysis feature of ChatGPT)
Provide options for language, mathematical expressions, and symbols	<ul style="list-style-type: none"> • To support language development by providing access to text on different reading levels • To generate content in different languages • To translate content into English • To clarify and expand the vocabulary • To summarize large amounts of text • To generate and promote cultural understanding (e.g., cultural references, idiomatic expressions)
Provide options for comprehension	<ul style="list-style-type: none"> • To access vast knowledge • To research various topics on differentiated levels (e.g., explain a concept in simple words) • To activate or supply background knowledge by creating overviews and at-a-glance topical reviews • To support information processing by generating and manipulating content in various formats • To enhance and generalize technological abilities
Multiple means of action and expression	
Provide options for physical action	<ul style="list-style-type: none"> • To offer opportunities for language practice • To optimize access to accessibility features
Provide options for expression and communication	<ul style="list-style-type: none"> • To create supports for grammar and sentence structure • To allow students create products in their native language and translate those into English • To create AI content and ask students to evaluate it • To generate various songs, games (e.g., Kahoots), and interactive activities around language learning concepts
Provide options for executive functions	<ul style="list-style-type: none"> • To access different writing models, structures, guides, and outlines • To monitor mechanics of writing (upload drafts and request revisions) • To use it as personal assistant (e.g., generating ideas and schedules)

of the calculator and the computer" (p. 407). The introduction of the Internet and Google Search were also disruptive to education, specifically conducting research the way it had been done before. In reality, generative AI users will most likely need to practice those critical thinking skills even more in order to interpret and evaluate AI outputs (ACM-Tutors, 2023; Montenegro-Rueda et al., 2023). So, we will continue to argue that educators can figure out how to escape

the negatives and benefit from all the positives that ChatGPT and generative AI can bring to the classroom, especially for struggling learners. Focusing on more complex Bloom's Taxonomy skills to design more nuanced assessments may be a good starting point (Gupta, 2023). This view is supported by other teacher educators, who urge to combat the fears and improper use by modeling best practices for the students (Trust et al., 2023).

ChatGPT to Support Language Learners

The participants came to the institute to engage in PD about working with multilingual English learners. Thus, it was not surprising to see a focus on language development in many of the ideas expressed for the perceived benefits of using generative AI. As noted in previous studies, generative AI can provide plenty of language input, conversation practice, and immediate feedback that are highly important for learning a new language (Huang et al., 2022). Most of these language-focused benefits were categorized as multiple means of representation by the teachers, such as developing language and proficiency, access to different writing models and structures, help with grammar, support comprehension and expansion of vocabulary, and provide feedback for writing. There were also ideas categorized as multiple means of action and expression by the teachers where they could see the benefit of having discussions with AI, providing learners with language practice, helping English learners express themselves, and helping students use grammar. Teachers could also see the benefit of AI providing opportunities for personalized language support which was categorized as multiple means of engagement. This aligns with previous studies showing how ChatGPT is a very versatile and easily accessible tool for self-directed language learning and promoting learner independence (Kohnke et al., 2023). Many groups identified use of different and native languages and using AI for translation as providing multiple means of engagement, representation, and action and expression. For example, English learners can write in their native language, translate it into English, and be given feedback using AI. Another interesting benefit was described as building cultural understanding by providing idiomatic expressions and cultural references.

Practical Implications Focused on Language Learners

This exploratory study offered an overview of how teachers working with English language learners and pre-service teachers who will soon support multilingual learners perceive the use of ChatGPT and generative AI to support UDL implementation for their students with various abilities, needs, and learning preferences. While more ideas will emerge as new features and AI tools appear on the market, these initial suggestions can be integrated into English language instruction right away. Similar to existing editorial commentaries, the participants in this study brainstormed ways to use ChatGPT to create UDL-based instructional materials (e.g., personalized and/or on different levels), support personalized student learning, assessment, and

feedback, generate models and resources for language learning, and enhance communication (Trust et al., 2023).

The results from participants that focused on the perceived benefits of generative AI to multilingual English learners are aligned with the foundations for Translanguaging Universal Design for Learning (TrUDL). Since multilingual learners should be able to use all languages in their repertoire, they can utilize AI to assist their ability to express their content knowledge in their home language(s) and provide translation of the concept in English to support their academic success. Particularly for diverse classrooms with learners who speak many different languages, most of which the teacher does not know, access to AI to provide personalized language support will ensure all learners have equitable access to home language support for learning new content in English. For example, Cioè-Peña (2022) provides an example of TrUDL where the teacher uses translanguaging by allowing students to audio record their ideas using two languages before transferring their ideas to writing in English and then employs UDL by providing multiple means for action and expression by giving students access to voice recognition software or providing learners with spelling and grammar checkers to help their accuracy in writing. As identified through this study, AI can be used for direct translation of students' ideas in their home language and as a tool to compare students' written products in English, which can be a means to provide feedback to learners. Both translation and modeling through AI can provide additional scaffolds and accommodations for multilingual learners who may struggle with the mechanics of writing or speaking. Another benefit identified was AI giving English learners access to cultural information through AI-generated idiomatic expressions, and new language learning applications using AI can provide learners with authentic-like conversation experiences that are also personalized and give feedback in real time (Hong, 2023). Then again, using AI for translation is still not always accurate (Sharadgah & Sa'di, 2022), therefore teachers need to teach multilingual students how to use translators effectively, understanding their limitations as well as their benefits for language learning. Current literature highlights both the profound influence of AI technology on language translations as well as challenges associated with linguistic nuances involved in translations (Mohamed et al., 2024). While it is expected that translation quality will continue to increase with more training and data sets, teachers may need to rely on parents and/or other language volunteers in the meantime to review the translations, especially as it comes to managing less-common languages, idiomatic expressions, cultural subtleties, and emotional tones.

Furthermore, a careful consideration of bias in AI is warranted. For example, evidence exists of implicit bias in ChatGPT reflecting the systemic inequities of the society (Warr et al., 2023). In addition to gender, racial, and

socio-economic biases, cultural prejudices can be perpetuated through AI-generated text and images (Borji, 2023). Thus, reliance on generative AI for cultural information should be accompanied with media literacy education to identify potential stereotypes and biases produced.

Limitations

This exploratory study was not without limitations. The convenience sample used in our work included teachers who had no or very limited experiences using generative AI tools such as ChatGPT. That might have contributed to misconceptions and inaccurate perceptions of ChatGPT usefulness. We also did not have an opportunity to re-assess the participants' responses to the same survey questions after the workshops. While future research might want to target more purposeful groups of teachers (e.g., technology teachers) and/or use more robust research methods (e.g., pre/post-tests), we believe that our study is still useful in understanding how teachers are dealing with the infusion of innovative technology. In addition, all participants in this study had experiences with multilingual learners (even those pre-service teachers were working towards getting their licensure to teach English Language Learners). As a result, we did not collect or analyze the data for each sub-group of teachers (e.g., elementary level, secondary level, special education teachers). Future research should explore any potentially varying perceptions by different groups of teachers.

Conclusion

As can be seen in Table 2, teachers recognize ways that generative AI can support UDL implementation for students with various abilities and needs, through multiple means of engagement, representation, and action/expression. Such tools as ChatGPT, which is powered by Large Language Model technology, do not create original content, but rather their responses are based on the data used to train them (Horwitz, 2022). The astounding speed at which generative AI produces responses to prompts makes it an especially powerful tool for teaching and learning. We also need to take into account teachers' concerns about students' use of generative AI, including cheating, lack of critical thinking skills and creativity, as well as ethical considerations. Interestingly, some current research contradicts these concerns and has shown that generative AI can actually be used in ways that boost critical thinking and creativity (Mejia & Sargent, 2023). As with most tools, some of the perceived benefits and drawbacks of generative AI are dependent on how generative AI is used. As a result, professional learning and modeling can help to address and resolve many of the concerns expressed by teachers.

It is interesting that most participants in this study wanted to target multiple means of action and expression in their classrooms, yet most of the teachers' ideas about ChatGPT aligned with UDL principles of multiple means of engagement and representation. Additional research is needed to better understand both teacher perceptions and best practices that leverage potential benefits and limit drawbacks. While allowing students to use ChatGPT to generate products may not be an option for most teachers, there are other ways generative AI can support multilingual learners in action and expression as well as in engagement and representation as they learn a new language, particularly through self-directed language learning. It has the potential to amplify and enhance learning (Marino et al., 2023). We are just at the beginning of this journey with new generative AI tools appearing on the market almost every day. For example, one of the newer tools LUDIA (<https://www.smores.com/vcpmk>) is an AI-powered UDL partner. It was developed for the instructional designers to support the intentional UDL design in effort to address learner variability and reduce learning barriers. Based on the input that describes the learners, learning goals, and challenges, it generates suggestions for flexible routines to intentionally build in multiple means of engagement, representation, action and expression (Novak, 2023). While it remains unclear what the future holds, one thing is clear – more research and explorations are warranted as we navigate this new era of generative AI.

Funding This study was not funded.

Declarations

Research Involving Human Participants All the procedures in this study were evaluated and approved by the Institutional Research Board. All authors have complied with the ethical standards in the treatment of our participants.

Informed Consent Informed consent was obtained for all individual participants in the study.

Conflict of Interest There is no known conflict of interest to declare.

Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.

References

- ACMTutors. (2023). Embracing AI in the classroom: ChatGPT, an enriching learning tool [Blog Post]. Retrieved from <https://www.ecmtutors.com/embracing-ai-in-the-classroom-chatgpt-as-an-enriching-learning-tool/>. Accessed 19 Nov 2023
- Alkaissi, H., & McFarlane, S. I. (2023). Artificial hallucinations in ChatGPT: Implications in scientific writing. *Cureus*, *15*(2), 2–5. <https://doi.org/10.7759/cureus.35179>
- Barbetta, P. M. (2023). Remedial and compensatory writing technologies for middle school students with learning disabilities and their classmates in inclusive classrooms. *Preventing School Failure: Alternative Education for Children and Youth*. <https://doi.org/10.1080/1045988X.2023.2259837>
- Bin, Y., & Mandal, D. (2019). English teaching practice based on artificial intelligence technology. *Journal of Intelligent & Fuzzy Systems*, *37*(3), 3381–3391. <https://doi.org/10.3233/JIFS-179141>
- Borup, J. (2023). This was written by a human: A real educator's thoughts on teaching in the age of ChatGPT. *Educause Review*. Available at <https://er.educause.edu/articles/2023/3/this-was-written-by-a-human-a-real-educators-thoughts-on-teaching-in-the-age-of-chatgpt>
- Borji, A. (2023). A categorical archive of ChatGPT failures. arXiv. <https://doi.org/10.48550/arXiv.2302.03494>
- CAST. (2018). Universal design for learning guidelines version 2.2. Retrieved from <http://udlguidelines.cast.org>. Accessed 14 Feb 2024
- Ciampa, K., Wolfe, Z. M., & Bronstein, B. (2023). ChatGPT in education: Transforming digital literacy practices. *Journal of Adolescent and Adult Literacy*, *67*(3), 186–195. <https://doi.org/10.1002/jaal.1310>
- Cioè-Peña, M. (2022). TrUDL, a path to full inclusion: The intersectional possibilities of translanguaging and Universal Design for Learning. *TESOL Quarterly*, *56*(2), 799–812. <https://doi.org/10.1002/tesq.3074>
- Cotton, D. R. E., Cotton, P. A., & Shipway, J. R. (2023). Chatting and cheating: Ensuring academic integrity in the era of ChatGPT. *Innovations in Education and Teaching International*. <https://doi.org/10.1080/14703297.2023.2190148>
- Delaney, T. A., & Hata, M. (2020). Universal Design for Learning in assessment: Supporting ELLs with learning disabilities. *Latin American Journal of Content and Language Integrated Learning*, *13*(1), 79–91. <https://doi.org/10.5294/lacil.2020.13.1.5>
- Eichhorn, M. S., Lowry, A. E., & Burke, K. (2019). Increasing engagement of English learners through Universal Design for Learning. *Journal of Educational Research and Practice*, *9*(1), 1–10. <https://doi.org/10.5590/JERAP.2019.09.1.01>
- Ertmer, P. A. (1999). Addressing first- and second-order barriers to change: Strategies for technology integration. *Educational Technology Research and Development*, *47*(4), 47–61. <https://doi.org/10.1007/BF02299597>
- Ertmer, P. A. (2005). Teacher pedagogical beliefs: The final frontier in our quest for technology integration? *Educational Technology Research and Development*, *53*(4), 25–39. <https://doi.org/10.1007/BF02504683>
- Evmenova, A. S. (2018). Preparing teachers to use Universal Design for Learning to support diverse learners. *Journal of Online Learning and Research*, *4*(2), 147–171. <https://www.aace.org/pubs/jolr/>
- Evmenova, A. S. (2021). Walking the UDL walk: Designing an online course about UDL following the principles. *Journal of Applied Instructional Design*, *10*(1). <https://doi.org/10.51869/101/ae>
- García, O. (2014). Translanguaging as normal bilingual discourse. In Hesson, S., Seltzer, K., Cotton, D. R. E., Cotton, P. A., & Shipway, J. R. (2023). Chatting and cheating: Ensuring academic integrity in the era of ChatGPT. *Innovations in Education and Teaching International*. <https://doi.org/10.1080/14703297.2023.2190148>
- Garg, S., & Sharma, S. (2020). Impact of artificial intelligence in special need education to promote inclusive pedagogy. *International Journal of Information and Education Technology*, *10*(7), 523–527. <https://doi.org/10.18178/ijiet.2020.10.7.1418>
- Golinkoff, R. M., & Wilson, J. (2023). ChatGPT is a wake-up call to revamp how we teach writing. [Opinion]. Retrieved from <https://www.inquirer.com/opinion/commentary/chatgpt-ban-ai-education-writing-critical-thinking-20230202.html>. Accessed 1 Nov 2023
- Greenhow, C., Graham, C. R., & Koehler, M. J. (2022). Foundations of online learning: Challenges and opportunities. *Educational Psychologist*, *57*(3), 131–147. <https://doi.org/10.1080/00461520.2022.2090364>
- Gupta, V. (2023). Worried that ChatGPT is coming for your job? An old assessment tool may have the answer [Opinion]. Retrieved from <https://www.latimes.com/opinion/story/2023-03-05/chatgpt-artificial-intelligence-ai>. Accessed 1 Nov 2023
- Haristiani, N. (2019). Artificial intelligence (AI) chatbot as language learning medium: An inquiry. *Journal of Physics: Conference Series*, *1387*(1), 012020. <https://doi.org/10.1088/1742-6596/1387/1/012020>
- Hong, W. (2023). The impact of ChatGPT on foreign language teaching and learning: Opportunities in education and research. *Journal of Educational Technology and Innovation*, *5*(1), 37–45.
- Horwitz, J. (2022). ChatGPT, artificial intelligence, and UDL: How harness the future to reach all students [Blog Post]. Retrieved from <https://www.novakeducation.com/blog/chat-gpt-artificial-intelligence-and-udl-how-to-harness-the-future-to-reach-all-students>. Accessed 1 Nov 2023
- Hu, K. (2023). ChatGPT sets record for fastest-growing user base - analyst note. *Reuters*. <https://www.reuters.com/technology/chatgpt-sets-record-fastest-growing-user-base-analyst-note-2023-02-01/>. Accessed 1 Nov 2023
- Huang, W., Hew, K. F., & Fryer, L. K. (2022). Chatbots for language learning – are they really useful? A systematic review of chatbot-supported language learning. *Journal of Computer Assisted Learning*, *38*(1), 237–257.
- Javier, D. R. C., & Moorhouse, B. L. (2023). Developing secondary school English language learners' productive and critical use of ChatGPT. *TESOL Journal*. <https://doi.org/10.1002/tesj.755>
- Kaplan-Rakowski, R., Grotewold, K., Hartwick, P., & Papin, K. (2023). Generative AI and teachers' perspectives on its implementation in education. *Journal of Interactive Learning Research*, *34*(2), 313–338. Retrieved February 16, 2024 from <https://www.learn-technic.org/mutex.gmu.edu/primary/p/222363/>
- Kim, S., & Choi, S. (2021). Teachers' perceptions and practices of translanguaging for emergent bilinguals in U.S. multilingual classrooms. *Translation and Translanguaging in Multilingual Contexts*, *7*(3), 279–307. <https://doi.org/10.1075/ttmc.00079.kim>
- Kohnke, L., Moorhouse, B. L., & Zou, D. (2023). ChatGPT for language teaching and learning. *RELC Journal*, *54*(2), 537–550. <https://doi.org/10.1177/00336882231162868>
- Koraishi, O. (2023). Teaching English in the age of AI: Embracing ChatGPT to optimize EFL materials and assessment. *Language Education and Technology*, *3*(1), 55–72. <https://bit.ly/43en7e1>. Accessed 14 Feb 2024
- Lozano, A., & Fontao, C. B. (2023). Is the education system prepared for the irruption of artificial intelligence? A study of the perceptions of students of primary education degree from a dual perspective: Current pupils and future teachers. *Education Sciences*, *13*(7), 733. <https://doi.org/10.3390/educsci13070733>
- Ma, L. (2021). An immersive context teaching method for college English based on artificial intelligence and machine learning in virtual

- reality technology. *Mobile Information Systems*. <https://doi.org/10.1155/2021/2637439>
- Mahdawi, A. (2023). Australian universities to return to pen and paper exams after students caught using AI to write essays [Opinion]. Retrieved from <https://www.theguardian.com/australia-news/2023/jan/10/universities-to-return-to-pen-and-paper-exams-after-students-caught-using-ai-to-write-essays>. Accessed 1 Nov 2023
- Marino, M. T., Vasquez, E., Dieker, L., Basham, J., & Blackorby, J. (2023). The future of artificial intelligence in special education technology. *Journal of Special Education Technology*, 38(3), 404–416. <https://doi.org/10.1177/01626434231165977>
- Mejia, M., & Sargent, J. M. (2023). Leveraging technology to develop students' critical thinking skills. *Journal of Educational Technology Systems*, 51(4), 393–418. <https://doi.org/10.1177/00472395231166613>
- Meyer, A., Rose, D. H., & Gordon, D. (2014). *Universal Design for Learning: Theory and practice*. CAST.
- Mohamed, Y. A., Khanan, A., Bashir, M., Mohamed, A. H., Adiel, M. A., & Elsadig, M. A. (2024). The impact of artificial intelligence on language translation: A review. *Ieee Access*, 12, 25553–25579. <https://doi.org/10.1109/ACCESS.2024.3366802>
- Montenegro-Rueda, M., Fernandez-Cereo, J., Fernandez-Batanero, J. M., & Lopez-Meneses, E. (2023). Impact of the implementation of ChatGPT in education: A systematic review. *Computers*, 12(8), 153. <https://doi.org/10.3390/computers12080153>
- Nazarovskiy, T., Ariely, M., Kurokova, M., & Alexandron, G. (2022). Teachers' trust in AI-powered educational technology and a professional development program to improve it. *British Journal of Educational Technology*, 53(4), 914–931. <https://doi.org/10.1111/bjjet.13232>
- Novak, K. (2023). AI for UDL: A review of the AI tool LUDIA [Blog Post]. Retrieved from <https://www.novakeducation.com/blog/ai-for-udl-a-review-of-the-ai-tool-ludia>. Accessed 1 Feb 2024
- OpenAI. (n.d). GPT-4 is OpenAI's most advanced system, producing safer and more useful responses. <https://openai.com/gpt-4>. Accessed 14 Feb 2024
- Radford, A., Wu, J., Child, R., Luan, D., Amodei, D., & Sutskever, I. (2019). Language models are unsupervised multitask learners. *OpenAI Blog*. Retrieved from https://d4mucfpksywv.cloudfront.net/better-language-models/language_models_are_unsupervised_multitask_learners.pdf. Accessed 1 Nov 2023
- Ralabate, P. K., & Nelson, L. L. (2017). *Culturally responsive design for English learners: The UDL approach*. CAST.
- Rao, K., & Meo, G. (2016). Using Universal Design for Learning to design standards-based lessons. *SAGE Open*, 6(4), 1–12. <https://doi.org/10.1177/215824401668068>
- Ray, P. P. (2023). ChatGPT: A comprehensive review on background, applications, key challenges, bias, ethics, limitations and future scope. *Internet of Things and Cyber-physical Systems*, 3, 121–154. <https://doi.org/10.1016/j.iotcps.2023.04.003>
- Rezende Junior, M. F., & López-Simó, V. (2024). What are the perceptions of physics teachers in Brazil about ChatGPT in school activities? *Journal of Physics: Conference Series*, 2693(1), 12011. <https://doi.org/10.1088/1742-6596/2693/1/012011>
- Rose, D. H., & Meyer, A. (2002). *Teaching every student in the digital age: Universal Design for Learning*. Association for Supervision and Curriculum Development.
- Rose, D. H., Meyer, A., & Hitchcock, C. (2005). *The universally designed classroom: Accessible curriculum and digital technologies*. Harvard Education Press.
- Sharadgah, A., & Sa'di, R. A. (2022). A systematic review of research on the use of artificial intelligence in English language teaching and learning (2015–2021): What are the current effects? *Journal of Information Technology Education*, 21, 337–377. <https://doi.org/10.28945/4999>
- The Learning Network (2023). What students are saying about ChatGPT [Opinion]. Retrieved from <https://www.nytimes.com/2023/02/02/learning/students-chatgpt.html>. Accessed 1 Nov 2023
- Topsakal, O., & Topsakal, E. (2022). Framework for a foreign language teaching software for children utilizing AR, voicebots, and ChatGPT (large language models). *The Journal of Cognitive Systems*, 7(2), 33–38.
- Torres, C., & Rao, K. (2019). *UDL for language learners*. CAST.
- Trust, T., Whalen, J., & Mouza, C. (2023). Editorial: ChatGPT: Challenges, opportunities, and implications for teacher education. *Contemporary Issues in Technology and Teacher Education*, 23(1), 1–23.
- van Dis, E. A. M., Bollen, J., Zuidema, W., van Rooij, R., & Bockting, C. L. (2023). ChatGPT: Five priorities for research. *Nature*, 614(7947), 224–226. <https://doi.org/10.1038/d41586-023-00288-7>
- Vogel, S., & Garcia, O. (2017). Translanguaging. *Oxford Research Encyclopedia of Education*. <https://doi.org/10.1093/acrefore/9780190264093.013.181>
- Vogels, E. A. (2023). A majority of Americans have heard of ChatGPT, but few have tried it themselves. Pew Research Center. From <https://www.pewresearch.org/short-reads/2023/05/24/a-majority-of-americans-have-heard-of-chatgpt-but-few-have-tried-it-themselves/>. Accessed 1 Nov 2023
- Warr, M., Oster, N. J., & Isaac, R. (2023). Implicit bias in large language models: Experimental proof and implications for education. Retrieved from SSRN. <https://doi.org/10.2139/ssrn.4625078>. Accessed 1 Nov 2023
- Wilson, J. (2023). Writing without thinking? There's a place for ChatGPT – if used properly [Guest Commentary]. Retrieved from <https://www.baltimoresun.com/opinion/op-ed/bs-ed-op-0206-chatgpt-tool-20230203-mydxftujjgndnjwwen4s4x7m-story.html>. Accessed 1 Nov 2023
- Zdravkova, K. (2022). The potential of artificial intelligence for assistive technology in education. In M. Ivanović, A. Klačnjanić, L. C. Jain (Eds.) *Handbook on intelligent techniques in the educational process. Learning and analytics in intelligent systems* (vol 29). Springer. https://doi.org/10.1007/978-3-031-04662-9_4
- Zhai, X. (2021). Practices and theories: How can machine learning assist in innovative assessment practices in science education. *Journal of Science Education and Technology*, 30(2), 139–149. <https://doi.org/10.1007/s10956-021-09901-8>

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.