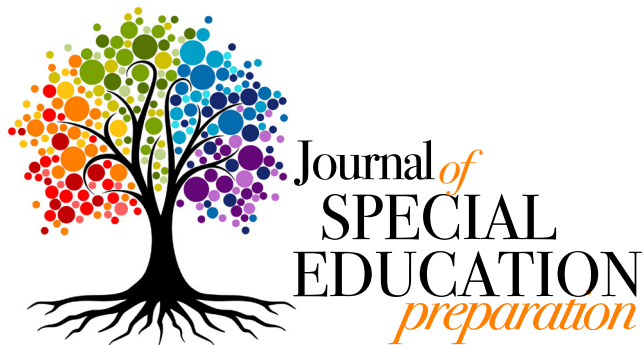




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FROM *the guest*  
EDITOR

## Artificial Intelligence in Special Education Teacher Preparation

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This *Journal of Special Education Preparation* special issue is dedicated to using artificial intelligence (AI) in special education teacher education. As guest editor, I'd like to acknowledge that the proverbial genie is out of the bottle when it comes to AI in education, and we hope that the articles in this issue will serve as a guide to special education teacher preparation programs. The eight articles in this issue identify AI's great potential to be a game-changing tool for special educators, the students, the families they serve, and the future of our nation's workforce. Cautionary caveats are also provided that we, as researchers and educators, must heed.

### The AI Evolution in Teacher Education: Embracing Innovation for Special Education

Goldman et al. help set the theoretical stage for integrating AI within special education teacher preparation through the lens of technological, pedagogical, and content knowledge (TPCK). In their articles, Dieker et al., Holman et al., Kaczorowski et al., Mosher et al., Johnston et al., and McMahon & Firestone all discuss how the landscape of education is rapidly transforming, driven by the relentless march of AI. This shift is a technological revolution and a profound opportunity to enhance teaching and learning, particularly in special education. As AI text generators like ChatGPT and Copilot become ubiquitous, we must rethink our approaches to teacher preparation and classroom practices. Now is the time for us also to understand how the use of AI in teacher preparation can help us recalibrate our focus on the truly human skills involved in teaching vs. those that can be augmented by technological assistance.

Mosher et al. and Kaczorowski et al. remind us that while AI is not new, its recent advancements and applications have garnered significant attention in teacher education. Reviewing past uses of AI and introducing adaptable tools can help teacher education programs stay ahead of the curve. By highlighting AI tools currently beneficial for teachers and struggling students and projecting future developments, educators can better prepare for integrating AI into their teaching methodologies.

### Reimagining Assignments and Activities

AI text generators offer robust functionality, from crafting written content to debugging code and improving communication skills. Their widespread use among college students signals a need for educators, especially those in preservice special education programs, to reassess the impact of these tools. All authors in this special issue discuss how instructors in educator preparation programs (EPPs) can foster a balanced environment that leverages AI's strengths as a tool for universal design and access while intentionally integrating or restricting AI in course assignments, maintaining academic integrity, and promoting critical thinking.

Jimenez et al. delve into AI's transformative potential, which is particularly evident in the education of students with moderate to severe intellectual disabilities (M/SID). Despite the importance of evidence-based practices (EBPs), educators often need help with practical implementation. AI can bridge this gap by supporting the application of EBPs, enhancing teacher fluency, and ensuring consistent practice. Higher education faculty play a crucial role in preparing educators to harness AI by

“Integrating AI in special education preparation is not just about adopting new tools but fundamentally rethinking how we prepare teachers and support students, especially those with special needs.”

modeling best practices, thus promoting the use of AI tools as part of inclusive pedagogy and improving learning outcomes for students with M/SID.

### The Rise of AI Virtual Agents

The rise of AI tools offers promise and challenge in increasingly complex classroom settings. Dieker et al. discuss how virtual agents, developed with input from administrators, educators, and computer scientists, showcase the potential of AI to enhance student learning and support teachers. These agents, equipped with biometrics and facial emotional recognition, help manage classroom activities and support students' emotional regulation. By understanding the development and application of these AI agents, teacher preparation programs can envision a future where AI seamlessly integrates into instructional practices, providing real-time support and feedback.

### Remixing Existing Practices with AI

McMahon & Firestone present en-

gaging and practical methods of helping educators to “remix” evidence-based and high-leverage practices they are already familiar with, including the new capabilities of AI. Transformational new technologies, such as AI, are powerful and disruptive, impacting multiple areas of society, including education. One of the best ways to implement AI in teaching is to support and extend current practices (Mishra et al., 2023). Similar to how a new remix on the radio can make an old favorite song fresh again, educators can use AI to support and enhance their instructional strategies and skills. However, adapting to this new paradigm of AI in education may be challenging for teacher preparation programs in special education.

Drawing on strategies from “Leveraging Emerging Technology to Design an Inclusive Future with Universal Design for Learning” (McMahon & Walker, 2019), this article provides a foundation for applying AI tools to support current practice. Based on Universal Design for Learning (UDL), the strategies aim to adapt AI tools to support high-leverage and established evidence-based practices. The goal is to inspire special educators to use AI to “remix” and innovate their instructional strategies.

### Integrating AI-Powered Personalized Learning

Holman et al. present compelling evidence for integrating Artificial Intelligence-Powered Personalized Learning (AI-PPL) in special education, representing a shift toward tailoring educational experiences to meet the unique needs of preservice teachers and students with disabilities. Their paper explores the implementation of AI-PPL tools in preservice teacher preparation programs, highlighting their potential to customize learning experiences, provide

adaptive feedback, and enhance engagement through interactive content. A review of current AI-PPL functionalities, such as adaptive learning environments and customized feedback mechanisms, demonstrates how AI-PPL can impact teaching practices and student learning outcomes. Critical attributes for successful AI-PPL integration include ensuring accessibility and inclusivity calling for further professional development to enhance educator competency and skills. By presenting real-world examples and guiding questions for extraordinary education faculty, this paper offers practical insights for educators and faculty members to effectively navigate the complexities of adopting AI technologies in teacher preparation programs.

### Conclusion

Integrating AI in special education preparation is not just about adopting new tools but fundamentally rethinking how we prepare teachers and support students, especially those with special needs. By embracing AI's potential and carefully considering its application, we can enhance the educational experience, making it more inclusive, effective, and adaptive to the needs of all learners. As we navigate this exciting frontier, collaboration among educators, researchers, and technologists will be vital to unlocking AI's full educational potential.

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# The Past, Present and Future Use of Artificial Intelligence in Teacher Education

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## ABSTRACT

The use of artificial intelligence (AI) is not a new concept. Still, the press, the worry, and the hype around the potential benefits and limitations of the explosion of these tools in this field is a current topic in teacher education. In this article, the authors summarize the past use of AI, present easily adaptable tools in teacher education, and discuss what is on the horizon in industry and special education teacher education. The authors highlight tools that should be considered in programs today, followed by ways to expand the field of AI in teacher education to support the learning outcomes of struggling students.

## KEYWORDS

**Artificial intelligence, accommodations, inclusion, innovation, modifications, special education, student learning, teacher preparation, technology**

Over the past 4 decades, the role of educators has changed. The role of an educator is moving from one who delivers knowledge to one who facilitates learning, critical thinking, and problem-solving (Brady et al., 2023). Special education teachers are expected to provide intensive intervention in areas of identified deficit through either co-teaching or direct instruction within inclusive settings to students with various academic and behavioral needs. The considerable demands on special educators to collaborate with caregivers, service providers, and general education teachers; individualize instruction for every student on their caseload; make time for developing and monitoring student goals; train paraprofessionals; and manage daily tasks has led to high turnover rates, stress, and burnout (Brady et al., 2023; Rock et al., 2023). Non-instructional tasks (e.g., lesson planning, grading, content development) significantly contribute to increased workload for all teachers (Higton et al., 2017) and burnout (Ag-yapong et al., 2022). Burnout leads to heightened absenteeism and low job performance (Klusmann et al., 2016). To counteract this stress, educators are seeking to adopt technologies to reduce workloads and increase time for instruction (Silva et al., 2023).

Many practices and tools within artificial intelligence (AI) in education (AIEd) support both preservice and in-service special education teachers. Technologies, such as chatbots, prediction platforms, automated grading systems, and intelligent tutoring, not only improve educational outcomes (Chiu et al., 2023a) but can also provide automated AI agents to answer questions and give students immediate feedback on assignments. The ability of AI to automate administrative tasks and facilitate specially designed instruction can provide educators with increased time, the number one issue noted by special education teachers, to focus on personalizing instruction and creating a motivational environment (Al-Mughairi & Bhaskar, 2024). Increased time has also reduced educator stress and burnout (Yin et al., 2021). When understood and used appropriately, AIEd can support special education teachers in instructional content development, planning, assessments, modifications, adaptations, and communication (Hashem et al., 2024) aligned with students' individualized education program (IEP) goals.

## Past to Present: The History of AI

AI has existed for over 70 years, yet numerous definitions of the term exist (Luckin et al., 2022). For this paper, AI is defined in its original meaning: any interactive machine capable of mimicking human intelligence (McCarthy et al., 1955). Generative models within AI date back to the 1950s (i.e., hidden Markov models, Gaussian mixture models). Logic Theorist was the first AI program developed. However, it was only in the addition of deep learning that generative models became popular (Ciesla, 2024). The first commercialized AI involved robots (Shakey [1966], WABOT-1 and Stanford Cart [1970], and WABOT-2 [1980]). The concept of AIEd was introduced with the creation of the Turtle robot and computational LOGO in the 1970s (Papert et al., 1971).

One of the most popular OpenAI bots to date, Chat Generative Pre-Trained Transformer (ChatGPT), had predecessors dating back to 1950 with Alan Turing's Turing Test. The Turing Test sought to discover whether a computer could communicate with people without humans realizing the communication was occurring with an artificial entity (Adamopoulous & Moussiades, 2020). The first AI chatbots, Eliza (1966), Parry (1972), Jabberwacky (1981, later termed Cleverbot in 1990), Alice (1995), and Deepblue (1997) led the way for future, more sophisticated bots such as IBM's 2010 Watson; Apple's 2011 Siri; Amazon's 2014 Alexa and 2017 Lex; Microsoft's 2014 Cortana and 2018 Xiaoice; Google's 2020 Meena and 2023 Bard; Meta's 2022 Blenderbot; and OpenAI's 2022 ChatGPT (Ciesla, 2024). The popularity of chatbots was solidified when, within two months of its launch, ChatGPT became the fastest-growing app in history (Makridakis et al., 2023).

Today, AI is being used daily by special education teachers for personalized instruction, social dialog, scaffolding, collaboration, experiential learning, and

much more (Luckin et al., 2022). Chatbots can answer questions and engage in real-time conversations with users. An in-depth interview with 34 educators on their willingness to adopt AI in their classrooms (Al-Mughairi & Bhaskar, 2024) revealed educators who integrated ChatGPT had enhanced technology skills and were more likely to stay engaged with future technologies. In recent years, AI has become so user-friendly that special education teachers working in transition settings are able to provide specially designed instruction to K-12 students using machine learning models without a computer science background through tools such as TensorFlow Playground and Teachable Machine (Wangenheim et al., 2021). These tools, when mastered in preservice preparation programs, can be equipped to better prepare students for the future workforce, which is especially important for students in transition programs (Miao & Shiohira, 2022). To continue this expansion, the field of teacher education needs to guide students in using AI effectively as an efficient helper rather than a replacement for human interaction or critical thinking (Ausat et al., 2023).

Educators need to prepare preservice special education teachers on how to use AI tools to provide personalized support through a variety of services, including (a) summarizing lessons, (b) answering questions, (c) modifying content, (d) providing recommendations on student goals, (e) providing insight on existing content, (f) designing assessments, and (g) generating questions, lessons, and activities (Al-Mughairi & Bhaskar, 2024; Baidoo-Anu & Ansah, 2023; Sun & Hoelscher, 2023). Although a primary benefit of AI is its easy access to information (Sun & Hoelscher, 2023), this same benefit causes ethical questions regarding AI's usefulness within education (Hosseini et al., 2023) and specifically how teachers are personalizing learning aligned with students' IEP goals and objectives.

## Concerns Over the Use of AI in Education

The capacity for AI to assist educators in administrative tasks and motivate students has been displayed in numerous systematic reviews of AI within education (Chen et al., 2020; Laupichler et al., 2022; Ng et al., 2023a, 2023b; Salas-Pilco et al., 2022; Sanusi et al., 2023; Su et al., 2022; Tan et al., 2022; Wangenheim et al., 2021; Zawacki-Richter et al., 2019). Research shows the integration of AI should be purposeful in teacher education, as the potential exists for a decline in the quality of education if teachers become over-reliant on AI (Chiu et al., 2023a). For example, AI can create SMART goals for students' IEPs. However, the educator must have knowledge of how these prompts should be written to ensure they are created and aligned with students' needs and where the chatbot is gathering information to create the prompts (i.e., is it from a knowledgeable, diverse, and valid source). Educators must also understand how to modify the output from these prompts to meet the individual student's needs. Prompt generation and output modification are critical new components of instruction within any special education teacher education program.

Several factors are essential for teacher educators to consider when preparing preservice special education teachers for AI use within classrooms. These factors can lead to the misuse of AI, including whether the following are present: (a) biased and discriminatory results that may not reflect the population of students the teacher is serving; (b) misinterpretation of data and communication; (c) reduced reliability and accuracy of information aligned with the students specific goals or objectives; (d) reduced interaction with students if AI is the default for instructional use; (e) fewer opportunities for building relationships through collaboration and teamwork when "auto" created lessons and activities are the default; (f) over-reliance on technology

negating preparing students with disabilities to think on their own; (g) reduced problem-solving and critical thinking; (h) decreased privacy and data security; and (i) potential copyright infringements (Arif et al., 2023; Hosseini et al., 2023; Sallam, 2023). Awareness of these concerns is critical in preparing special education teachers as it helps educators understand the scope of the positive and negative impacts of AI tools. A breakdown of some of these critical considerations follows.

### Misinformation

AI may provide factually incorrect information, including misconceptions, biases, and inaccurate data (Zhou et al., 2023), especially when the inclusion of disability in current databases of knowledge is potentially limited or unknown. Ensuring preservice teachers understand the biases, inadequacies, and inaccuracies within the pattern-finding mechanism, training, and data sources is a critical new component of preservice preparation. Possible solutions in teacher preparation include being able to provide teachers with how to access accurate data by: (a) providing engineered detailed prompts within search features (see Figures 1-3), (b) pulling data from knowledgeable databases created by trusted experts (e.g., Custom GPT), (c) providing specific questions within the prompt of what kind of response is warranted and in what vernacular, (d) creating a clear pedagogical focus for AIED's use, and (e) using AIED as one source within many sources to enhance or gather outside thoughts and perspectives, rather than replace human interaction and data collection.

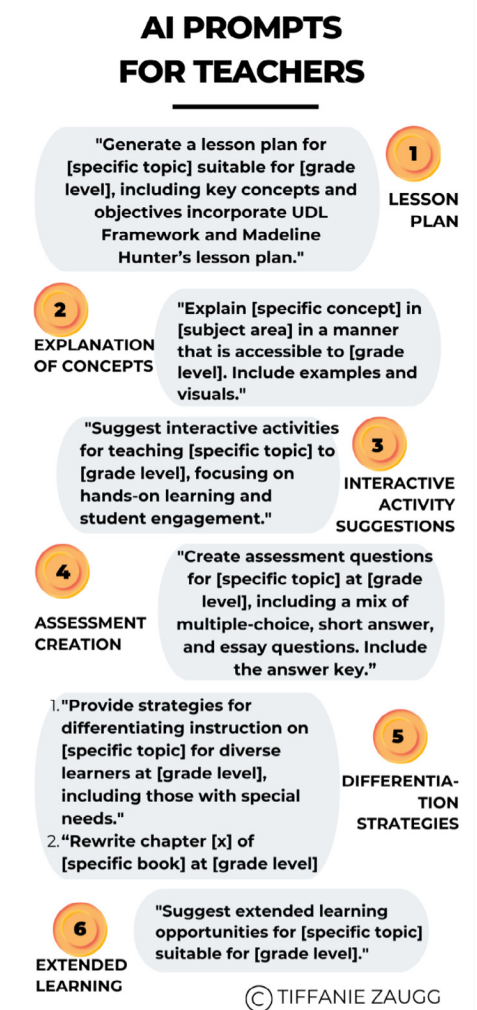
It is also helpful to consider preparing teachers to reflect on core questions before using AI data. These reflective questions might include: "Was the data on which the AI was trained representative of the population affected by subsequent decisions?" "Is the advice or information given well-balanced and derived from an

analysis of information from trustworthy sources using effective methods?"

"Was the data on which the AI system was trained properly representative of the population affected by AI output or insights?" "Is the data derived from pattern-finding methods, and if so, were there biases within this source data?" Teacher candidates need to understand the source of the data they are seeking to ensure inclusivity of the population they are serving. This may require preservice teachers to look at the cited sources given by the AI tool to ensure it is built upon peer-reviewed and evidence-based practices in the field.

Teachers must also understand how the prompt placed within AI content generators influences the output. For example, a special education teacher working with a high school student with extensive support needs can assist the student in creating a resume of their skills for a job. Then, the educator can show the student how to attach the resume to the search bar using Microsoft CoPilot (<https://copilot.microsoft.com/>). The student can be trained on entering different prompts for different purposes, such as "Use the attached resume to create a cover letter for this LinkedIn job description as a communications greeter for the Johnson Public Library in Overland Park, KS." CoPilot will type a letter, pulling from the resume and matching it to the job description and key information from LinkedIn and the Johnson County Library website. The teacher would then show the student the links at the bottom where it pulled this information and help determine if these are the correct links for the job. If they are, the next task would be asking CoPilot to read the letter aloud and having the student follow along, noting any misinformation or mistakes. They could then work together on correcting any mistakes and adding any additional content to the cover letter. They would ask CoPilot how to cite its assistance on this task and add this citation to the

**FIGURE 1:** Sample Graphic for Preservice Teachers to Explore AI for Professional Tasks



bottom of the letter.

Reflecting with future educators on examples of how to assist students with both the input and the output of AI-generated tasks is imperative. The student and teacher could go on to create cover letters based on the resume for a specific university or other jobs that fit the student's skills. They can even ask CoPilot to list jobs based on the resume the teacher guided the student in writing. Figure 1 provides examples of forms of prompts to assist educators in understanding the need for precise, detailed prompts stating who the content is being generated for, in what format



**TABLE 1:** Free and Low-Cost Educator Applications

Application Purpose	Free & Low-Cost Applications With These Capabilities			
Content Summarizer/Generator	ChatGPT	Midjourney	Microsoft Copilot	CustomGPT
Image Editor/Generator	Lensa	DALL·E 3	OpenArt	Craiyon
Video Editor/Generator	Fliki	Runway	HourOne	Synthesia
Audio Editor/Generator	Podcast AI	Listnr	Coqui	Wellsaid
Writing Editor/Generator	ParagraphAI	Grammarly	HyperWrite	Claude 3
Analyzing Data	DeepMind	AI Notebook	Stability AI	AnswerRocket
Personalized Instruction	PopAi	Sizzle	Flexi	Khanmigo
Assessment Tools	Twee	Quizalize	<a href="https://www.almanack.ai">Almanack.ai</a>	Magic School
Character/Meme Assistants	<a href="https://www.character.ai">Character.ai</a>	Super Meme	<a href="https://www.artflow.ai">Artflow.ai</a>	Free AI Assistant
Productivity Assistant	<a href="https://www.brain.fm">Brain.fm</a>	Otter	NotionAI	Zapier
Presentations/Designs	Canva	Adobe Firely	Microsoft Designer	Gamma

Note: A supplemental resource can be found at: <https://docs.google.com/document/d/1TeN8LeOI-puwiY7vsWvHUU26jA3rIAaCWkv21Np04/edit?usp=sharing>, which shares how to use each of the above resources. Many of the applications listed above have multiple functions and can be used in addition to what is listed within this chart. Most of the above apps have free and paid subscription versions.

the output is expected, and why.

### **Safe and Ethical Use**

Utilizing AI effectively requires both safeguards and reflective practice. Particularly, educators should consider what data is best collected or what information is best discovered using AI, who will be involved with the AI, what other options are available that may be more advantageous, how will AI analyze and evaluate information, and how will this data relate to and inform practices. Professional development (PD) for ethical AI implementation can help educators avoid misuse (Ng et al., 2023a). The PD should include instruction on AI's capabilities, uses, and limitations; examples of how AI may be effectively incorporated into the classroom; and current technological aspects of AI.

### **AI to Support Educators**

The United States is one of many countries developing a national AI strategic plan (Laupichler et al., 2022). Despite evolving guidance and frameworks, educators often interact with AI without realizing the algorithms,

software, and applications embedded within tools such as Google Classroom, Excel, PowerPoint, chatbots, podcasts, and YouTube. For example, when creating an Excel spreadsheet of student data, Microsoft utilizes AI to provide an array of possible visual methods for best presenting the data. PowerPoint presentations now have AI-powered design generators that provide ideas on how best to display the content on blank slides. Siri answers a question or types a text based on information spoken into the teacher's phone. Other applications utilize AI more overtly (i.e., editing such as Grammarly and adapting content like Magic Write, AudioPen, Curipod, EduAid, Ludia, and Goal Genius). Keeping in mind the safeguards noted, Table 1 provides a listing of a few common AI applications used to assist educators, as well as a description of how authors may use this tool and how an AI chatbot recommends using the tool. There are many tools available to create content from a prompt (e.g., <https://poe.com/>, <https://app.magicschool.ai/tools>, <https://www.perplexity.ai/>, <https://claude.ai>, <https://gemini.google.com/>, [www.khanmigo.ai/](https://www.khanmigo.ai/), and <https://www.comml00.com>). It is important to provide educators with a few of these top tools and discuss how these tools may be helpful in performing in a manner such as presented in Table 1.

software, and applications embedded within tools such as Google Classroom, Excel, PowerPoint, chatbots, podcasts, and YouTube. For example, when creating an Excel spreadsheet of student data, Microsoft utilizes AI to provide an array of possible visual methods for best presenting the data. PowerPoint presentations now have AI-powered design generators that provide ideas on how best to display the content on blank slides. Siri answers a question or types a text based on information spoken into the teacher's phone. Other applications utilize AI more overtly (i.e., editing such as Grammarly and adapting content like Magic Write, AudioPen, Curipod, EduAid, Ludia, and Goal Genius). Keeping in mind the safeguards noted, Table 1 provides a listing of a few common AI applications used to assist educators, as well as a description of how authors may use this tool and how an AI chatbot recommends using the tool. There are many tools available to create content from a prompt (e.g., <https://poe.com/>, <https://app.magicschool.ai/tools>, <https://www.perplexity.ai/>, <https://claude.ai>, <https://gemini.google.com/>, [www.khanmigo.ai/](https://www.khanmigo.ai/), and <https://www.comml00.com>). It is important to provide educators with a few of these top tools and discuss how these tools may be helpful in performing in a manner such as presented in Table 1.

### **Administration, Logistics, and Time Management**

AI has the capacity to simplify administrative tasks (Shumanov & Johnson, 2021) without taking over instruction by providing special education teachers with time-saving tools for tracking attendance and behavioral information, such as Poll Everywhere's Attendance Management (Karsenti, 2019). Preservice teacher preparation programs need to create a model for teaching various AI tools. For example, preparation programs may want to support teachers using apps like ReportGenie and Grow to input IEP information for report cards and produce printouts of student progress or import Google Sheets data to create visualizations for parents. AI can assist educators in language translation and pronunciation of words in other languages (Hashem et al., 2024). Apps are even

available to locate objects or information promptly (Mosher, 2022). The free or low-cost apps PictureThis and Leafsnap use visual recognition software to identify a plant, state the species, provide care information, and give details on where the plant may best be located. When walking with students, teachers can take a picture of a plant or tree and receive the plant's origin, watering specifications, and methods to treat the pictured plant's common pests. Special education preservice teachers need a universal design for learning (UDL) mindset to explore, understand, and adopt AI tools during their preservice program to help ensure their future success and use of AI in their classrooms.

**Planning and Goal Setting.** With AI apps, portable devices can provide immediate content, even on the go. For example, Pearson and McGraw-Hill offer digital learning platforms that can be accessed from the teacher's phone. Teachers can adjust course content through learning management systems such as Moodle and Coursera. AI-powered goal-setting tools can help educators determine realistic goals, track progress, and adjust goals based on individual performance and achieved milestones (Baidoo-Anu & Ansa, 2023). Other examples of tools preservice preparation programs in special education can use are [GoalGenius.ai](#), IEP CoPilot, and TaskAde to assist in generating ideas for IEP goals educators can use as prompts.

For example, one professor challenged students in a special education language and literacy class to use the tool of choice to complete two tasks. The first was to create summaries from a chapter in *Because of Winn Dixie* at the 100 and 800 Lexile levels. The preservice teachers were then tasked with using an image generation program to create image prompts that students could use to write a paragraph aligned with the task. This activity concluded with the preservice teachers being asked

to translate the passages into two other languages for two students: one who spoke German and had an identified disability and another English language learner who shared that Spanish was the only language spoken in the home. This activity not only showed the efficient use of AIED tools but also provided a way to think about scaffolded texts, language translation, personalized content, and differentiation.

The second activity the professor planned was integrating into the teacher preparation prompt engineering and UDL lesson development. Using the same book, the teachers were asked to prompt ChatGPT to create a lesson plan. They were then asked in small groups to critique the plan and develop three more prompts (one focused on UDL, one on ideas aligned with a specific disability, and one on identifying creative ways to assess learners). These students then compared, critiqued, and contrasted what they found and submitted their original and advised lesson plans. Finally, they were asked to use videos uploaded to the course site to discuss what they learned regarding the strengths, weaknesses, and ethics behind using AI tools.

**Assessing and Grading.** Providing ongoing and immediate feedback is a critical and often difficult skill for new teachers, and essential for ensuring learning mastery and assessing progress toward IEP goals for students with disabilities. Algorithms from AI can provide immediate grading on student assessments (Gran Ekstrand et al., 2021), and AI-powered chatbots have the capacity to provide automated learning assessments based on the goals teachers input into the chatbot (Durall & Kapros, 2020; Tlili et al., 2023). Gradescope, Autolab, and AI Tutor collect assessment results, evaluate the results, and provide feedback, allowing a quicker response rate based on data than many current methods of data collection and helping the teacher adapt instruction (Okonkwo & Ade-Ibijola, 2020). AI

even has the capacity to monitor how students process information (Chiu et al., 2023b) and provide adequate feedback.

AI has proven helpful in teacher-student communication after assessments through methods such as promoting self-reflection and recommending adaptive teaching strategies (Timms, 2016). AI apps can collect and analyze data from multiple sources (Muljana & Luo, 2021) and provide insight into students' learning processes and possible methods of support (Jia et al., 2021). For example, Carnegie Mellon University's free authoring tool, LightSIDE (Kumar & Sree, 2014), provides automated essay scoring using syntactic elements based on answers to specific questions educators input before the assessment. The UTIFEN platform, used by educators in the Republic of Niger in West Africa, promotes mobile learning and has the potential to analyze individual successes and failures to create data-based interventions. The platform sends automated reminders to students throughout the intervention and provides personalized feedback on accomplished goals and milestones. AI's ability to automate time-consuming administrative tasks (i.e., grading, attendance, progress monitoring) has the potential to save educators key instructional time daily.

### **Supporting Personalized Student Instruction**

Emerging tools offer promising pathways to personalize and enhance students' learning and executive functioning skills while reducing the burden on teacher time (Mosher et al., 2020). AI tools are becoming more advanced (Carew, 2020) and prevalent. Teacher educators and the teachers they prepare need to integrate these tools into preparation and practice. Educators can create personalized, inclusive experiences by incorporating AI to meet students' diverse needs. Teachers can use AI to assist students in various tasks across reading, text generation, cognitive scaf-

folding, physical and sensory areas, and executive functioning. Examples of how AI can help support students are provided below.

**Reading and Comprehension.** Various AI tools foster motivated reading practice by generating or recommending reading materials based on student interests, reading proficiency, and learning goals (Li et al., 2023). AI algorithms assessing reading levels can dynamically adjust texts to appropriate difficulty, ensuring comprehension and engagement. Chatbots and intelligent tutors can provide coaching and support when a peer or adult is unavailable. These platforms can analyze reading patterns and adaptively adjust the difficulty level of texts and instruction to match individual students' proficiency levels (Sarker, 2021).

**Leveled and Generated Text.** As noted in the example of the use of AI in special education teacher preparation, emerging tools in the AI realm can quickly and efficiently screen for reading fluency and decoding problems and provide potential interventions (Erbeli et al., 2023). Eye-tracking technology, combined with AI and previously established machine learning software, shows promise in streamlining the identification of reading disabilities (Gran Ekstrand et al., 2021; Benfatto et al., 2016). Kim and Wiseheart (2017) and Rello and Bastelaros (2015) examined the unique patterns of eye movements between children with and without dyslexia, and AI is taking this information to generate applications capable of noticing these differences. Text-to-speech technology integrated into reading apps can assist students with reading difficulties by providing audio narration. AI algorithms can highlight keywords, provide definitions, and offer contextual explanations to aid comprehension. AI can generate personalized stories tailored to students' interests and reading levels, promoting engagement and comprehension with interactive quizzes or branching narratives.

**Accessible Formats and Differentiated Instruction.** Current tools can generate compelling and creative lesson plan activities and content (Pavlik, 2023).

AI can simplify and motivate students through summarization and game-like activities (Jovanović & Milosavljević, 2022). AI applications can create personalized texts in various formats (audio, braille, translations), catering to students with visual impairments, learning disabilities, or language barriers. AI-powered writing assistants can help students generate coherent and well-structured written content. These tools can provide suggestions for improving grammar, vocabulary, and style while offering real-time feedback on the written content. Natural language generation models can automate the creation of study guides, summaries, and other materials based on input from textbooks, articles, and notes. AI-driven tutoring systems can provide personalized learning experiences by adapting instructional strategies to students' cognitive abilities, learning styles, and preferences. Intelligent tutoring systems can identify areas of difficulty or misconceptions and offer targeted interventions, explanations, and practice exercises to master concepts.

**Cognitive Scaffolding and Executive Functioning.** AI-powered tutors can provide real-time feedback on comprehension, vocabulary understanding, and inference skills, adapting to individual needs and learning styles. For example, teachers can create a bot for their classroom in a specific area of difficulty while exploring already existing or emerging AI tutors (e.g., Kahnamigo). AI tools can guide students in reflecting on their reading process, identifying strengths and weaknesses, and developing self-regulated learning strategies. To enhance various components of executive functioning, AI may provide personalized support, feedback, and guidance to students across different stages of their academic journey. For example, Hughes et al. (2022) created an

AI agent combined with biometrics to help students with disabilities self-regulate in general education settings. To improve social communication, self-regulation, and critical thinking skills, AI was used to help create an extended reality program (Mosher et al., 2024) that supports skill development in over 180 social skills through 140 scenarios. The potential benefits for students with executive functioning challenges and pragmatic delays are significant, and ongoing research explores new and innovative supports.

### AI in Teacher Preparation

The Council for the Accreditation of Educator Preparation (2018) declared technology a cross-cutting theme in its teacher education requirements, and effective faculty modeling of technology use in teacher preparation is emphasized in the Teacher Educator Technology Competencies. Teachers' beliefs regarding technology use are strongly influenced by the program design of their teacher preparation experiences (Voithofer & Nelson, 2021). This creates new challenges and opportunities in preparation. To fully maximize the potential of AI, teachers need to understand its applications, barriers, and potential as they enter the classroom (Basilotta-Gomez-Pablos et al., 2022) through effective modeling.

### Pedagogical Shifts

AI tools challenge teachers to rethink pedagogy and assignments, forcing teacher educators to determine how this shapes programs and curricula. Even technological approaches need to be reconsidered with the advent of tools that remove the need for sophisticated skills. For example, the TPACK framework focuses on technological, pedagogical, and content knowledge (Voithofer & Nelson, 2021). With AI, the technological and content load are reduced. AI searches can produce content in seconds, and few new technology skills are needed to

operate the latest AI interfaces. In higher education, the pedagogical category specifically calls for rethinking teaching and learning for the success of future students.

Shifting to more student-centered use of technology, inquiry-based teaching activities, and other constructivist approaches requires a shift in instruction and a change in mindset at the teacher preparation level. While educators may recognize the benefits of promoting critical thinking, problem-solving, and a deeper understanding among students, many still use traditional reductionist teaching that aligns well with standardized testing and traditional assessment methods. The real power or danger in the use of AI is in either promoting or not promoting critical thinking, problem-solving, and a deeper understanding among students, which align with an array of emerging assessment methods. Just as new AI-driven adaptive learning systems can dynamically adjust the difficulty level of content based on a student's performance and progress, they also offer new ways of assessing learning based on individual needs and goals. Teacher preparation programs can help new educators understand how to use AI to guide students through constructing knowledge, problem-solving, and developing meaningful forms of assessing new learning.

AI tools challenge educators to focus on student-centered approaches, customized learning, and a greater reliance on creative thinking. Adaptive learning systems automatically respond to student needs and allow them to be consistently challenged without feeling overwhelmed or bored (Smith et al., 2022). The need for differentiation to be accomplished solely by the teacher is relieved through automation, allowing time for teachers to interact with, coach, and develop students' deeper understanding (Carreon et al., 2022). Developing the right questions to ask to solve a problem becomes a critical skill when answers are easily

## FIGURE 2: Screenshot of Custom ChatGPT Response to Prompt to Create Sample Progress Monitoring Chart

### Assessment Details:

- **Assessment Type:** Two-Digit Addition
- **Goal:** Add two-digit numbers with 90% accuracy

### Progress Monitoring Chart:

DATE	NUMBER OF PROBLEMS	CORRECT ANSWERS	ACCURACY (%)	COMMENTS/STRATEGIES USED
01/08/2024	10	7	70%	Used fingers to count
08/08/2024	10	8	80%	Used number line
15/08/2024	10	9	90%	No manipulatives
22/08/2024	10	10	100%	Mental math
29/08/2024	10	9	90%	Used hundreds chart
05/09/2024	10	10	100%	Mental math
12/09/2024	10	10	100%	Mental math

### Comments and Observations:

- **01/08/2024:** Student relied heavily on fingers for counting.
- **08/08/2024:** Introduced number line; student showed improvement.
- **15/08/2024:** Student was able to solve problems without manipulatives.
- **22/08/2024:** Student achieved perfect score using mental math.
- **29/08/2024:** Used hundreds chart for verification.
- **05/09/2024:** Consistently achieving high accuracy with mental math.
- **12/09/2024:** Maintained perfect score with mental math.

### Intervention Phases:

- **Primary Instruction:** Initial assessments and introduction of basic strategies.
- **Secondary Intervention:** Use of manipulatives and visual aids.
- **Tertiary Intervention:** Focus on mental math and advanced strategies.

### Goals and Adjustments:

## FIGURE 3: Screenshot of Response to Prompt to Create Chart in Undergraduate Teacher Prep Course

Creating a progress monitoring chart for a second grader learning new vocabulary words involves several steps. Here's a simple guide to help you set up and use the chart effectively:

### Step 1: Define the Goal

Set a clear, measurable goal for the student. For example, "The student will correctly identify and use 20 new vocabulary words by the end of the semester."

### Step 2: Choose a Measurement Tool

Select a tool to measure the student's progress. This could be a weekly quiz, flashcards, or a vocabulary game.

### Step 3: Administer and Score Probes

Administer the chosen measurement tool at regular intervals (e.g., weekly). Score the student's performance each time.

### Step 4: Create the Chart

You can create the chart using graph paper or a digital tool like Excel. Here's a simple example of how to set it up:

#### Horizontal Axis (X-Axis)

- Label this axis with the weeks of instruction (e.g., Week 1, Week 2, Week 3, etc.).

#### Vertical Axis (Y-Axis)

- Label this axis with the number of vocabulary words correctly identified and used (e.g., 0, 5, 10, 15, 20).

### Step 5: Plot the Data

Each week, plot the student's score on the chart. Connect the data points with a line to visualize progress over time.

### Example Chart

WEEK	WORDS CORRECTLY IDENTIFIED AND USED
1	5
2	7
3	10
4	12
5	15
6	18
7	20

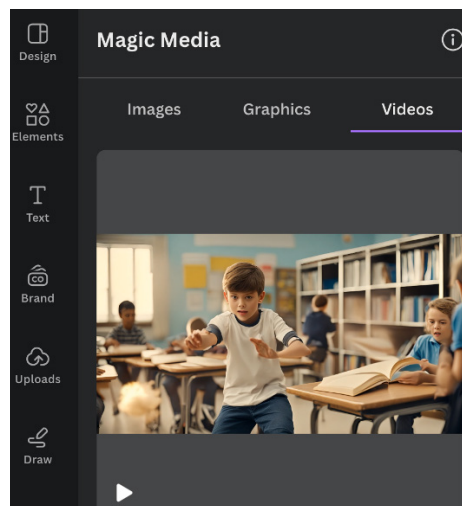
accessible. Validating resources and drawing (and challenging) conclusions generated through AI are essential skills, giving communication and collaboration higher value.

### **Samples and Consideration for AI Use**

As noted in Technology Vision (2024), AI and large language models (LLMs) are moving fast, and by the time the report was published, new best practices for building generative AI advisors already existed. Preparing for the speed of change is a challenge at all levels of education, but flexible thinking in preparing future teachers is essential to ensure learners with disabilities have access to AI tools as they evolve. In the short term, content experts in education could create their own custom chatbots or AI assistants to direct students to avoid the generic output of LLMs like ChatGPT. More refined and specific small language models will control the quality of content and can easily be created with products like Custom GPT (<https://customgpt.ai>). Examples of two separate sample inputs to create a progress monitoring chart using a customized chatbot, Education and Learning in an Inclusive Environment (EL; Zaugg, 2024), are shown in Figures 2 and 3. These were prompts written into an AI assistant created to search more than 5,000 reputable open-source educational resources (e.g., IRIS modules, high leverage practices, CAST, journals) to provide immediate and direct access to reputable solutions for preservice and in-service teachers. This EL AI assistant is a free tool available to educators.

Figure 2 shows a prompt given to the EL AI assistant to create a progress monitoring chart for two-digit addition. Figure 3 presents a sample response the EL AI assistant generated when asked to create a progress monitoring chart for a teacher preparation course. As shown in the figures, the specific words added to or removed from a prompt change

**FIGURE 4:** Screenshot Using AI-Powered Magic Media in Canva



the output of the information provided. This is why it is imperative to teach users where to locate chatbots that pull information solely from validated sources and how to write specific, detailed prompts to get the desired output.

Zaugg (2024) used a quasi-experimental research design to analyze the effects of AI assistant usage among preservice teachers who watched a 10-minute video overview demonstrating how to use an AI assistant to create lesson plans that include accommodations and modifications. Students in the study created lesson plans that were ranked significantly better by outside evaluators than those of a control group that heard the same lecture on accommodations and modifications but did not receive specific examples of how to use the EL AI assistant for such assignments. Students also completed the lesson plans in a fraction of the time needed compared to their control peers. The study additionally examined the correlation between the use of AI assistants and the likelihood that preservice teachers would allow their future students to use AI tools. Results indicated a significant change in the attitudes and practices of preservice teachers regarding AI, with

notable improvements in their familiarity and ethical considerations of AI use in educational settings.

Beyond searching for content and creating classroom resources and tools, AI allows users to create new practice opportunities for preservice educators (Misra et al., 2019). Song et al. (2022) evaluated the effects of a teaching simulation activity using a chatbot on preservice teachers' efficacy. The researchers asked 46 preservice teachers to teach a chatbot about school violence and how to handle it. The results of their research suggested that designing this content provided preservice teachers with opportunities to increase their teaching efficacy. Teacher preparation programs that provide opportunities for students to utilize innovative technologies produce educators who show greater comfort and competency with these technologies (Mosher & Carreon, 2021).

With new tools emerging daily that allow users to generate videos from basic written descriptions, teacher educators can go even further by creating limitless scenarios for future educators to explore and create. The ability to create video-based training materials is linked to the teacher's ability to describe the desired scenario, which improves teacher pedagogy. Tools such as Canva, a user-friendly graphic design platform that allows users to create a wide variety of visual content, are particularly popular among non-designers due to their simplicity. Canva now includes Magic Studio, an AI-powered platform that creates video clips and images using a simple written prompt. Figure 4 shows a screenshot of a classroom scene created by the Canva AI-driven Magic Studio feature with the prompt, "Create a boy throwing a book in the classroom." More sophisticated AI video-generation programs are also available at varying prices and allow educators to create realistic scenarios that can be used to prepare novice teachers for unlimited classroom situations.

### Future Use of AI in Special Education Teacher Preparation

The future of AI in teacher education has the potential to transform the profession by addressing the high levels of stress and burnout among educators attributed to their extensive workload. AI in education encompasses technologies like chatbots, automated grading systems, and intelligent tutoring, all promising to impact the future of teaching and learning. The evolution of AI from its inception over 70 years ago, with the development of the first AI program to the introduction of AIED in the 1970s, has led to its current integration into classrooms for various purposes. The subsequent rise of AI chatbots has provided the foundation for increasing personalized instruction and social dialog.

The pace at which AI continues to evolve is exponential and important to consider in teacher preparation (Fonseca et al., 2024). The future use of AI is something even AI cannot predict. For example, a study of LLMs (e.g., GPT-4) within medicine showed that AI already has capabilities to extensively analyze vignettes, interpret stories, and provide an accurate diagnostic hypothesis based on the data at a mean success rate of 71.3% compared to the neurologists' success rate of 69.2% (Fonseca et al., 2024). This means educators in the future may be able to accurately use AI to identify interventions for a struggling student and create a hypothesis as to why a student is struggling with greater accuracy than a single educator alone. This also means that in the future, if provided with reputable and accurate source data, AI may be able to make meaningful analysis and predictions with less biased results.

A study of 51 students from three research-intensive universities identified themes students believe future higher education institutions must provide future educators (Chiu, 2024). These themes include new learning outcomes involving AI literacy, interdisciplinarity,

maker learning, and assessments centered around in-class, hands-on, relevant activities. Teaching future educators how to implement multiple formative assessments is imperative to ensure generative AI is not used just to generate answers but instead provides meaningful measures relevant to students in the future workforce.

Future teacher preparation for special education is likely to focus on the use of AI to create personalized and inclusive learning environments. AI tools can generate adaptive learning systems that tailor educational content to each student's unique pace and style, providing a more individualized experience. AI can also assist in managing classrooms by tracking student progress, adapting learning plans, and offering real-time analytics based on student performance.

A survey of 2,778 published researchers in top-tier AI Journals predicted that by 2047, there is a 50% chance that AI will be able to autonomously create a product (e.g., song, story, picture) indistinguishable from or outperforming one created by a popular human in that decade (Grace et al., 2024). Respondents also predicted a 10% chance that by 2037, human occupations will become fully automatable. The predictions of these researchers reveal to teacher preparation programs the importance of future educators instructing students in areas such as critical thinking, communication, and collaboration, skills that will continue to be imperative no matter what occupations are available in their students' futures.

One of AI's greatest potential uses is personalized data-driven feedback. With the evolution of tools in data tagging and teacher and student performance observation, learning tasks can move from subjective to objective analyses. AI can analyze data to provide direct, personalized methods to remediate deficits in teacher performance, impacting student learning (Hashem et al., 2024). Furthermore, AI can provide targeted

interventions from this analyzed data in seconds, enabling teachers to address each student's needs. Incorporating AI into teacher preparation programs will require careful consideration of ethical implications, such as ensuring privacy and avoiding bias. The integration of AI will also necessitate training future educators on imperative safeguards, such as never placing students' identifying information into any AI technology not stored on local district-protected servers and teaching their students these safeguards.

Future pathways for the use of AI include personalized learning in immersive environments. AI systems can tailor preservice teachers' learning in their university courses, and then they can use these tools to customize instruction for their students. Realistic simulations of classrooms with students who have special needs (Berg et al., 2023; Dieker et al., 2023) and simulations of various tasks, including learning and workforce training (Mosher & Carreon, 2021), already exist and have data supporting their effectiveness in education. The integration of AI can improve these simulations to provide real-time responses from realistic avatars without the need for humans to staff the behind-the-scenes responses, allowing preservice and in-service teachers to practice new skills in a safe environment while receiving AI-driven feedback on their performance.

By providing personalized learning, simulations, data-driven feedback, and assistive technologies, AI can help ensure all students have access to qualified and effective teachers and reach maximum learning outcomes. For this to occur, a call for action is needed for AI to be integrated into programs today. It is imperative that with this call, AI users are encouraged to continue using innovative technology with constant reflection and expansion as new tools evolve to support teacher and student learning outcomes.

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# Early Adopters: Navigating AI Integration in Special Education Teacher Preparation

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## ABSTRACT

Exploring the role of artificial intelligence (AI) in education is important as it challenges traditional teaching practices and shapes how educators may approach them in the future. In this article, we document the transformative integration of AI in special education teacher preparation, highlighting how we, as early adopter professors, attempted to navigate this journey, offering practical applications for AI use. Practical applications of generative AI tools include aligning course objectives, developing modules, and creating assignments and assessment measures. Additionally, we describe innovative uses for AI, such as incorporating chatbots in teacher preparation courses, navigating curriculum development, generating case studies, and aligning individualized education program (IEP) goals with curricular standards. We also explore how AI can be employed as a reflective coaching tool for teaching practice. Ethical considerations are emphasized, focusing on transparent communication about AI use and documenting the learning process to humanize assessment experiences and mitigate potential risks.

## KEYWORDS

**Artificial intelligence, chatbots, curriculum development, special education, teacher preparation, video-based reflection,**

**A**s artificial intelligence (AI) becomes more accessible to the public, educational institutions worldwide are considering its transformative effects on teaching and learning. This evolving landscape elicits diverse perspectives, ranging from concerns about academic integrity to opportunities for redefining assessment practices. In this article, we advocate for a deliberate approach to AI integration in special education teacher preparation, positing that, like any technology, AI enhances learning when thoughtfully integrated. We emphasize collaborative engagement with AI to navigate its practical and ethical complexities, recognizing it as a tool that, when wielded with intentionality, has the potential to elevate educational practices.

We, the authors of this article, include full-time faculty, adjunct faculty, and administrators in teacher preparation programs across two universities (one public, one private) in the Northeastern United States. At this time, our universities have broad AI policies, allowing instructors the academic freedom to choose how and when to integrate AI into courses, if at all. As AI has become more readily available, we have found ourselves examining ways in which we can learn together with our teacher candidates to use AI productively and ethically to enhance and elevate our educational experiences. As we progress in this journey, we aim to document faculty and student experiences implementing AI in practical and innovative ways within teacher preparation programs to provide insights from multiple angles and promote an openness to unanticipated findings.

A term coined and conceptualized by McCarthy and his colleagues for a conference at Dartmouth College in 1956, AI is based on the “conjecture that every aspect of learning or any other feature of intelligence can, in principle, be so precisely

described that a machine can be made to simulate it” (McCarthy et al., 1955, para. 1). Even at that time, this concept was not a new one. In his famous 1950 article, Alan Turing, the renowned World War II codebreaker, introduced the Imitation Game and proposed exploring the deceptively simple question, “Can Machines Think?” (Turing, 1950, p. 1). As we fast forward through decades of fascinating developments and conversations around AI, we find ourselves trying to understand how machine and human thinking may both complement and supplement one another in the context of teaching and learning.

Humans are uniquely capable of considering context and complex ethical and philosophical conflicts that are paramount in educational decision-making. Teachers serve as situational processors of sorts, loaded with imperatives that must function together - sometimes amidst situational conflict - to achieve the best possible outcomes. Maybe that is why education feels inherently personal, individualized, and situational. It often requires constant introspection, reflection, and (re-)evaluation in order to find a path to knowledge, best practices, and growth. If that feeling is true, how can we, as educators of future teachers, help direct these processes, scaffold effective behaviors, and assist in the development of the next generation who will need to do the same, and how do we do that at the incredible scale and pace required? In short, how might we design and create infinite systems of scalable personalization with finite time and resources, and how do we collaborate with teachers, learners, and AI to make this a reality?

The applications we describe are utilized in programs preparing both special education and general education teachers, as we take an inclusive approach to teacher preparation. While we present specific considerations for special educa-

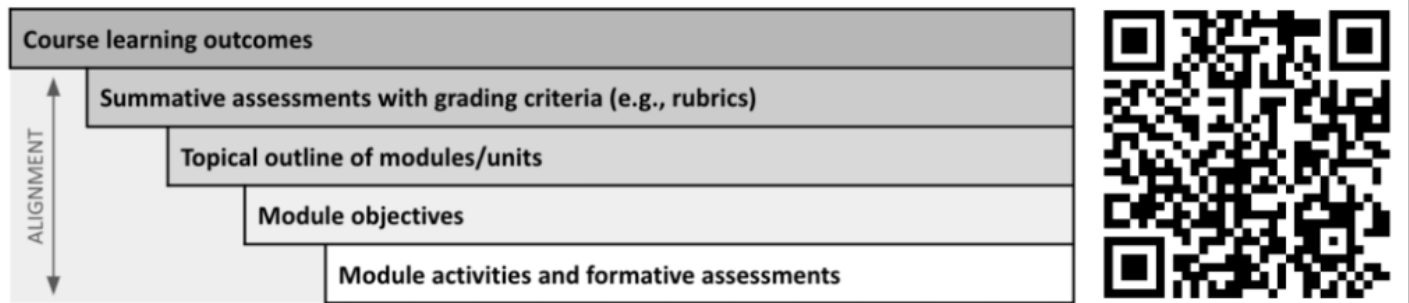
tion, these practices are widely generalizable. Research on AI in teacher preparation is in its relative nascency, as most research to date focuses on teachers’ professional knowledge and practical guidance and frameworks for AI integration (Sperling et al., 2024). We have not located any intervention research that examines the impact of AI use on the learning of teacher candidates. Therefore, at this time, we are primarily documenting how we are utilizing AI for teacher preparation, drawing connections to educational theory and research. We look forward to exploring ways in which we can systematically study the impact of AI integration, as the scholarship of teaching and learning is a critical vehicle for professional growth in the context of rapid technological innovation. We also affirm that our presentation of the applications below is framed within the same ethical boundaries that must anchor all teaching and learning experiences. Although it should perhaps come as no surprise, we have found the infusion of AI in teacher education work replete with fresh quandaries (e.g., *To what extent is it useful to try to detect AI in student work?*) and thought-provoking wonders (e.g., *Might it be unethical to not provide teacher candidates opportunities to learn about, and use, AI effectively in their work?*). In each example, we attempt to unearth some of the most relevant ethical considerations and offer suggested methods to forge ahead into this brave new world. In so doing, we hope we provide a glimpse at the intriguing and oft transformational potential of AI applications while maintaining a reality-based perspective about the ethical considerations, concerns, and limitations inherent to all technological development.

## **CURRICULUM ALIGNMENT AND COURSE DESIGN**

AI can be an invaluable tool for

instructional design and content development. In recent years, faculty at our institutions have undertaken comprehensive updates and redesigns of undergraduate and graduate teacher preparation programs. We generally take a *backward design* approach to curriculum development, beginning with the desired results, determining acceptable evidence, and then planning learning experiences and instruction to match (Wiggins & McTighe, 2005). This effort necessitates substantial curriculum alignment, both at a macro level and within individual courses. Without the use of AI, achieving these changes and launching newly revised curricula would have been significantly more time consuming.

In our curriculum planning processes, after faculty engaged in brainstorming for big picture planning, the next step was to update syllabi and assignments to reflect the revised content. Producing dozens of syllabi in a short time can be overwhelming for full-time faculty who already have many responsibilities. To support us in this process, we utilized generative AI tools (e.g., *ChatGPT*, *Claude*, *Gemini*) to help translate our brainstorming into measurable course outcomes and well-organized topical outlines. This involved providing a single-shot prompt like “*Help me turn this list of ideas into 7-8 learning outcomes,*” followed by a copy and paste of our brainstormed ideas. We then engaged in “dialogue” with the AI to refine these outcomes by asking the AI to *add*, *delete*, *rephrase*, and *combine* ideas, utilizing our content expertise to guide our “conversation.” While this required some time to prompt the AI and refine the outputs, the overall time saved in generating quality course outcomes and topical outlines was substantial compared to creating them from scratch. Moreover, we acknowledge that although faculty have the expertise to do this work without AI, using AI in this

**FIGURE 1:** Funnel Down Approach to Course Design and Alignment with QR Code to an Example Chat

way allows us to be more efficient curriculum designers, offloading lower-order tasks to enhance problem-solving efficiency.

After using generative AI for big picture curriculum alignment, we also applied it to internal course development, aligning course objectives with topical outlines, module-level objectives, assignment descriptions, and assessment criteria and methods (such as rubric development). This was particularly beneficial for developing new online graduate courses. While there are various approaches to using generative AI for this kind of alignment, we found that working with a “funnel down” approach was both productive and efficient (see Figure 1). This approach involved generating course outcomes and summative assessments early on and then making adjustments as we developed the modules/units for the course. Though the approach began linearly, it quickly evolved into a recursive process as we revisited course outcomes and assessments as the modules evolved. Figure 1 also includes a QR code linking to an example AI chat used for course redesign.

Once the framework for each course was developed, some faculty elected to use AI to generate a variety of ideas for in-class and out-of-class activities to support each module, offering students choice in their learning modalities. Generative AI was particularly useful in helping faculty generate case studies, which promote learning through the

application of course content in teacher preparation programs (Richman, 2015). We discovered through this process that when utilizing AI for case study generation, it is crucial to provide careful prompting and critically evaluate the output, as generative AI is prone to reinforcing stereotypes, highlighting biases, or even promoting harmful rhetoric about specific groups of people (Howard & Borenstein, 2018). For example, during a professional development session when we were practicing using AI for case study generation, we entered a prompt to generate a description of a student with a disability who was also an emergent bilingual raised by two mothers. ChatGPT responded by stating that it was not biologically possible to have two mothers. Initially troubled by that response, we queried AI again, prompting it to offer answers that were inclusive of LGBTQ couples, and ChatGPT adjusted by eliminating its originally exclusionary perspective. This experience underscored the importance of being actively engaged in the process and not simply copying and pasting from generative AI without critical evaluation. We are pleased to have observed improvements in AI’s responses over time, reflecting a more inclusive and accurate understanding of diverse family structures.

## SUPPORTING ACADEMIC SKILLS

Gratified by the influence of AI on our curriculum development, we engaged

university students in leveraging AI to enhance their learning and development of key academic skills. Rather than forbidding the use of AI, we advocated for discriminating use, creating contexts where students can learn how to use AI in rewarding and ethical ways and in consultation and collaboration with their instructors. This included explicit instruction on prompt engineering and how to use AI as a scaffold that supports and enriches learning rather than supplants it. Though we have not yet begun to research the impact of our instruction with AI, we connect our instruction back to high-leverage practices (HLPs) for students with disabilities (Aceves & Kennedy, 2024) that are grounded in research and an integral part of our teacher preparation programs. Our most utilized HLPs include using explicit instruction (HLP 16), providing scaffolded support (HLP 15), using student assessment data, making adjustments to improve student outcomes (HLP 6), and providing positive and constructive feedback (HLP 22).

## Getting Started with Prompt Engineering

While most of our students understand that large language models such as GPT-4 are trained on massive amounts of data and designed to respond to simple queries that are void of much context, learners are not always aware of specific strategies for writing prompts within AI platforms. Few students arrived in

**FIGURE 2:** Criteria for Quality Prompting

<b>Clarity:</b> Straightforward, unambiguous, and precise language ensures that requests are understood.
<b>Specificity:</b> Defining the scope and details of requested information better enables the model to generate responses that meet users' expectations.
<b>Neutral Tone:</b> Maintaining a neutral tone helps avoid biased responses, as it allows the chatbot to remain objective and factual.
<b>Inquiry Type:</b> Prompts that clearly indicate whether the user seeks a description, explanation, comparison, etc., guides the model in structuring its response accordingly.
<b>Fact-Based Queries:</b> Requesting fact-based responses rather than opinions, especially in areas where bias is likely to be an issue, prompts AI to rely on verifiable information rather than generalized statements.
<b>Cultural Awareness:</b> Specifying relevant cultural factors helps the AI to tailor its response to the appropriate context, reducing the risk of culturally insensitive or inappropriate responses.
<b>Explicit Instructions to Avoid Bias:</b> Explicitly prompting instructions can avoid specific types of bias that are common in certain disability circles.

**FIGURE 3:** CRAFTS Acronym for Prompting

<b>C</b>	<b>Call to Action</b> Begin with a clear call to action, much like a basic zero-shot prompt. <i>e.g., Explain the concept of motif in literature.</i>
<b>R</b>	<b>Role</b> Ask AI to assume a specific role as it completes the request. <i>e.g., Assume the role of a seventh-grade special education teacher who supports students with learning disabilities, including those with dyslexia, dysgraphia, and language processing disorders.</i>
<b>A</b>	<b>Audience</b> Consider how the output will be used, and by whom, taking care to ensure that AI is aware of who it will be framing its response for. <i>e.g., Include descriptions and examples of motif that students with learning disabilities would understand.</i>
<b>F</b>	<b>Format</b> Direct AI to produce the output in a meaningful format. <i>e.g., Compose your explanation in three paragraphs, and follow with examples of motifs found in popular Taylor Swift songs. Use bullet points to separate these examples from one another.</i>
<b>T</b>	<b>Technicalities</b> Include parameters and other specifics relevant to the desired conventions. <i>e.g., Use words that most seventh graders born and raised in Buffalo, New York would understand.</i>
<b>S</b>	<b>Sociocultural Lens</b> Include social and cultural contexts and direct the bot to mitigate cultural biases in its output. <i>e.g., Use neutral language that does not assume characteristics, roles, or preferences based on protected characteristics like race, gender, age, etc. For example, avoid gender-specific terms when gender is irrelevant.</i>

our classrooms equipped to use generative AI in Fall 2023, shortly after our universities had established policies that supported ethical use. In fact, most of our students were admittedly distrustful of AI, and the limited experiences they had produced less-than-ideal results. Explicitly coaching these learners to add necessary context, examples, non-examples, and criteria of quality in their initial or subsequent queries was an important first step that improved their results and inspired them to try and try again. Invitations to use chatbots to define course concepts, unwrap standards, design learning progressions, and craft lessons, units, and assessments wound their way through many of our courses. As we were new users ourselves, these formative experiences enabled us to study our students' typical prompt-crafting approaches, notice common missteps, and help them work through the resulting knots in their processes. It was through trial and error, in the context of learning alongside our students, that we began to define these criteria for quality prompting (see Figure 2).

Attending to these criteria prepared most students to conduct simple and slightly more complex queries well. In general, prompt quality improved

through explicit instruction, practice, assessment, feedback, and revision. The CRAFTS acronym (see Figure 3) was a useful scaffold for those honing their prompting skills. Eventually, some learners became sophisticated users, particularly those who were likely to test more complex inquiries, such as few-shot or chain-of-thought prompting (Wei et al., 2022), when simple queries returned unsatisfying results. For example, prompting chatbots to produce simple responses to queries like, “Design a lesson that teaches students with dyslexia how to identify the main idea in informational text,” produced less useful results than querying bots to “Assume the role of an eighth-grade special education teacher. Design a 10-minute mini-lesson that includes an explicit strategy for identifying the main idea in a news story. Ensure that this strategy is one that is aligned to best practices for supporting comprehension instruction with dyslexic learners.” It was our experience that pre-service special educators, in particular, relied on these advanced approaches most often. This made sense, as using AI in service to students with learning disabilities requires nuanced and heavily contextualized queries.

### **Instructional AI for Scaffolding Academic Behaviors and Writing**

Our examples thus far have involved the use of generative AI, which produces content for the user. Another way we have supported academic skills is through the use of *instructional* (or *assistive*) AI, which guides writing and thinking processes rather than producing written content for the learner. Instructional AI can be used to appropriately self-level feedback and provide support based on students’ current skill sets, thereby reducing the need for an expert “on-demand” in the form of a professor or writing center tutor. Once again, we successfully leveraged instructional AI

to offload behavioral/skill-building feedback and coaching and devoted the newly generated time capital to engage in higher-level thinking and facilitate both the acquisition and demonstration of content knowledge and classroom-specific applications.

As an example of how newfound/reallocated time can invigorate faculty instruction, some of us utilized a tool called *Packback* to help craft formative and summative discourse and writing assessments. Its built-in behavioral and writing tutor, powered by AI, supports question and argument development, thesis construction, and the alignment of supporting ideas. *Packback* also provides coaching, guiding students to assess the credibility of sources. This provides personalized, real-time support to students and ensures they can preserve their own authentic voice as they demonstrate understanding of content, rather than having that demonstration obscured by limitations of their current academic skill sets. This strengths-based emphasis also supports ethical best practices for supporting agency. Internalized stigmas associated with asking for help, or even self-identifying as a student who needs help, create barriers that *Packback* enables learners to overcome. First-generation college students, as well as those from low socioeconomic backgrounds and other historically marginalized communities, tend to be more affected by such stigmas (Winograd & Rust, 2014), and the implications for increasing equitable access in this way were also a major factor in our decision to implement *Packback*. This application of AI allowed faculty users to pay more attention to the applicative context and content being created by each individual student while using the course design, scope and sequence, and assessments to provide sequential structure. Additional reductions in such direct professor intervention for procedural and remedial

skill support meant we could pace the course to include more deep processing of ideas.

While *Packback*’s AI engine is designed to meet the students at their current level with appropriate feedback as the student works, we also had to create a course structure and assessments customized to meet course objectives within the platform. In that way, we crafted formative and summative assessments in a cadence meant to support the scaffolding of not only assignments, course deliverables, and collaborative discourse but also the scaffolding of the behaviors and skills necessary to be more responsive to individual student needs. We have used the AI-supported tools *Packback* provides – live Socratic discussions, multiple polling features, extended-form writing, and professor analytics and communication tools built for scaling purposes – to provide a sequential course structure that reinforces procedural and process-based skills and behaviors.

Figure 4 shows how we implemented a guided, structured, and sequential course design that efficiently covered the necessary content acquisition and skill development outlined in our course objectives, including a variety of deliverable assessments to match. We found the structuring of weekly, formative, learner-outcome reflections on in-class activities and crowdsourcing student-generated applications were helpful to build up to summative assessments of modular concepts. These assessments provided the majority of the content for the final, more formal, summative deliverable to demonstrate achieved learning outcomes aligned with course objectives. *Packback* provided the AI assistance to build requisite skills where there was a need for individualized, remedial support while not monopolizing in-class time and resources to do so. We found the resultant

**FIGURE 4:** Weekly Course Structure with Packback Instructional AI Tool

<b>MONDAY</b> asynchronous activity before class	<b>Prep Day</b> Automated Poll ( <i>Packback Questions</i> tool - opens at 12:00 AM) <i>Identify the most important main idea take-away from lecture prep materials</i>
<b>TUESDAY</b> In-class activity	<b>Modified Lecture Day (with time to write “crowdsourced content”)</b> Socratic Application Question ( <i>Packback Questions</i> tool) <i>Find an application of a concept we talked about and ask students how they would implement in their own classroom</i>
<b>WEDNESDAY</b> asynchronous activity before class	<b>Prep Day</b> Select a peer question you’d like to present to begin the next in-class activity <i>Look for a peer’s posted application question in Packback you’d like to discuss/explore as a class</i>
<b>THURSDAY</b> In-class activity	<b>Class Content Processing and Related Activity</b> 100-word learner outcome reflection ( <i>Packback Deep Dives</i> tool) 2 Responses to peer questions ( <i>Packback Questions</i> tool) <i>Now that you have digested and clarified content knowledge and engaged in application activity, answer peer questions and inventory your learning</i>
<b>FRIDAY</b> asynchronous activity after class	<b>Reflection or Work on Summative/Modular Deliverables</b> “ <i>What? So What? Now What?</i> ” Format Journal or Summative Deliverable ( <i>Deep Dives</i> tool) <i>Synthesize your learning and be sure to include how you’ll use it in your studies or future classroom</i>

efficiency freed us up to clarify content-based confusion without sacrificing instruction, cultivate excitement about identified student interests, and utilize the influx of time to prepare meaningful experiential activities within our full-class setting.

While most educators strive to maintain such learner-centered postures, special education teachers must be especially attuned and responsive to the unique needs of the children they serve. It was our goal to demonstrate careful course planning for our students and provide a series of assignments and assessments built to accurately reflect the learning outlined in the course outcomes. Reflective discussion of this type of instructional design enabled our students to recognize the benefit of efficient and cohesive planning and execution with AI support.

## SUPPORTING

## TEACHING SKILLS

In addition to using AI to support broad learning skills, as educators in teacher preparation programs, we also used it to support teacher candidates in their development of skills specifically related to instructional planning, delivery, and assessment.

### Using AI to Elevate Instructional Planning and Preparation

Traditionally, teacher candidates learn to write lesson and unit plans during their teacher preparation programs. However, there is a nationwide shift in expectations that turns pre-service teachers toward high-quality instructional materials and encourages adaptation rather than the development of original units and lesson plans (Council of Chief State School Officers, 2022). Generative AI has also become increasingly skilled at writing detailed lesson plans. We need

to ask ourselves: Is our instructional time best spent coaching pre-service teachers to write original lessons or, instead, to analyze and internalize lessons provided to them? Comparably, we acknowledge that many of our teacher candidates will work in schools where they are not given access to high-quality instructional materials, and, as future special educators, teacher candidates may still need to develop specially designed instruction for learners with disabilities that is aligned to individualized education programs (IEPs) as well. We have found it necessary to invite critical discourse with our teacher candidates about their roles, responsibilities, threats, and opportunities in given contexts when considering the use of AI.

Early in our programs, long before they attempt to write a lesson of their own, teacher candidates first learn to lesson plan by analyzing example lessons,

looking for key components like standards, objectives, materials, procedural descriptions, instructional supports, opportunities for student engagement, and formative and summative assessments. In class, they discuss which practices are supported by research and what barriers to learning may be present within the lesson plan. We are beginning to expand this analysis to include lessons produced by AI. For example, a detailed prompt into generative AI – *Write a 45-minute lesson plan for third-grade students around this English Language Arts Standard: “3R6: Discuss how the reader’s point of view or perspective may differ from that of the author, narrator or characters in a text.” The lesson should embrace principles of universal design for learning, offering multiple and flexible means of representing the content, student engagement, and student action and expression* – will produce a detailed lesson plan, complete with most of the key components we would be looking for on our lesson plan templates. If we do not explicitly address AI for instructional planning in our courses, teacher candidates may be inclined to simply copy and paste the AI output into the template without critically analyzing that output to ensure the recommendations by AI are actually based on research and best practice.

As we move forward with AI integration in our programs, we plan to give teacher candidates time to generate lessons with AI, putting into practice some of the aforementioned prompting strategies to improve upon the initial AI-generated lesson. For example, ChatGPT rarely writes lesson objectives in a measurable/observable way initially. A teacher candidate could type the following prompt to adjust the lesson objectives: *Rewrite the learning objectives so they are written in an observable/measurable way with clear criteria that align with the lesson assess-*

*ment.* Depending on the initial prompt, ChatGPT may give some initial ideas for differentiation or universal design, but they are often general ideas. If the teacher candidate is given a case study or is generating a lesson for students at one of their field placements, they could add specificity with follow-up prompts:

- *I have a student who is an English Language Learner in this course; what are at least three ways I could support them during this lesson?*
- *There are two students with IEPs in my class. One student has ADHD and, while they enjoy reading, they have difficulty staying focused on a single task. The other student has a learning disability and is not yet reading at a third-grade level. This student is receiving Tier 3 reading support focused on decoding and phonological awareness. How can I support each of these students during this lesson?*

Not every response from AI will be high quality, but it will generate some ideas that can then be used to spark discussion in teaching methods courses. Then, if and when teacher candidates need to write their own lessons, we hope they will be able to use AI to launch ideas so they can spend their time applying critical thinking and analysis skills to improve the lesson and prepare for quality instructional delivery.

### **Reflecting on Instructional Delivery with AI Coaching**

Alongside a growing emphasis on candidates’ ability to adapt high-quality instructional materials, the integration of video-based coaching in preparation programs is gaining traction as a means to foster self-reflection and improve candidates’ pedagogical skills. Reflective ability is multifaceted and refers to teachers’ ability to (a) describe important

teaching decisions, (b) analyze the reasons behind those decisions, (c) evaluate the impact of those decisions on student learning, and (d) apply insights to create a plan for extending effective or changing ineffective practices in the future lessons (Nagro et al., 2017). Teacher preparation programs have increasingly turned to technology platforms to support teacher reflection (e.g., Vosaic, GoReact) as they provide candidates with the ability to upload videos of their teaching, mark or tag important moments, and then compose reflective annotations tied to those moments. Vosaic recently integrated a new AI feature, *AI Mate*, to “enhance teacher coaching and improve video analysis for research.” Using transcripts from teaching videos, *AI Mate* can analyze an uploaded video lesson and provide time-stamped feedback based on prompts customized by the user. *AI Mate* can be used to support faculty members as they guide and evaluate teacher candidates’ performance. It can also help teacher candidates independently engage in self-reflection, helping them identify strengths and opportunities for improvement and set goals for future teaching.

AI-enhanced coaching offers a predictable mix of advantages and challenges, and benefits from thoughtful decision-making by those well-versed in teacher preparation pedagogy. Instead of primarily serving as a summative measure of teaching proficiency (e.g., videos of lessons as part of a capstone project), we view video as holding far greater promise when wielded as a tool for formative assessment and growth (Kaczorowski & Hashey, 2020). The key to this work is scaffolding teacher candidates’ video-based reflective ability (e.g., Reichenberg, 2022; Nagro et al., 2022), so they enter the profession with the skills to continuously enhance their teaching practices. As with other applications discussed herein, the infusion of AI into



video-based reflection activities holds the potential to upend the traditional roles of both teachers and learners in this space. When scaffolding video-based reflection, teacher educators typically begin by developing candidates' ability to use annotation tools to notice and describe important instructional decisions by watching videos of other teachers, highlighting observed strengths, and making recommendations for further enhancements. The annotation features allow users to mark important lesson segments and annotate those marked moments using text, audio, or video commentary. Once foundational knowledge about evidence-based pedagogy is established and familiarity with the technology tool is achieved, candidates can capture their own teaching with video and use it to describe important moments, evaluate the effectiveness of their teaching, and apply insights from their reflection to set goals for continual growth.

Faculty feedback in a video-based reflection process is critical to nurturing candidates' reflective ability and growth, helping them identify strengths, notice areas for improvement, and set goals for the future. Much like the examples described above that highlight how AI can offload time required for the initial stages of developing assignments or grading, AI Mate offers a similar affordance in video coaching as it can analyze a video lesson and generate initial feedback based on a prompt. For example, in a course where candidates are developing their ability to incorporate specific questioning techniques, a faculty member could prompt AI Mate to, "*Identify all moments where the teacher posed questions to students in this lesson.*" Working from the automatically generated video transcript, AI Mate creates an annotation with hyperlinked time stamped moments for each question posed in the lesson (e.g., 1:34 – 1:42), and provides the

text of questions asked. In this way, AI enables faculty to efficiently access the most pertinent moments related to an instructional skill being taught, freeing up time for the instructor to more deeply analyze these important moments based on criteria they may have taught in class and used in their assignment rubric. The nuanced expertise of the faculty perspective is preserved in this example as the application of AI heightens, rather than subverts, the faculty-student learning relationship. A student receiving detailed feedback from this faculty member about their questioning techniques is then better able to understand their relative areas of strength and areas for growth. Likewise, the faculty member is afforded more time to analyze the frequency and quality of questioning techniques, helping them provide better feedback and thereby gauge their students' questioning ability. Just as we have illustrated in other examples herein, AI Mate can capably provide a foundation for faculty to build upon as they analyze candidates' teaching videos and provide input about the strengths and areas for growth in specific instructional delivery skills.

With more complex prompts, AI Mate can also perform overarching evaluations of teaching videos. One example is the prompt, "*Analyze this lesson using Danielson's Framework for Teaching (FFT). Provide an overall summary of observed strengths and opportunities for improvement, and mark three specific moments where you provide recommendations for growth.*"

While AI Mate will execute this prompt, we see a far more diminished role for faculty expertise and insight, and it raises questions about the quality of feedback for the candidate. In the best-case scenario, an instructor could again use this AI-generated analysis as a base as they view the video and provide feedback. However, given the

nuanced nature of classrooms in which teaching and learning are enacted, videos of actual teaching (as opposed to simulated in-class microteaching) are replete with myriad contextual factors that require a holistic view of the teaching event. These factors are essential for faculty to consider in their evaluation of candidates' teaching performance. In evaluating teaching performance, faculty must always take into account contextual factors such as an understanding of student characteristics (e.g., disability status, multilingual learners), classroom variables (e.g., grade level, individual behavior intervention plans, school-wide practices), curricular focus (e.g., content area(s), relationship to larger unit), and pedagogical orientation (e.g., explicit instruction, inquiry-based approaches, project-based learning), to name just a few. Thus, while AI applications like AI Mate can respond to prompts that attempt to capture the "big ideas" about evidence-based teaching practices in the provision of video-based coaching and also offer suggestions about means of improving instruction, we assert that a faculty member's ethical use of AI for evaluating teaching will always be anchored in a deep understanding of the realities of a given instructional context. As such, AI-generated assessments of specific or general teaching practices, as captured in videos, are most valuable as a starting point for faculty input and less valuable as a standalone end product.

While we affirm an integral role for faculty expertise and insight in the context of class assignments within teacher preparation programs, AI-supported coaching might also be leveraged independently, without faculty involvement, by reflective, self-driven students and by practicing teachers. In this case, we see value in leveraging a tool like AI Mate as a means by which teachers can

receive individualized feedback on their teaching, especially in the absence of a mentor, learning partner, or community of practice. Although some districts support robust approaches to individual teacher professional development, many do not; therefore, facilitating a self-directed approach to professional development can be an invaluable tool.

This is perhaps especially true for novice teachers without access to mentorship, whose schools may not attend to important aspects of teacher induction, or those who are simply struggling to improve their instructional skills. As long as an individual user can leverage relevant criteria for desired teaching performance (e.g., Danielson's FFT, explicit instruction, HLPs), they can create prompts for video-based coaching tools like AI Mate to help evaluate important aspects of their teaching and provide suggestions for improvement. A teacher experiencing difficulty providing timely and behavior-specific feedback, for example, could upload a video and use the prompt "*Evaluate all the instances where the teacher gave feedback in this lesson. Use Archer and Hughes' description of effective feedback skills to identify moments where the teacher could improve the quality of the feedback.*" Upon reviewing the moments highlighted by the AI coach, the teacher can prompt it to provide suggestions for improvements in specific areas. Here, AI as a pedagogical coach may be viewed as an essential ally in service of better teaching and, thus, improved student outcomes in the classrooms of teachers seeking to improve their instruction. Although a more knowledgeable other (e.g., instructional coach, mentor teacher, administrator) is an ultimate collaborator in teacher induction, such individuals are not always available or accessible in ways that allow novice teachers to benefit from their guidance. AI-enhanced video

coaching, as illustrated in the examples above, offers an important avenue for enhancing the provision of feedback in formalized teacher preparation spaces, as well as for those who seek input on their own teaching performance in a more individualized way.

### **Ethical Assessment Design with AI**

Assessing learning in AI-augmented special education settings demands diverse perspective-taking, the intentional interrogation of biases, and a willingness to apply critical lenses to popular but perhaps superficial and even problematic uses of these tools within the field. For example, special educators can prompt AI to provide rapid, abundant, and meaningful feedback on student work alongside a more quantitative evaluation. However, employing AI for this purpose without the consent of each learner and their guardians pushes the boundaries of ethical use. It is important to establish protocols and norms for AI-augmented assessment practices in order to prevent this sort of harm.

Chatbots may also be used to develop differentiated summative assessments, rubrics, examples and anchors, and related learning progressions that integrate multimodal formative assessment opportunities. For example, special educators might use the CRAFTS protocol (see Figure 3) to generate project based learning experiences and related assessments in alignment with grade-level standards. They could prompt AI to generate aligned rubrics and other assessment tools next. Finally, they might direct the application to produce examples and anchors aligned to each performance level. Once complete, teachers might input these data and challenge the machine to produce learning progressions and differentiated approaches that are attentive to the specific needs of learners with disabilities.

As the learning experience unfolds, learners and their guardians can be coached to use AI to receive just-in-time feedback and just-right instructional support at times when the teacher is unavailable. Inputting task directions, aligned rubrics, examples, and anchors and then tasking AI to use these data to generate actionable feedback that also addresses learners with disabilities' specific needs offers a powerful lever for teachers. Establishing norms and protocols for seeking student and parent consent to use AI for such purposes is an important first step for any educator seeking to use AI in this way. For ethical reasons, it makes sense that whenever possible, teachers coach students and their guardians to engage AI for feedback purposes themselves rather than inviting instructors to submit student work to the machine on their behalf. Such practices better protect ownership and privacy. They also build the capacity of students and their guardians to ethically engage AI in service to their unique interests and needs.

It is important for educators to know that AI algorithms are informed by the same social, political, and racial biases that permeate society, and this has implications for assessment design. Taking care to evaluate AI outputs and consider where biases might manifest in the feedback and content generated is a critical first step. Establishing assessment design protocols and learning how to refine prompts to mitigate such biases are essential to ethical use. We must also work to diversify the data sources that AI tools are trained on by ensuring that learners with diverse abilities are shaping the algorithms. Submitting related feedback samples that are free from gender, racial, ethnic, and other biases is also useful. All of these efforts require the consent of students and their guardians, as well as their collaboration.

While it is true that chatbots run on

biased algorithms, it is also true that AI-augmented tools can enable educators to mitigate the personal biases they bring to their own work. This is particularly useful when teachers engage in research that is intended to uncover and address complex learning needs. AI helps educators align and balance their assessment systems, triangulate the data that drives their decision-making, and rely on formative assessment to gain much-needed perspective about performance. While standardized test results and summative local assessments offer meaningful generalizations about what students may know or be able to do relevant to learning outcomes, it is formative assessments and, more importantly, assessments that invite multimodal expression that enable a much clearer view of why students might perform the way they do. Such assessment practices rely on qualitative data, and because they fail to quantify learning or performance, interpretations are more subjective, and analyses are more time-consuming.

Integrating AI tools within such processes can attenuate the influence of bias and increase efficiency by providing data analyses that are consistently and rapidly applied across different contexts and student groups. AI can also highlight patterns and anomalies in student performance that might not be obvious to educators alone and recommend intervention approaches that rely on an array of high-level, research-based best practices, which teachers may not recall on demand or have time to investigate themselves. When appropriately prompted and engaged, AI encourages a more objective review of students' work and learning behaviors, enabling educators to make more informed, equitable decisions.

For instance, [Otter.ai](#) is a transcription tool that is particularly useful to special educators who invite learners to

“Explicitly coaching new users to leverage these tools productively without compromising empathy, understanding, and human connection is especially crucial in special education contexts.”

demonstrate what they know and can do through various means of multimodal expression. This application records audio, captures images, extracts action items, summarizes discussions, and defines patterns and themes in the resulting data. Teachers and learners may rely on the tool to record and analyze small and full group discussions as well as one-on-one conferences with one another. This enables progress monitoring in multimodal contexts where learners may not rely on written words to express themselves. The potential for [Otter.ai](#) to rapidly capture, analyze, code, and summarize volumes of qualitative assessment data, documented in process, as students with learning disabilities leverage the modes of expression that serve them best democratizes the experience while ensuring that special educators are grounding instructional decisions in robust data.

The rise of AI reminds us that the best evidence of learning is gathered in-process. Research suggests that such formative assessment data improves student achievement. This is because formative assessment intentionally illuminates and inspires instructors to

be responsive to students' instructional needs. Moreover, formative assessment has been found to particularly benefit striving learners, thereby reducing the achievement gap (Black & William, 2010). Relying on the products of learning, such as test or quiz results, final papers, and other summative measures, does not necessarily help us understand how conceptual knowledge and critical skills are acquired or where within the process meaning breaks down. It is formative assessment data that guides timely instructional decision-making. With the dawn of AI, learners are also able to rapidly generate robust content that is not reflective of their own thinking, compositional or design capacities, or skill mastery. We simply cannot rely on summative assessments alone to help us understand learners or facilitate learning well. This is why pedagogical documentation is beginning to play an increasingly essential role in our practice.

## DOCUMENTING LEARNING WITH AI

Aware of the biases and significant false-positive rates inherent in AI detection tools, some of our colleagues began decentering summative assessments and requiring students to document their learning processes in order to mitigate academic dishonesty. We know that what makes pedagogical documentation truly powerful is the reflective nature of this work. We document learning in order to study and improve it. We are eager to understand and better serve our students, which means using AI tools to increase natural intelligence and skills as well as learner agency. Pedagogical documentation helps us realize this vision. It involves coaching students to notice when learning is happening; holding space for them to pause and capture images, video or audio recordings, and artifacts of these moments;

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teaching them how to interpret and reflect upon this data; and inviting them to use various tools to curate and share their learning stories.

Pedagogical documentation is a multimodal assessment practice that generates more holistic portraits of each learner, better attuning us to their strengths and needs. This is because each mode of expression enables learners to make their thinking and processes visible in ways others do not (Cope & Kalantzis, 2022). For instance, images capture much that words alone cannot describe, and video recordings of learning in-process help us notice things we would not otherwise. This makes for a far more textured reflection of learning and a nuanced assessment of learners. Experience has taught us that documenting and sharing our collective learning processes fuels feedback loops that improve engagement with course content, between learners, and between learners and instructors. Finally, pedagogical documentation invites us to study the impact of teaching and learning on student performance in ways that summative assessment alone cannot (Hattie, 2023). This is how we humanize the learning process in ways that AI cannot. It is also how we might better mitigate bias and ensure integrity within the assessment process.

For example, AI tools are perfectly capable of quickly producing high-quality literature reviews in various academic contexts, leaving all instructors grappling with the true provenance of any student's submitted work. Alternatively, pedagogical documentation turns our collective attention toward the research and writing *process*. Learners might be invited to document how they conducted their search. They might be challenged to gather audio and video reflections

that make their analyses of gathered sources clear, and they might also be asked to document how each phase of the learning experience changed their thinking about what it means to engage in a discriminating inquiry and complex compositional process. Learners might record their peer review engagements, speak to how their findings inform their thinking about unique personal experiences, and use artifacts from their note-making, drafting, or prototype creation to speak to the evolution of their ideas and work. In this way, pedagogical documentation is a perfect fit for classroom cultures where performance is a byproduct of critical and creative thinking. Pursuing this greater vision enables all of us to bring a far more critical lens to each AI engagement.

## CONCLUSION

AI tools rapidly tailor learning experiences to the diverse needs and interests of individual students by creating multimodal, differentiated content. Our classroom experiences have taught us that pre-service special educators who possess heightened levels of digital literacy, understanding of AI functionalities, and the willingness to tinker, play, adapt, and critically edit AI-generated content enjoy more satisfying results. Explicitly coaching new users to leverage these tools productively without compromising empathy, understanding, and human connection is especially crucial in special education contexts, and this challenges us to pursue curricular alignment with care.

Successful integration of instructional AI shifts our expectations beyond quick content generation or even complex problem-solving in specific classroom contexts. Instead, we suggest that integration is only truly successful if it func-

tions in service to culturally sustaining and deeply human pursuits. When we remember that AI is not merely another tool but a paradigm shift that is reshaping industries, societies, and our own perceptions of learning and cognition, we understand that every instructor and department has a unique role in ensuring students are not only adept users of AI but also critical thinkers, capable of navigating and influencing this rapidly evolving landscape. Collaborating with our colleagues and students to establish a clear vision that makes our shared values and boundaries clear can set a foundation for a more informed, adaptive, and forward-thinking generation of special educators. To accomplish this, we must also remain aware of inherent bias in the algorithms that power AI, their tendencies to erase BIPOC, LGBTQ+, female scholars, and others who live on the margins, and the steps we must take to mitigate harm and teach our students to do the same.

Further research is needed to understand the long-term impacts of AI integration on student learning outcomes and educator practices. Experts in special education technology identify some critical areas for research on AI integration, including personalized learning approaches, accessibility, early identification of learning disabilities, and teacher support (Center for Innovation, Design, and Digital Learning, 2024). The U.S. Department of Education (2024) also emphasizes the need to establish evidence of AI's impact on educational outcomes. They acknowledge the value of documenting the learning process and utilizing broad methods that capture what students know and can do rather than only relying on standardized measures. We posit that studying the pedagogical documentation of pre-service teachers can provide

deeper insights into the learning process with AI. By systematically studying and reflecting on AI integration in educational settings, educators can help establish evidence-based practices that enhance learning and teaching. As we explore and evaluate the impact of AI-enhanced learning, again and always, the questions matter: *What should we ask of ourselves in an AI-augmented learning environment? What should we ask one another? What should we ask the machine? And how?*

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# Leveraging Artificial Intelligence to Enhance Implementation of Research-Based Practices for Teaching Students with Moderate to Severe Intellectual Disability

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## ABSTRACT

Artificial intelligence (AI) has transformative potential to support the education of students with moderate to severe intellectual disabilities (M/SID) and their teachers. Although research and evidence-based practices (EBPs) are integral to fostering positive student learning outcomes, educators face challenges in effectively implementing these strategies. In this article, we discuss how higher education faculty can prepare educators to harness the use of AI as a powerful tool to support the implementation of EBPs in the classroom, addressing teacher fluency and maintenance of application.

## KEYWORDS

**Artificial intelligence, evidence-based practices, instruction, moderate to severe intellectual disabilities, research-based practices**

The core principle of *research-based practices and evidence-based practices*<sup>1</sup> (EBPs) is to define and employ practices and instructional strategies that have demonstrated positive impacts on student outcomes through rigorous research across multiple studies (Hsiao & Peterson, 2019). Over the last decade, various literature reviews (e.g., Browder et al., 2014; Saunders et al., 2020; Spooner et al., 2012) and valuable, reliable, and no-cost resources and tools have emerged from research centers (e.g., Collaboration for Effective Educator Development, Accountability, and Reform [CEEDAR]; Frank Porter Graham Child Development Institute [FPGI]) to aid in teacher preparation and the application of recognized EBPs for students with moderate to severe intellectual disability (M/SID). Browder et al.'s (2014) Innovation Configuration specifically outlines EBPs to support students with M/SID across the domains of academics, daily living, job and community, self-determination, and social and communication skills. Legislation such as the Every Student Succeeds Act (ESSA, 2015) and the Individuals with Disabilities Education Act (IDEA, 2004) mandates that schools utilize alternative assessments for students who partake in alternate assessments based on standard state academic content assessments. In order to equip students with the ability to demonstrate advancement in line with state standards, even amid adjusted achievement expectations, teachers require comprehension of academic interventions.

## Capabilities of Artificial Intelligence Technologies in Supporting Pre-Service Teachers

Artificial Intelligence (AI) technologies offer a diverse range of capabilities that can significantly support teacher preparation, ultimately enhancing the quality of education (Center for Innovation, Design, and Digital Learning [CIDDL], 2024). AI has the potential to reduce educator stress and burnout by automating tasks like grading and lesson planning. One key area where AI excels is in assisting educators in curriculum development and lesson planning. Natural language processing algorithms can analyze educational materials, textbooks, and online resources to identify

<sup>1</sup> Throughout this paper we have italicized research- and evidence-based practices to highlight for readers.

relevant content, suggest instructional strategies, and even generate lesson plans. This not only saves teachers time but also ensures that lessons are aligned with learning objectives and standards. However, it is crucial to address challenges related to training and job security to ensure that AI integration complements teaching rather than replacing it.

Overall, AI technologies have the potential to revolutionize teacher preparation by providing personalized learning experiences for students, streamlining curriculum development and lesson planning, and offering innovative approaches to professional development for educators. By harnessing the power of AI, we can better equip special educators with the tools and resources (including time) they need to effectively support student learning and achievement (Marino et al., 2023), aligned with research.

### Connections Between Teacher Preparation and Research- and Evidence-Based Practices

Although AI has many benefits, it is still critical for teachers to understand and implement research-based practices and EBPs fluently. For students with M/SID, specific EBPs have been identified and are included in textbooks used with pre-service teachers fulfilling coursework relevant to students with M/SID (e.g., constant time delay, system of least prompts, task analysis; Browder et al., 2020; Collins, 2022). Using AI to identify these EBPs is not enough. As instructors of pre-service teachers, we ourselves need to be able to communicate and teach these EBPs and lead our students through the phases of learning.

Just as we ask our teachers to do for their students, we must guide pre-service teachers through the four stages of learning (Collins, 2007). These stages include acquisition (i.e., learning a new behavior or response), fluency (i.e., how well/quickly a teacher can make that

**FIGURE 1:** Example of a Task Analysis for Self-Monitoring KWHL Chart

☐ filling out my KWHL chart

☐ Write the topic in the "K" column

☐ List what I already know in the "W" column

☐ Jot down questions I have in the "H" column

☐ Identify where I can find answers in the "L" column

☐ Continue researching and adding to the chart.

Note. Generated by goblin.tools

response), maintenance (i.e., the ability of a teacher to make that response over time), and generalization (i.e., the ability of a teacher to perform a behavior over time; Collins, 2022).

Currently, faculty members are tasked with integrating technology into their own courses, as well as equipping future special educators with the skills to effectively utilize technology in their classrooms (Markelz, 2022). We must teach our pre-service teachers wisely, instructing and assessing to be sure that our students are fluent in research-based practices and EBPs while teaching in parallel how to use technology—including AI—to support classroom instruction. While AI technologies can provide lesson plans, materials, and assessments, AI alone cannot take the place of a teacher who is versed in research- and evidence-based instructional practices.

### Research-Based Practices and Evidence-Based Practices and AI

According to current talk across the field of education, AI holds potential for various applications within the classroom setting (e.g., grading and feedback, student monitoring and supports) that can enhance student engagement or predict graduation rates and accessibility

(Remian, 2019). However, more examples are needed of how pre- and in-service educators can use AI to support the research-to-practice gap (CIDDL, 2024) by addressing their own needs, as well as those of their students with M/SID. Multiple AI tools can be found that assist in creating lesson plans; however, when considering the complex support needs of many students with M/SID, it is necessary for educators to utilize and combine multiple AI resources to maximize their time and effort. In the following sections, we offer examples of employing research-based practices and EBPs alongside AI to educate students with M/SID. We also illustrate how AI can assist in teacher preparation and enhance maintenance and generalization in implementing these research-based practices and EBPs.

### Task Analytic Instruction

A *task analysis* (TA) is an evidence-based (McConomy et al., 2022; Sam & AFIRM Team, 2015) systematic instructional tool used to break down the steps involved in a task to help make it more manageable and bite-sized. TAs can be implemented in many areas for students with and without disabilities, including academic, adaptive, and everyday living skills. While each TA should

**FIGURE 2:** Example of a Task Analysis for a Developing Lesson with Grade-Aligned TextChart

<input type="checkbox"/> creating a lesson plan using different AI tools for teaching the novel <i>Animal Farm</i>
▶ <input type="checkbox"/> Research different AI tools available for creating lesson plans
▶ <input type="checkbox"/> Select AI tools that are most suitable for teaching literature
▶ <input type="checkbox"/> Familiarize yourself with the novel <i>Animal Farm</i> and its themes
▶ <input type="checkbox"/> Outline the key concepts and learning objectives you want to cover in the lesson plan
▶ <input type="checkbox"/> Use the AI tools to create engaging activities and assessments for the students
▶ <input type="checkbox"/> Incorporate multimedia elements such as videos, interactive quizzes, and simulations
▶ <input type="checkbox"/> Ensure that the lesson plan aligns with educational standards and guidelines
▶ <input type="checkbox"/> Test the lesson plan using the AI tools to identify any areas that need adjustments
▶ <input type="checkbox"/> Gather feedback from colleagues or beta testers on the effectiveness of the lesson plan
▶ <input type="checkbox"/> Make any necessary revisions based on the feedback received
▶ <input type="checkbox"/> Finalize the lesson plan and establish a timeline for implementation
▶ <input type="checkbox"/> Monitor student progress and engagement during the lesson
▶ <input type="checkbox"/> Evaluate the lesson plan's effectiveness in meeting the learning objectives
▶ <input type="checkbox"/> Make adjustments to the lesson plan as needed based on student performance and feedback

Note. Generated by goblin.tools

be individualized for students' current skill levels, AI can support educators in developing and then editing the steps needed for a particular student to learn a new task. See Figure 1 for an example of how AI (i.e., GoblinTools) generated a TA to support student *self-monitoring* by filling out a KWHL *graphic organizer* (see Saunders et al., 2020). Figure 2 also shows how a TA can be used to support teacher instruction, in this case, how to create a lesson using *grade-aligned text* (Browder et al., 2014).

### Story-Based Lessons

*Shared story reading* is an EBP for students with M/SID and is defined as a practice used to access age-appropriate literature through reader-listener interaction in which a story is read aloud and the student interacts with components of the text (Hudson & Test, 2011). Also known as a *story-based lesson* (SBL), the development of grade-appropriate text can be time-consuming. Teachers typically gain fluency in new skills over

time through practice to develop SBLs. However, AI could significantly aid in adapting text, playing an important role in this process.

**Repeated Storylines.** Another component in SBL is the use of repeated storylines. Repeated storylines have been used across adapted text to provide students with big ideas of a short book, chapter, or sections of a book (Browder et al., 2007). They have been used to provide sentences for *choral responding* (Sindelar et al., 1986), used for writing mini-book reports by sequencing the sentences to summarize the story, and have been programmed into augmentative and alternative communication devices to increase opportunities to respond during literacy lessons for students with complex communication needs (Browder et al., 2008). Sometimes, it is hard to generate a one-sentence repeated line that accurately describes the chapter. AI can be used to support this—and save time doing so. An example of repeated storylines for

Chapters 1-3 of *Animal Farm* by George Orwell generated by ChatGPT is presented in Table 1. It is important to note that this should be used as a tool and that knowledge of the book is important before utilizing AI to ensure that the generated repeated storylines align with the chapters and novel.

**Mathematics and Science.** Educators of students with disabilities are often expected to teach most, if not all, of the content areas to their students while also attempting to individualize and differentiate to ensure all students are able to access the general education curriculum. Many special educators have expressed feeling unprepared to teach certain content areas, such as mathematics or science (Knight et al., 2018). This is where the assistance of AI is particularly useful. Research has shown that using children's literature with students with M/SID to teach mathematics concepts helps with student engagement and increasing problem-solving skills by putting these concepts into contexts students can relate to (Courtade et al., 2012). Within mathematics instruction, AI can help teachers create individualized math stories based on student interests, math standards, and early numeracy concepts.

Science wonder stories are another example of a research-based practice to enhance student comprehension of complex science concepts (Apanasionok et al., 2020; Browder et al., 2014). However, educators must be familiar enough with the science concepts to create a story that is not only scientifically sound but also does not promote misconceptions while maintaining personally relevant experiences (Trela & Jimenez, 2013) for the students. With the help of certain AI tools, teachers can learn how to create mathematics and science stories that are both individualized to the students' abilities and needs along with their personal interests to increase engagement. For example, for a student



**TABLE 1:** Example of Repeated Story Lines for Chapters 1-3 of the Novel, *Animal Farm*

Chapter	Suggested repeated story-line
1	Mr. Jones, the farmer, is mean to the animals and doesn't treat them well.
2	The animals gather secretly to discuss their plans for rebellion.
3	Mr. Jones and his men try to take back the farm from the animals, but the animals are brave and stand up to them.

Note. Generated by ChatGPT

with a high interest in music who is learning to add numbers from one to 10, an educator could use AI to generate a mathematics story featuring the student's favorite singer, along with math problems aligned with their learning goals.

### Vocabulary Instruction

Vocabulary instruction is an important lesson component to enhance student comprehension. Vocabulary words can be taught either explicitly or incidentally and are often categorized into three different tiers. Tier 1 words are the everyday words that are used and heard often. Tier 2 words are words that might appear often in readings and heard from adults but may not be as familiar to a child, while Tier 3 words are usually content-specific (Spencer et al., 2012). When choosing vocabulary to teach, it can be difficult to decide which words are the most important, particularly when teaching grade-aligned content. AI tools can be used to generate a list of key vocabulary and definitions for a given topic. When using AI to generate a vocabulary list, educators should be cautious and check that the vocabulary aligns with the lesson and that the definitions are accurate. Further, educators should consider editing definitions into language and reading levels appropriate for their students.

### Lesson Sample: Using AI to Support Research to Practice

#### Story Based Lesson Components

Please see the Supplemental Materials (Example Lesson Development of

*Animal Farm* Using AI Tools), in which we outline multiple examples of how various AI tools could be used within an instructional unit (e.g., *Animal Farm*). We first started by asking AI to develop adapted text for the first three chapters of the book using a third-grade Lexile reading level, followed by vocabulary words for the first three chapters, along with the definitions of each (i.e., rebellion, comrades, tyranny). It should be noted that the vocabulary words generated were not always in the adapted text; therefore, it would be important to edit the text to add those keywords, as they are important concepts in the story. You may also need to use broader or more narrow prompts if the tool is not generating what you are looking to teach. For example, to modify the definition for the vocabulary word *tyranny*, we asked the tool if it could define tyranny as language appropriate for students in seventh grade with extensive support needs, to which it generated a few different examples of a modified definition to choose from.

Next, we prompted the tool to create comprehension questions from the first three chapters that align with Bloom's taxonomy (i.e., a published framework for categorizing educational goals. Bloom's taxonomy is used to design learning activities, assessments, and instructional strategies that promote higher-level thinking skills and deeper understanding among students). It is important for educators to first review the English language arts (ELA) standards aligned to the grade level of the

students they are teaching. For example, figurative language is highlighted in ninth-grade ELA standards—the adapted text and comprehension questions should also include figurative language. We then created the repeated storylines (see Table 1). AI tools can create adapted novels for students; however, it is important to understand that AI is not perfect at creating correct grammar usage. Therefore, educators must ensure that the adapted novel is clear and true to the meaning of the novel and the standards being taught. Additionally, if you use a resource to create an adapted story, keep in mind that the vocabulary instruction, comprehension questions, and repeated storylines generated by an AI tool may no longer align with the adapted version. It is important to check that your lesson and assessments are aligned.

### Lesson Plan Development

Using another AI tool, we generated a lesson plan that included learning targets, assessment suggestions, and an outline. We did need to edit some of the learning targets to better align with the lesson. This tool was able to create an assessment for the lesson it generated, or you can input questions aligned with Bloom's taxonomy to create a worksheet. Along with the lesson plan, this tool also generated an interactive slide deck to go along with the lesson, which outlined the story elements of *Animal Farm* as well as guided questions. We then used the draft slide deck to edit, align vocabulary, adapt text, adapt key comprehension questions appropriate

**TABLE 2:** ChatGPT Suggestions for Adaptations and Modifications for Teaching *Animal Farm*

Adaptation/Modification	Descriptions
Use Interactive Technology	audiobooks, e-books with text-to-speech features, or accessible digital platforms
Provide Physical Supports	adapted seating, positioning devices, or assistive technology devices that help students access and interact with the novel more comfortably.
Implement Augmentative and Alternative Communication (AAC)	communication boards, speech-generating devices, or picture exchange systems to facilitate communication and participation in discussions about the novel
Simplify Text and Language	Use adapted versions of the novel with simplified vocabulary, shorter sentences, and clear visual supports.
Provide Sensory Supports	incorporating sensory supports such as tactile materials, auditory cues, or sensory stories that engage students' senses and promote comprehension and retention of the story's content.
Offer Adapted Activities	Provide hands-on activities, interactive games, or modified art projects that allow students to explore and interact with the story in meaningful ways.
Use Visual Supports	picture symbols, visual schedules, or graphic organizers to help students organize and understand the story's plot, characters, and key concepts. Provide visual cues and prompts to support comprehension and communication.
Personalize Learning Experiences	Offer choices and opportunities for students to engage with the story in ways that align with their abilities, preferences, and strengths.
Encourage Peer Support and Collaboration	Foster peer support and collaboration by pairing students with and without disabilities in learning activities related to "Animal Farm." Encourage peer modeling, cooperation, and mutual assistance to promote social interaction and learning.
Provide Adapted Assessments	Use alternative assessment methods such as verbal responses, visual presentations, or interactive projects that reflect students' unique abilities and strengths.

for the students, and plan grade-aligned standards.

**Personalization.** Using the MagicSchool AI tool, we wanted to enhance engagement and differentiate activities. We used the *Make it Relevant* generator to generate activities relevant to individual student backgrounds. We asked it to create activities for students who are non-verbal, in wheelchairs, and live in state-run homes. MagicSchool generated differentiated activities for these descriptions of students. While this tool was a great start, we then used these ideas to consider cultural sensitivity when implementing activities while also ensuring that students' accommodations were still being considered. AI tools can generate content that is sensitive to cultural nuances and linguistic diversity. This ensures that instructional materials are

respectful and inclusive. Table 2 outlines examples of AI-generated modification and adapting suggestions for our example lesson on *Animal Farm*.

### **Cross-Curricular Components**

Utilizing the MagicSchool *Math Word Problems* generator, we prompted it to create word problems aligned to the high school geometry standard for teaching planes, lines, and angles. Using *Animal Farm* as a theme, it generated examples that incorporated the characters and settings of the novel. In addition, to create a social studies lesson, we first prompted ChatGPT to identify the social studies themes within *Animal Farm*. We then thought about how to align these themes with our own individual state grade-level standards. Finally, we created a social studies lesson plan aligned with the state

standards that included a tool that provided a step-by-step lesson along with suggestions for differentiation. We then used *Accommodation Suggestions* to ask how students with M/SID could participate in the geometry lesson. However, the suggestions were incredibly generic (e.g., provide hands-on experiences), thus highlighting that AI tools are just a starting point for educators, not a replacement.

### **The Future of Innovation and AI for Educating Students with M/SID**

Holmes et al. (2021) expressed concern with the ethical intentions of using AI in the classroom, stating that there is a difference between "doing ethical things and doing things ethically" (p. 504). The authors went on to argue that

to do things ethically not only means to make ethical choices but also to consider any unintended consequences that could arise, including in the areas of bias, equity, inclusion, and autonomy. The most immediate ethical concern with using AI to support students with M/SID is student privacy and well-being. Educators need to be aware of the legal implications of using students' identifiable information when utilizing AI to assist in creating accommodations, goals, individual education programs (IEPs), and behavioral support plans. When using these tools to help teachers ease their workloads, caution should be used (e.g., being used as a generic guide instead of having it generate a complete IEP for any student). AI serves as a valuable tool to support teachers and aids in preparing educators for their multifaceted role in teaching. Rather than replacing the demands of lesson planning, it enhances and supports teachers as they develop greater fluency in their craft.

### **Higher Education and Teacher Preparation**

Similar to the research-to-practice gap, there seems to be a gap in professional development for institutions of higher education (IHEs) related to AI. In 2023, the U.S. Department of Education's Office of Educational Technology published a report on AI and its impact on the future of teaching and learning. The report urged increased research and development in integrating AI into teacher preparation programs, calling on institutions to systematically incorporate AI into their curricula.

Since the report was published, there have been several responses to the call. Black et al. (2024) propose seven critical strategies to offer guidance to IHEs regarding the revision of their curricula. These strategies are aimed at preparing pre-service teachers to create effective learning environments for their students

using AI technologies and include (a) fostering a universal foundational understanding of AI, (b) cultivating skills for effectively harnessing AI instructional tools, (c) using the five big ideas in AI as guidance for K-12 AI literacy education [perception, representation and reasoning, learning, natural interaction, and societal impact; AI4K12], (d) facilitating exploratory experiences that develop and apply AI knowledge, (e) infusing AI literacy across existing curriculum, (f) integrating critical examinations into classroom experiences, and (g) intentionally infusing these approaches into teacher preparation. Please see Black et al. for further information.

Although these strategies may be new for IHEs, they are critical. We cannot expect our pre-service teachers to use AI effectively (i.e., after fluency of instructional skills) without first addressing needs at the college or university level.

### **The Role of AI in Supporting Educators**

Educators of students with M/SID often play multiple roles, including grant writing for additional resources within their own classrooms. AI may also provide support and help build fluency in grant proposal development. For example, teachers could ask tools, such as ChatGPT or Copilot, "What are some organizations that provide funding to get assistive technology in my classroom;" or "How can I get grants for assistive technology I need in my classroom;" or "Could you create an example of a generic grant proposal for assistive technology that I could modify for different organization's requirements?" After using AI to support grant development, educators would still need to consider the specific guidelines within the call for proposals and review how their own classroom and specific needs are embedded into the proposal.

AI can also play a pivotal role in

fostering collaboration and communication among educators, therapists, and parents who serve students with M/SID. A collaborative approach is essential for providing holistic support to students with intellectual disabilities (Jimenez & Taber-Doughty, 2023). Virtual assistants and chatbots, armed with AI capabilities, serve as valuable allies in this endeavor. For example, educational teams often grapple with finding relevant resources tailored to individual student needs. AI can curate and recommend appropriate materials, such as adaptive learning modules. AI-powered virtual assistants may offer real-time support to teams by answering queries.

In conclusion, this article advocates for the integration of AI technologies as a means to enhance the implementation of research-based practices and EBPs in the classroom for students with M/SID. By leveraging AI's capabilities, higher education faculty can prepare educators in creating a more adaptive, inclusive, and personalized learning environment, ultimately supporting educators to improve the educational experiences and outcomes for this unique population.

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# Teaching in the Era of Artificial Intelligence: Reimagining Activities and Assignments in Preservice Special Education Teacher Education Programs

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## ABSTRACT

Artificial intelligence (AI) text generators, such as ChatGPT and Copilot, have been used for various purposes such as creating written content, writing or debugging computer code, answering questions, providing information, and improving written communication. This robust functionality of AI text generators along with the high rate of use reported by college students highlights the need for instructors in special education teacher preparation programs to contend with the impact of AI on teaching and learning. The purpose of this article is to provide examples of how teacher educators might reimagine assignments and activities in the era of AI text generators. Specifically, the authors explore ways that AI applications might be intentionally incorporated or, conversely, intentionally restricted in the design of course assignments and activities.

## KEYWORDS

**Artificial intelligence text generators, AI, educational technologies, large language models, teacher education**

**A**rtificial Intelligence (AI) refers to software designed to simulate human intelligence. AI text generators achieve this by using machine learning and advanced natural language processing techniques to automatically generate a written response when presented with a query or prompt. AI text generators have been used for myriad purposes, including creating written content, writing or debugging computer code, answering questions, providing information, and improving written communication. These tools have the potential to help educators streamline various aspects of their work, allowing them to focus more on individualized instruction, student support, and overall classroom engagement (Howard et al., 2024). For example, AI text generators may assist educators in creating schedules, organizing resources, generating lesson plans, adapting content, or generating and editing emails, newsletters, or other communication. Although not focused solely on special education teacher preparation programs, recent research has revealed widespread use of AI text generators among college students. Specifically, a recent survey indicated that 56% of college students reported using an AI application to help complete assignments or exams, and 53% reported having completed assignments that required the use of AI (Nam, 2023; Welding, 2023). The robust functionality and the high rate of AI text generator use by college students highlight the need for instructors in special education teacher preparation programs to consider the impact of AI text generator use on teaching and learning.

Numerous AI text generators are currently available, including Copilot (formerly known as Bing Chat), ChatGPT, Jasper, ChatSonic, and Bard (Ortiz, 2023). Ortiz (2023) summarized the similarities and differences of several AI text generators across a range of variables, noting that some tools are free (e.g., Copilot, Google Bard), some have both free and subscription options

The robust functionality and the high rate of AI text generator use by college students highlight the need for instructors in special education teacher preparation programs to consider the impact of AI text generator use on teaching and learning.

(e.g., ChatGPT), and others are only available through a paid subscription (e.g., Jasper, ChatSonic). Further, while some AI text generators access content directly from the internet to generate responses (e.g., Copilot, Google Bard), others use pre-trained text data that is updated as new text becomes available (e.g., ChatGPT; Ortiz, 2023). Due to differences in their purpose and structure, different AI text generators may provide different responses to the same queries, and AI text-generated responses are likely to change over time, even when using the same AI application. In this paper, we used different AI text generators for our examples to illustrate the use of a variety of platforms. However, when developing their own assignments, instructors should be aware that using the prompts/queries from this paper may result in different responses from different platforms and at different times. It is important to note that, as existing AI tools evolve and new ones are developed, the unique aspects offered by different AI text generators will likely change. As a result, course instructors and preservice teachers must learn about AI in general, as well as the features of specific applications. Moreover, policies and practices related to the use of AI text generators vary across campuses (Nam, 2023) and are likely to change over time. Teacher educators must learn about and adhere to

their own campus policies related to the use of AI on course assignments, particularly as some campuses may ban AI use or consider it to be plagiarism. Instructors should also include a statement on their syllabus regarding their expectations related to students' use of AI text generators.

All AI text generators are subject to limitations and potential harms, including the generation of incorrect or biased content; the generation of different responses based upon the phrasing of the prompt/query, the AI application used, and timing; and implications for privacy. Given that AI applications generate content from existing data, including text found on the internet and/or the data that they are trained on, and that their algorithms are created primarily by a homogenous group of people with their own biases (Williams, 2024), AI-generated content has been shown to contain inaccuracies, biases, and subjective viewpoints (Hao, 2019). When queried about this limitation, ChatGPT responded by indicating, "... While I strive to provide helpful and informative responses, it is important to remember that I can generate content that may not always align with factual, ethical, or widely accepted viewpoints" (OpenAI, 2023a). This limitation is further impacted by the fact that the phrasing of the prompt/query given to the AI text generator can influence its output. For example,

ChatGPT indicated,

The phrasing of the query can greatly impact the AI-generated response. Different phrasings may prompt the AI to provide varied answers or approach the subject from a different angle. Additionally, specific keywords or phrases used in the query can influence the AI's response by guiding it towards relevant information or triggering certain pre-programmed patterns of behavior (OpenAI, 2023a).

With these limitations in mind, instructors and college students should recognize that AI text generators are simply technological tools (Heberer et al., 2023; Lanier, 2023) and that the effective and ethical application of these tools is dependent upon the skills and abilities of the person using them. Therefore, instructors in special education teacher preparation programs need to ensure that preservice teachers understand how to effectively use AI text generators (e.g., recognizing the impact of the wording of queries on responses, critically evaluating the retrieved information, fact-checking content by corroborating information from multiple sources). In addition, instructors must help preservice teachers understand that the ethical issues around AI use in PK-12 settings are not yet fully understood. Therefore, preservice teachers will need to take responsibility for continuing to update their knowledge on ethics related to AI use in educational settings (e.g., Crompton et al., 2024; Tang & Su, 2024).

In addition to understanding how to use AI text generators effectively and ethically, instructors also must ensure that preservice teachers know and follow laws, school/district guidelines, and ethical standards to prevent personally identifiable information (PII)

**FIGURE 1:** Framework for Reimagining Activities and Assignments Using AI

<p><b>ASSIGNMENT NAME:</b></p> <p><b>Desired Preservice Teacher Outcomes:</b> <i>(What should the preservice teacher be able to do as a result of this task or experience? Are all outcomes observable and measurable?)</i></p> <p><b>Task Analysis:</b> <i>(Clearly identify each step in the assignment.)</i></p> <p><b>AI Usage and Limitation:</b> <i>(How will AI be used or limited/constrained? Refer to the desired outcomes and task analysis to determine where using AI may increase efficiency without compromising critical thinking, or where explicit limitations on AI may be desired to encourage critical thinking.)</i></p> <p><b>Support Preservice Teacher Use of AI:</b> <i>(What skills will preservice teachers need to learn to use AI? Select all that apply.)</i></p> <p><input type="checkbox"/> Identifying and refining prompts/queries</p> <p><input type="checkbox"/> Analyzing and evaluating AI-generated content</p> <p><input type="checkbox"/> Safeguarding and redacting personally identifiable information (PII)</p> <p><input type="checkbox"/> Documenting the use of AI text generators (including the tool and the prompt/query)</p> <p><input type="checkbox"/> Citing and referencing AI-generated content</p> <p><input type="checkbox"/> Other: _____</p> <p><input type="checkbox"/> Other: _____</p> <p><b>Carefully Design Evaluation Rubrics</b> <i>(Can more points or weight be given to parts of the assignment that cannot be completed solely using AI? Parts of an assignment that cannot be completed solely using AI are listed below. Select all that apply.)</i></p> <p><input type="checkbox"/> Analyzing accuracy of AI-generated content</p> <p><input type="checkbox"/> Applying AI-generated content to real-world scenarios</p> <p><input type="checkbox"/> Using AI-generated content to articulate and defend ideas in ways that go beyond straightforward information retrieval</p> <p><input type="checkbox"/> Responding to questions that require a deep understanding of AI-generated content</p> <p><input type="checkbox"/> Self-reflecting on personal growth or assignment quality</p> <p><input type="checkbox"/> Other: _____</p> <p><input type="checkbox"/> Other: _____</p>
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of PK-12 students from being shared online. Teacher educators should emphasize that laws such as the Family Educational Rights and Privacy Act (FERPA; 1974) apply to information submitted to AI text generators in the same way they apply to other forms of online and offline sharing. Research on other online platforms has shown that school personnel may be disclosing considerable amounts of PII on social media, which may risk PK-12 student privacy in unethical and/or illegal ways (Rosenberg et al., 2022). Although the risks of releasing PII on social media are not exactly the same as the risks of submitting PII to AI applications, preservice teachers should be taught to never enter PII into AI text generators. This type of

sharing would violate FERPA because the information is being disclosed to a private company which clearly does not comprise “school officials” acting with “legitimate educational interest” on behalf of students (FERPA, 1974). Due to these considerations, instructors should include explicit guidance and feedback to ensure that preservice teachers do not enter PK-12 student PII in prompts or responses to AI application exchanges, particularly when they have access to actual student data for an assignment (e.g., case studies, assessment reports, field placement observations and reflections).

The advantages of AI combined with the limitations and potential harms of these technology tools result in the need to carefully examine their

use. Figure 1 provides a framework to guide course instructors as they reimagine activities and assignments in special education teacher preparation programs in the era of AI text generators. As illustrated by Figure 1, this framework includes (a) articulating desired preservice teacher outcomes, (b) developing a task analysis of the assignment or activity, (c) identifying how AI will be used or limited, (d) specifying what supports preservice teachers will need to learn to use AI, and (e) designing evaluation rubrics to ensure that preservice teachers cannot complete or pass a course/assignment using solely an AI text generator. Based upon this framework, the purpose of this article is to provide specific examples of how assignments



**FIGURE 2:** Reimagining PLAAFP and IEP Components to Include the Use of an AI Text Generator**ASSIGNMENT NAME:****ASSESSMENT REPORT CASE STUDY****Desired Preservice Teacher Outcomes:**

*(What should the preservice teacher be able to do as a result of this task or experience? Are all outcomes observable and measurable?)*

As a result of this assignment, preservice teachers will:

- interpret assessment data from a case study of a PK-12 student
- protect PK-12 student PII by redacting it before entering assessment data into an AI text generator
- evaluate the quality of a partial PLAAFP statement and IEP goals generated by an AI text generator
- revise/rewrite the generated PLAAFP statement to meet the quality criteria of a PLAAFP statement
- revise/rewrite the generated IEP goals that follow from the data and PLAAFP statement
- provide written citations and references to an AI text generator program

**Task Analysis:**

*(Clearly identify each step in the assignment.)*

**Step 1:** Based on the data in the assigned case study, summarize the assessment data in a brief narrative for one area of assessment (i.e., behavior, math, reading, writing social/behavioral, physical, or functional skills) for the hypothetical PK-12 student.

**Step 2:** Using Copilot (so you can check the sources it has used), set the conversation style to “more precise”, enter the narrative assessment data (without the PK-12 student’s PII) and request that Copilot write a PLAAFP statement that meets the criteria that we have learned in class. Example prompt: “Please write a Present Levels of Academic Achievement and Functional Performance (PLAAFP) statement, comparing the student’s performance to 4th grade level Acadience or DIBELS Next benchmarks, including the student’s strengths and needs, and including an impact statement, for the reading performance of a 4th grade student with a specific learning disability in basic reading using these baseline data, like a special education teacher would: 3rd grade level: 80 words correct per minute with 6 errors on 3rd grade, with retell fluency of 32, and retell quality of 3 on curriculum based measure passages. 4th grade level: 62 words correct per minute with 10 errors; Retell fluency of 27 and retell quality of 3. He likes to read graphic novels.” Please copy and paste the prompt you entered, the results of the chat, and the citations provided by Copilot into your assignment. Also, please include an APA citation to the AI text generator (see McAdoo, 2023: <https://apastyle.apa.org/blog/how-to-cite-chatgpt>).

**Step 3:** Write a brief evaluation of the quality of the generated PLAAFP statement, ensuring that the statement includes accurate information based on the assessment(s) that were used, the grade level comparison, all the needed components, etc. Revise the PLAAFP statement as needed to meet the criteria.

**Step 4:** Using Copilot, enter the revised PLAAFP statement and request that it generates two annual IEP goals using the SMART criteria (spelled out). Example prompt: “Please write an Individualized Education Plan (IEP) goal using the Utah State Core Standards, so that it is SMART: Specific, Measurable, Attainable, Results-oriented, and Time-bound for 5th grade reading levels using these baseline data [referring to the revised PLAAFP statement], like a special education teacher would: In September 2020, a 4th grade student reads 80 words per minute with 6 errors at a 3rd grade reading level.” As in Step 2, please copy and paste the prompt you entered, the results of the chat, the citations provided by Copilot, and a citation to the Copilot program into your assignment.

**Step 5:** Write a brief evaluation of the quality and appropriateness of the IEP goals based on the data provided, your knowledge of the academic or behavioral area, and SMART criteria. If needed, revise the IEP goals to meet the required criteria.

**Step 6:** Make sure your PLAAFP component and IEP goals are individualized to the PK-12 student now. You can and should add the PK-12 student’s name and other relevant PII at this point.

**Step 7:** Your final product will contain the following elements (in the following order):

- A brief narrative summary of the assessment data provided in the case study for one academic, behavioral, physical, or functional area that you wrote without the use of an AI system
- The prompt you entered into Copilot to generate a PLAAFP statement based on the PK-12 student data, without the student’s name and without any PII
- The response from Copilot with the text of the generated PLAAFP component
- A brief paragraph of your evaluation of the quality of the generated PLAAFP, referencing the criteria for PLAAFP statements from class
- A revised PLAAFP statement component that meets the criteria
- The prompt you entered into Copilot to generate two IEP goals based on the PLAAFP component
- The response from Copilot with the text of the two IEP goals
- A brief paragraph of your evaluation of the quality of the generated IEP goals, referencing the criteria for IEP goals from class
- Revised IEP goals that are individualized (i.e., the PK-12 student’s name is now included) and meet the SMART criteria
- An APA-formatted reference of the AI application that you used

**AI Usage and Limitation:**

*(How will AI be used or limited/constrained? Refer to the desired outcomes and task analysis to determine where using AI may increase efficiency without compromising critical thinking, or where explicit limitations on AI may be desired to encourage critical thinking.)*

AI will be used to generate draft PLAAFP components and IEP goals, but preservice teachers will need to reflect critically on the output and revise the output to meet the learning outcomes for the assignment. Also, preservice teachers will learn to use AI without compromising PK-12 student PII, to include prompts entered into AI, and to provide a reference for the AI program.

**Support Preservice Teacher Use of AI:**

*(What skills will preservice teachers need to learn to use AI? Select all that apply.)*

- Identifying and refining prompts/queries
- Analyzing and evaluating AI-generated content
- Safeguarding and redacting personally identifiable information (PII)
- Documenting the use of AI text generators (including the tool and the prompt/query)
- Citing and referencing AI-generated content
- Other: \_\_\_\_\_

**Carefully Design Evaluation Rubrics**

*(Can more points or weight be given to parts of the assignment that cannot be completed solely using AI? Parts of an assignment that cannot be completed solely using AI are listed below. Select all that apply.)*

- Analyzing accuracy of AI-generated content
- Applying AI-generated content to real-world scenarios
- Using AI-generated content to articulate and defend ideas in ways that go beyond straightforward information retrieval
- Responding to questions that require a deep understanding of AI-generated content
- Self-reflecting on personal growth or assignment quality
- Other: \_\_\_\_\_

and activities can be reconceptualized, with specific attention given to the ways in which AI text generators can be intentionally incorporated or intentionally restricted when designing course assignments and activities.

### **Reimagining Assessment and IEP/IFSP Case Studies**

As part of their preparation, preservice special education teachers must learn how to interpret and develop components of comprehensive assessment reports as part of special education evaluations or reevaluations. These reports document PK-12 students' backgrounds, socio-emotional, behavioral, physical, functional, and pre-academic or academic performance (Council for Exceptional Children [CEC], 2015a, 2015b). In addition, preservice teachers need to learn how to use this information to draft individualized family service plans (IFSPs) for children from birth to 3 years old or individualized education programs (IEPs) for students from age 3 to 22. More specifically, they must be able to describe students' present levels of academic achievement and functional performance (PLAAFP) and determine appropriate goals, accommodations, services, and methods for communicating progress (Yell et al., 2021).

With these objectives in mind, we reimagined an assessment case study assignment to include the use of an AI text generator (see Figure 2). In this assignment, the instructor uses AI output to demonstrate examples and non-examples of components of an assessment report. Then, preservice teachers use data from a real or imagined PK-12 student case study to write an assessment report and develop a related draft of an IEP (or components of this document, such as present levels, goals, and accommodations). Although this example focuses on IEPs, similar elements would be considered for IFSPs.

### ***Incorporating the Use of AI Text Generators***

Using the capabilities of AI text generators, preservice teachers can enter PK-12 student data (with PII removed) and request that the AI application develop PLAAFP statements and IEP goals. Instructors who incorporate the use of AI into assessment case study assignments may need to support preservice teachers in their ability to create and refine effective queries/prompts, to analyze and evaluate AI-generated content, and to appropriately cite and reference AI-generated content. For instance, when we tried this activity (see Supplemental Materials Figure S1), we found that we needed to add details to the prompt in order to generate output with all required components of a PLAAFP statement (e.g., student's strengths, needs, impact statement) or IEP goal (e.g., specific, measurable). For this assignment example, we used Copilot (called Bing Chat at the time) because it includes an online search component and provides citations to the sources used to generate output (OpenAI, 2023b). These features of Copilot were helpful in evaluating the quality of sources of information and revealed systematic improvement of source quality as we provided more specific prompts about high-quality PLAAFP and IEP components (see Figure S1). Instructors could use this type of output to model examples and non-examples of PLAAFPs and IEP goals to help students distinguish between well-written and inadequately-written components.

To complete the case study assignment, preservice teachers must use critical thinking skills and their knowledge of assessment and instruction to analyze the appropriateness of the output provided by the AI application. For example, part of the

assignment requires evaluating the AI output in relation to required elements of PLAAFP statements (e.g., a comparison of the PK-12 student's performance to grade-level benchmarks or standards, a summary of the student's strengths and needs, an impact statement of how the disability affects the student's progress in the general education curriculum) and/or IEP goals (e.g., specific, measurable, achievable/appropriate, reasonable, timebound). The preservice teacher must determine if the output met the criteria or if they need to edit it further.

In addition, the course instructor must emphasize the importance of (a) protecting the data of real PK-12 students according to FERPA (i.e., if preservice teachers were working with real students and wanted to try this activity with real data); (b) evaluating the quality of the AI output before submitting assignments or using in schools; and (c) individualizing the AI output to each student, including input from the student, family, and team, while also considering "individual abilities, interests, learning environments, and cultural and linguistic factors" (CEC, 2015a, p. 5) when developing PLAAFPs and IEPs. Without these considerations, the spirit and letter of the Individuals with Disabilities Education Act (IDEA) would be violated. In this case, the course instructor may consider recommending the use of AI text generators for producing drafts but should accentuate that preservice teachers will also need to demonstrate evidence of individualization and collaboration with the PK-12 student, family, and the IFSP/IEP team without the use of AI.

Finally, preservice teachers will likely need support in appropriately citing and referencing AI-generated content. Specifically, within the assignment, preservice teachers should be instructed to document

**FIGURE 3:** Evaluation Rubric for Systematic Instructional Program Assignment

Each criterion will be assessed on a scale of 1 to 5, with 5 indicating exemplary performance and 1 indicating poor performance.

	1	2	3	4	5	Score
<b>Clarity and Relevance of PLAAFP Statement and IEP Goals</b>	PLAAFP statement and IEP goals lack clarity and relevance, contain inaccuracies and inconsistencies, and lack a connection to the target student data presented.	PLAAFP statement and IEP goals are somewhat clear and relevant, with some inaccuracies or inconsistencies present, and make some link to target student data.	PLAAFP statement and IEP goals are adequately clear and relevant, with minor inaccuracies or inconsistencies, and are linked to target student data.	PLAAFP statement and IEP goals are clearly stated with few inaccuracies or inconsistencies and are clearly linked to target student data.	PLAAFP statement and IEP goals are clear and relevant, accurately reflect student needs and SMART criteria without any inaccuracies or inconsistencies and are driven by target student data.	
<b>Critical Analysis and Evaluation of IEP Goals</b>	Evaluation lacks depth and critical analysis, providing minimal insight into the appropriateness of the IEP goals as they relate to target student needs.	Evaluation contains some depth and critical analysis but lacks thoroughness, offering limited insight into the appropriateness of the IEP goals and how they relate to target student needs.	Evaluation demonstrates reasonable depth and critical analysis, providing insight into the appropriateness of the IEP goals and how they relate to target student needs.	Evaluation shows depth and critical analysis, offering insight into the appropriateness of the IEP goals and how they relate to target student needs.	Evaluation exhibits thorough depth and critical analysis, offering insight into the appropriateness of the IEP goals with clear links to data and the relationship to target student needs.	
<b>Accuracy of Research Summary Evaluation</b>	Evaluation of the research summary lacks accuracy and insight, with limited understanding of its relevance to instructional practices and how they relate to target student needs.	Evaluation of the research summary is accurate and provides insight but lacks relevance to instructional practices and how they relate to target student needs.	Evaluation of the research summary demonstrates accuracy and insight, providing some links to relevant instructional practices and how they relate to target student needs.	Evaluation of the research summary shows accuracy and insight, offering multiple direct links relevant to instructional practices and how they relate to target student needs.	Evaluation of the research summary displays accuracy and insight, and data based instructional practices with comprehensive analysis and how they relate to target student needs.	
<b>Task Analysis and Data Collection</b>	Task analysis and data collection are ineffective, lacking appropriate detail, failing to inform instructional planning adequately, and making no link to student data/needs.	Task analysis and data collection are somewhat effective but lack thoroughness, resulting in limited impact on instructional planning and an incomplete link to student data/needs.	Task analysis and data collection are adequate, providing some detail to inform instructional planning effectively and reflecting consideration of student data/needs.	Task analysis and data collection are effective, offering thorough detail to inform instructional planning accurately and reflecting a connection to student data/needs.	Task analysis and data collection are highly effective, providing comprehensive detail leading to precise instructional planning catered to individual student data/needs.	
<b>Systematic Instructional Program Plan</b>	Systematic instructional program plan lacks clarity and completeness, missing essential components and coherence.	Systematic instructional program plan is somewhat clear and complete but lacks detail or coherence in some areas.	Systematic instructional program plan is clear and complete, with all essential components included but lacking thoroughness or coherence.	Systematic instructional program plan is clear and mostly complete, with all essential components included, reasonably detailed, and coherent.	Systematic instructional program plan is clear and complete, with all essential components included, highly detailed, and logically organized.	
<b>Total Score</b>						

their prompts/queries, insert a citation to document the use of the AI text generator, and add the AI tool to their reference list (see McAdoo, 2023: <https://apastyle.apa.org/blog/how-to-cite-chatgpt>).

### ***Reimagining Writing a Systematic Instructional Program Plan***

Writing a systematic instructional program plan provides a second example of how an assignment might be reimagined in the era of AI. A

systematic instructional program plan is a structured and organized teaching approach that provides highly teacher-controlled instruction to PK-12 students with disabilities. Effective systematic instructional program plans

are based on evidence-based practices (EBPs) and research in special education theoretically rooted in applied behavior analysis (ABA; Collins, 2022). Such plans allow teachers to tailor their instruction to meet the specific learning needs of each student through controlling the stimulus presented, the response prompts provided to the student, the reinforcement delivered for correct responses, and the error correction procedure used for incorrect responses. They also provide a framework for assessment of student progress and data-based instructional modifications. It is important to note that developing systematic instructional program plans is one part of a process built on assessment, the development of instructional targets, stimulus analysis (i.e., task, concept, response), baseline logic, and well-written IEP goals (See Supplemental Materials Figure S2). Systematic instructional plans are different from lesson plans because instruction continues across multiple daily sessions. The instruction on targeted skills outlined in systematic instructional programs should be embedded across lesson plans. In other words, the lesson plans may vary, but the instructional targets and procedures of the systematic instructional program plan will stay consistent. In this assignment, preservice teachers use real PK-12 student data (e.g., PLAAFP, IEP goals, interventions, student performance data) and AI tools to generate steps of the systematic instructional program and then individualize the AI output based on student performance and instructional needs. See Figure 3 for a sample rubric for evaluating these skills.

### ***Incorporating the Use of AI Text Generators***

Much like the PLAAFP assignment described above, preservice teachers could enter example PK-12 student data

into an AI text generator and request that it develop a systematic instructional program plan for a targeted skill; however, as previously discussed, AI output is often incomplete or incorrect without additional, iterative prompting. This prompting requires critical thought and the application of knowledge of systematic instruction to critically analyze the output's accuracy and appropriateness. As evidenced by the assignment description in Supplemental Materials Figure S2 and the evaluation rubric in Figure 3, AI text generators can assist, but not replace, preservice teachers in designing and evaluating systematic instructional programs. To do this, preservice teachers must use their working knowledge of ABA principles and strategies that drive systematic instruction as well as the student's strengths and needs according to assessment-based PLAAFP statements. In turn, instructors can evaluate how effectively preservice teachers are able to individualize goals based on PK-12 student data. For example, if the targeted skill is a behavioral chain (i.e., a multi-step response), preservice teachers must conduct a task analysis to break the task into steps to target for instruction. Although they can ask an AI text generator to develop the steps of a task analysis, they must then ensure that the AI output has identified the targeted steps with sufficient detail for a specific student. The AI text generator may make the instructional program too complex by including more task steps than are necessary for effective and efficient instruction or not sufficiently complex if the generated steps fail to identify all needed areas of instruction. To illustrate, a toothbrushing program for some PK-12 students may include a step such as, "Brush teeth for two minutes," while other students would need this step broken down into more detail, such as "Brush upper right teeth

for 30 seconds; brush upper left teeth for 30 seconds; brush lower right teeth for 30 seconds; brush lower left teeth for 30 seconds." Similar instructional decisions will need to be individualized for each student and every systematic instructional program plan, which will require the preservice teacher to apply both basic knowledge of the ABA instructional framework as well as how to use student data to help make instructional choices.

### **Reimagining Annotated Bibliographies**

Creating annotated bibliographies provides a further example of how to modify assignments using AI tools. Annotated bibliographies are lists of sources related to a specific topic, accompanied by brief descriptive and evaluative annotations for each source. Often written in paragraph form, the annotations may include descriptive summaries of the source's content (e.g., purpose, main arguments/findings, conclusions), as well as an analysis and interpretation of the source (e.g., assessment of the credibility and authority of the author[s], evaluation of relevance and potential value to the topic; Hicks & Roberts, 2018). When used as part of a course, annotated bibliography assignments can support preservice teachers as they (a) expand their professional knowledge and (b) learn to evaluate research to identify effective practices. Further, annotated bibliography assignments can assist preservice teachers in understanding how and why to use the information provided in the sources they have read (Merkle, 2022) and can be used as a starting point for literature reviews (Metcalf, 2003).

### ***Incorporating the Use of AI Text Generators***

Given the capabilities of AI text gen-

**FIGURE 4:** Critical Analysis of an AI-Generated Annotated Bibliography and Source

Using an AI text generator for this assignment saved you time and effort by generating the annotation. However, it is your responsibility to (a) thoroughly read each source, (b) make judgments about the quality of the source, and (d) identify how the information contained in the source advances your understanding of your selected topic. To do this, answer each of the following questions for **each** source **without** using AI.

**Reference (cited per APA-Style Guidelines):**

**Credibility of Source:**

*(Do you view this as a credible source? What are the qualifications/backgrounds of the authors, did the source undergo peer review, etc.? Provide specific examples to support your response.)*

**Accuracy of AI-Generated Annotation:**

*(Does the AI-generated annotation accurately summarize the content of the source? Are there any inaccuracies? Provide specific examples to support your response.)*

**Relevance to Chosen Topic:**

*(Is there information relevant to your chosen topic/question that was included in the source but was NOT included in the AI-generated annotation? Provide specific examples to support your response.)*

**Need for Clarity and/or Further Questions:**

*(Based on your reading of the annotation and the source, what remains unclear, and what new questions arose related to your chosen topic/question?)*

**Limitations:**

*(What do you view as limitations of this source? For each identified limitation, explain why you view it as a limitation.)*

erators, we reconceptualized annotated bibliography assignments to recognize AI's utility while still providing preservice teachers the opportunity to expand their professional knowledge and skills related to the evaluation of research. Supplemental Materials Figure S3 summarizes this reimagined assignment using the framework presented in Figure 1. As illustrated by Figure S3, most of the desired learning outcomes remain similar to those that might have been identified before preservice teachers had access to AI tools. A notable difference is that, instead of independently writing concise annotations that summarize the main arguments, findings, and critical points of each source, preservice teachers will instead prompt the AI text generator to generate the initial annotation. However, they will still be responsible for (a) evaluating the accuracy of the AI-generated annotation, (b) making judgments about the quality of the

source, and (c) describing how the information contained in the source advances their understanding of a selected topic. In discussing the desired learning outcomes of this assignment, instructors may need to assist preservice teachers in understanding that an AI text generator can be an effective tool for supporting the development of some parts of an annotated bibliography assignment (e.g., creating a draft annotation for a source), but that it is not sufficient for completing other parts of this assignment (e.g., critically evaluating the AI output, critically evaluating the source).

As noted in previous examples, instructors will need to aid preservice teachers with crafting prompts/queries, critically evaluating output, and appropriately citing and referencing AI-generated content. The prompt used to generate an annotation with AI is relatively straightforward and therefore requires minimal instructor support. We and

our preservice teachers have used the prompt, "Create an annotated bibliography of the following article (insert APA style reference for the article here)," to generate output from several different AI text generators. Although limited support is needed in terms of identifying prompts themselves, preservice teachers may need substantial support to achieve learning outcomes related to fact-checking the AI output and critically analyzing the source. Providing instruction in these skills is particularly important given that the minimal effort required for generating annotated bibliographies via AI may reduce the extent to which preservice teachers engage with primary sources and derive their own conclusions (Kasneci et al., 2023). As part of the reimagined annotated bibliography assignment, Figure 4 provides a set of guiding questions for preservice teachers to answer that evidence their acquisition of fact-checking and critical thinking skills. As illustrat-

ed by the questions posed in Figure 4, preservice teachers are encouraged to engage with the source by responding to questions related to credibility and accuracy of the AI-generated content. Further, their critical thinking skills are fostered by responding to questions about the limitations of the source and information that is missing or unclear.

Instructors who reimagine annotated bibliography assignments to include the use of AI should also consider designing an evaluation rubric to ensure that preservice teachers cannot complete or pass the assignment using solely an AI text generator. To do this, responses to the questions posed in the critical analysis in Figure 4 could be weighted more heavily when grading, with minimal weight given to content that is AI-generated. Given that annotated bibliographies are often used as a starting point for a literature review, the following section provides an example of how the creation of a literature review can also be reimaged when using AI.

### **Reimagining Writing a Literature Review**

Literature reviews integrate ideas on a given topic from key sources into a cohesive summary. They are a fundamental part of academic and scientific research and serve as a means for preservice teachers to understand, analyze, and interpret studies related to potential research questions (Galvan, 2017). While AI text generators can assist at various stages of the academic writing process, they again do not replace the need for human expertise. As mentioned in the preceding section, content knowledge, critical thinking skills, and fact-checking skills are necessary to ensure accuracy in AI-generated summaries and analyses. This shift from merely utilizing academic output to critically reviewing and analyzing existing knowledge creates

space for innovative solutions to current educational problems (Butson & Spronken-Smith, 2024). When using AI, instructors must emphasize that preservice teachers should (a) use AI applications as aids to enhance their work rather than as a substitute for traditional research and analysis and (b) carefully review and verify content generated or suggested by AI to ensure accuracy and appropriateness for their literature review. Supplemental Materials Figure S4 illustrates how this assignment was reimaged to utilize AI text generators in certain steps while retaining a focus on the core skills of a literature review including critically analyzing available literature, summarizing sources and AI output, and drafting the literature review.

### ***Incorporating the Use of AI Text Generators***

AI text generators can assist in parts of a literature review, making the process more efficient for preservice teachers. As mentioned in the prior section on annotated bibliographies, AI can analyze vast amounts of academic literature and produce annotations and summaries of key components. AI tools can also suggest research topics or questions based on current trends, gaps in the literature, and the preservice teacher's interests. Utilizing AI in the initial phase of topic selection can shift the focus from, "what is a good issue?" to "what is a recognized issue in this field?" and help streamline the initial phase of topic selection. Preservice teachers can define their area of interest and select the specific issue they wish to research from the results returned by AI.

AI applications can also automate searching for and summarizing relevant research articles and papers. Using the process described in the section on annotated bibliographies as a starting point for a literature review

provides distinct benefits to preservice teachers, including creating an opportunity for efficient, personal engagement with the research. Further, the use of AI to annotate relevant research allows preservice teachers to focus on the critical skills of identifying quality research (e.g., scholarly, peer-reviewed, timely) in a more efficient and logical manner.

As shown in Figure S4, AI text generators can also be used to draft portions of literature summaries and analyses, to edit drafts of the final document, and to present content in the applicable format (e.g., APA style). AI can play a significant role in supporting preservice teachers by transforming articles into an AI-supported paper. For example, preservice teachers may find additional relevant resources as they vet sources, or they can prompt AI tools to suggest additional resources and related materials that are linked to the key themes identified or that may help expand or refine the topical focus. In addition to annotating individual sources, AI tools can also create summaries and analyses across multiple articles. Preservice teachers can then utilize these summaries to identify key themes, trends, and relationships among the different vetted sources.

Although not included in the reimaged assignment shown in Figure S4, AI could also potentially be used to suggest an initial outline or structure for a literature review paper based on the analysis of the annotated bibliography. In this case, preservice teachers should be required to submit the initial outline, citing the AI text generation, and then track and submit their edits and organizational changes that represent critical thinking (e.g., framing arguments and counterarguments, presenting supporting evidence based on the information in the annotated bibliography). Once the preser-

vice teacher has generated a draft, with or without AI assistance, they can use AI grammar and style-checking tools to refine their writing by identifying and correcting grammatical errors, improving sentence structure, and ensuring that content is presented in the required style (e.g., APA). Critically, instructors must require evidence of how preservice teachers integrated their own knowledge (e.g., content, quality research, professional style) and skills (e.g., critical thinking, analysis, writing, editing) into the iterative process of prompting and utilizing AI output effectively and efficiently.

### Reimagining Comprehensive Portfolio Written Reflections and Oral Presentations

The examples thus far have focused on ways that teacher educators can intentionally incorporate the use of AI into assignments, recognizing the utility of AI as a technology tool while also ensuring that preservice teachers cannot complete or pass a course/assignment using solely an AI text generator. In this final section, we provide an example of how assignments can also be reimagined to intentionally restrict the use of AI. Portfolios consisting of work and reflection on that work have been used for many years in higher education and teacher education specifically (Feder & Cramer, 2023). These portfolios can be structured in different ways and can serve multiple purposes, such as a portfolio of assignments completed in a single course or across multiple courses (Burns & Haight, 2005), a teaching portfolio for job applications, or a capstone project portfolio compiled at the end of a degree program (Schrand et al., 2018).

#### Restricting the Use of AI Text Generators

We present this assignment (see

Supplemental Materials Figure S5) as an opportunity to minimize the utility and relevance of AI applications because certain portfolio components, such as written reflections on preservice teachers' own learning, are particularly individualized and would not meet learning outcomes if developed with the use of AI text generators. Specifically, an AI application would have limited utility to a preservice teacher completing a portfolio requirement like a written reflection or self-evaluation of multiple aspects of their learning, such as describing how a portfolio artifact demonstrates their growth in or mastery of specific standards for the profession (e.g., the CEC *Initial or Advanced Preparation Standards*; CEC, 2015a, 2015b; Nagro & deBettencourt, 2019). Due to these limitations and the fact that using AI could undermine the instructional goals of reflection, we have structured the portfolio assignment in a way that minimizes the use of AI applications. Furthermore, we recommend that preservice teachers should not use AI to generate reflections in general.

Although it is possible for an AI text generator to create a written reflection, limitations include: (a) character limits on prompts (e.g., Copilot's 4,000-character limit; OpenAI, 2023b) which make the submission of longer written artifacts challenging; (b) lower quality reflection in AI output; and (c) less opportunity for preservice teachers to engage in the kinds of reflective and self-analytic thinking that are common learning goals of higher education in general and teacher preparation in particular (e.g., CEC 2015a, 2015b; Nagro & deBettencourt, 2019). For example, we tested whether Copilot could generate an adequate reflection by entering a shortened artifact and requesting a self-reflection as the output (see Supplemental Materials Figure

S1). Although the output's language appeared reflective (e.g., "As a student in special education, I have learned about the importance of education assessment and evaluation..."), it largely entailed repetition of information in the artifact. For instance, the second paragraph of the output mostly repeated words and phrases from the artifact itself, such as a summary of the assessment tool used. Such output can be considered lower quality reflection (Nagro & deBettencourt, 2019). Higher quality reflection would include more information about the preservice teacher's growth in these skills in general, with shorter sections from the artifact used as examples. It would also detail specific actions the preservice teacher plans to take in the future based on their evaluation of past teaching.

In addition, this portfolio example includes an oral presentation, which addresses skills preservice teachers will need to demonstrate in their future career and that are not well-suited to AI support. For example, in school settings, preservice teachers will need to present orally and think critically in real-time, such as during instructional interactions, IEP team meetings, and staff and faculty meetings. Although AI text generators can be used during real-time communication via chat (Brynjolfsson et al., 2023), this is less feasible and may be less socially desirable in PK-12 classrooms and schools.

Figure S5 provides an example of a master's degree portfolio assignment in which preservice teachers are asked to demonstrate depth and breadth of knowledge that meet the *Advanced Preparation Standards* (CEC, 2015a). The portfolio requires written self-evaluations of how specific artifacts demonstrate the preservice teacher's progress toward or mastery of each standard. Artifacts can include

**TABLE 1:** Concerns and Strategies Regarding the Use of AI Text Generators by Preservice Teachers

Concern	Strategies	Related Resources
Plagiarism and academic integrity	Educate preservice teachers on proper citation and use of sources. Emphasize critical thinking and originality in assignments. Clearly outline expectations for using AI-generated content in syllabi and assignments.	McAdoo (2023); Nam (2023)
Quality and accuracy of AI-generated content	Provide guidelines for evaluating AI-generated text. Require preservice teachers to verify information from multiple sources. Use AI as a tool for generating ideas rather than final content.	Hao (2019); Heberer et al. (2023); Lanier (2023); Williams (2024)
Student learning and understanding	Ensure assignments focus on learning objectives, not just content generation. Incorporate discussions and reflections on AI use in education. Provide explicit instruction and support on how to effectively use AI tools. Ensure assignments require critical thinking and analysis beyond AI capabilities.	Butson & Spronken-Smith (2024); Kasneci et al. (2023); Nagro & deBettencourt (2019)
Ethical implications	Discuss ethical considerations in AI use with preservice teachers. Explicitly instruct preservice teachers on how to handle personally identifiable information when using AI. Highlight biases and limitations of AI tools used.	Crompton et al. (2024); Tang & Su (2024)

both course-related and non-course-related items, such as leadership experiences and professional development attendance or presentation. Depending on the assignment directions, some of these artifacts may have been developed using AI applications, thus introducing one appropriate form of incorporating AI within portfolios. Finally, the assignment includes an oral presentation in response to broad questions that ask preservice teachers to integrate information across artifacts and reflect on their learning throughout the program. This assignment presumes that preservice teachers have already engaged in a wide

variety of assignments and applied experiences during their program that can serve as high-quality artifacts and can be connected to the standards or learning outcomes that are the focus of the portfolio evaluation. This assignment prioritizes (a) higher order thinking and communication learning objectives; (b) responses that are highly individualized and directly beneficial to preservice teachers (e.g., support job or graduate school applications; prepare for interviews, collaborations, or advocacy); and (c) scaffolding and feedback to increase the quality of self-evaluation and analytical and applied reasoning, such as

through faculty instruction, modeling, and criteria for high-quality responses (e.g., rubrics). When implementing an assignment like this, course instructors should clearly communicate the purpose and value of restricting preservice teachers' use of AI text generators for production of reflective responses. On the other hand, instructors can also provide guidance on appropriate uses of AI text generators, such as in the generation of artifacts, if their use would effectively support the learning objectives.

## CONCLUSION

In summary, instructors in special



In summary, instructors in special education teacher preparation programs must recognize that AI text generators have the potential to support, but not replace, human expertise.

education teacher preparation programs must recognize that AI text generators have the potential to support, but not replace, human expertise. Table 1 summarizes concerns noted in the literature related to the use of AI applications along with practical strategies to mitigate these concerns. The extensive capabilities and widespread adoption of AI text generators among college students, along with the associated constraints and possible negative consequences of these technological tools, underscore the importance of deliberate consideration regarding their integration into special education teacher preparation programs. This article provided examples of how teacher educators might reimagine their course assignments and activities in the era of AI. Instructors must carefully consider their learning objectives and identify ways that AI text generators can be intentionally used or intentionally restricted to achieve those objectives. Further, instructors must teach preservice teachers to appropriately document their use of AI text generators and should design their assignments in a way that prevents preservice teachers from passing

a course or assignment using solely an AI text generator. For each example assignment, we have provided a basic structure as well as a framework to promote critical thinking and analysis. Notably, instructors who choose to adopt the structure and framework of any of these example assignments will need to individualize them for their respective courses through adaptations such as linking to course objectives, adding grading rubrics, or specifying needed AI application features.

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# Exploring the Integration of Artificial Intelligence into Special Education Teacher Preparation through the TPACK Framework

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## ABSTRACT

With the introduction of artificial intelligence (AI), specifically generative AI and large language models (e.g., ChatGPT, Google Gemini), into education, there is a conversation regarding what knowledge teachers still need and will need moving forward. In this article, we describe how AI can, and should, be aligned to the Technological Knowledge, Pedagogical Knowledge, and Content Knowledge (TPACK) framework, as a part of special education teacher preparation. Additionally, we explore the implications of AI on the TPACK framework, specifically how AI can be integrated within each of the three components, specific tools that support each aspect, and guiding questions that teacher-educators and pre-service teachers should be using when considering AI. We will provide teacher-educators with example activities they can use with their pre-service teachers to introduce AI and integrate its use within their curriculum, framed within the TPACK.

## KEYWORDS

**Artificial intelligence, special education teacher preparation, TPACK**

**D**r. Williams exited another department meeting shaking her head. Beyond the typical policy and standards decisions that most gatherings included, talk about the dangers of artificial intelligence (AI) occupied a significant amount of her colleagues' discussions. Of course, she agreed that AI tools like ChatGPT and CoPilot were disruptive innovations and required departmental considerations; however, her efforts were focused not on preventing the use of these growing and ever-changing innovations, but on identifying ways to harness them in a meaningful way. While Dr. Williams did not consider herself a technologist, she understood that these tools played a role in preK-12 instruction and, thus, required her to stay on top of the innovations. Dr. Williams understood that if she did not infuse these technologies into her pre-service special education teacher preparation courses, then her undergraduate and graduate students might not be prepared to meaningfully implement these innovations into their preK-12 learning environments. The challenge was: How?

Artificial Intelligence (AI) is one of the most disruptive technologies in education, with the potential to shift how students with and without disabilities are taught and how general and special education teachers (SETs) are prepared (Marino et al., 2023). The introduction of generative AI (genAI; e.g., ChatGPT, Gemini, Claude) into education has led to conversations about what knowledge teachers still need and will need, as these AI have the potential to complete tasks previously reserved for humans (Marino et al., 2023). Simply teaching pre-service SETs how to use these existing, new, and emerging AIs for the sake of pushing technology into classrooms is not effective in supporting meaningful integration into instruction and improving student outcomes (Voithofer & Nelson, 2021). To bridge these technological advancements (specifically genAI) with student needs, pre-service SETs need explicit instruction as to how to use these technologies within their classroom instruction. Thus, pre-service SETs need to be strategically taught to use these and similar tools

**TABLE 1:** Types of AI

TYPE OF AI	DEFINITION	AI	
<b>Prior to November 2022</b>			
Adaptive Learning Platforms/ Intelligent Tutoring Systems	Systems that adapt to new data by learning, extracting patterns, and changing without human intervention	ALEKS	Khan Academy
		Freckle	Lalilo
Natural Language Processors	Systems that read and respond to human stimuli in everyday language	Alexa	Read&Write
		Co:Writer	SIRI
		Grammarly	
<b>After November 2022</b>			
Generative Pre-Training Transformer	Systems that respond to questions using data on which they were previously trained	ChatGPT	GrammarlyGo
		CoPilot	KhanMingo
		Gemini	

Note. Definitions from Ruiz, P., & Fusco, J. (2024). *Glossary of artificial intelligence terms for educators*. Center for Integrative Research in Computer and Learning Sciences. <https://circls.org/educatorcircls/ai-glossary>

in isolation and integrate them into evidence-based pedagogy (Voithofer & Nelson, 2021).

Broadly, AI is a branch of computer science that creates “intelligence” from data and algorithms, allowing it to make decisions and find patterns (Ruiz & Fusco, 2024). Models of AI include (1) natural language processors, which can understand and comprehend language (e.g., Alexa, Siri; Ruiz & Fusco, 2024), and (2) adaptive learning platforms, which learn about and subsequently use these data on students’ areas of strength and need to adapt instruction to meet their unique individual needs (e.g., ALEKS, Lalilo; see Table 1; Ruiz & Fusco, 2023). It is important to note that AI in classrooms is not new and has existed within classrooms and schools for decades (e.g., predictive text, attendance monitoring systems, and speech-to-text; Goldman, Taylor, et al., 2024; see Table 1). This includes learning management systems, large language model device features (e.g., Digital Assistants: Siri, Cortana, Google, word prediction, text-

to-speech), and other features on common classroom devices such as Chromebooks, Apple iPads, and laptops. What is new to the classroom and the human experience is genAI such as ChatGPT, Gemini, and CoPilot. In November of 2022, Open AI released ChatGPT to the public, allowing widespread use of these large language models. What sets these new AI apart from the AI pre-November 2022 is the ability to create new knowledge without human intervention (Ruiz & Fusco, 2024). GenAI is trained on large datasets, which include all the publicly available data on the internet, and it can generate texts, images, and data based on prompts from the user. The various types of AI have been increasingly present in schools (Wang et al., 2024) as more and more districts invest in current and innovative technologies to support managing student data and leveraging it as a tool to support student learning. With increased access to technology and AI, teachers need a way to understand, integrate, and evaluate the use and effectiveness of the technology

implementation.

At present, much of the energy appears to be focused on considering the ethical implications of genAI before widespread classroom implementation for student assignments. Fortunately, there are a number of state and local education efforts underway to develop recommendations for AI policies in syllabi including explaining why AI is required or prohibited, explicitly sharing examples and non-examples of appropriate use, and explaining how misuse will be addressed (Stanford, 2024). For example, the AI Assessment Scale is a tool developed by researchers to offer institutions of higher education a structured approach to AI usage (Perkins et al., 2024). This five-point scale assists faculty in providing higher education students, in this case, pre-service SETs, with explicit guidance as to the level of AI that can be used in their assignments, with 1 being no AI and 5 being full AI. Likewise, the Sante Fe Community College (see <https://libraryhelp.sfcc.edu/Chat-GPT/syllabus-statements>), like many colleges

**TABLE 2:** Sample Prompts

TOPIC	PROMPT
IEP Goal	You are an experienced special education teacher. Write a SMART math goal that targets adding three-digit numbers with regrouping. The goal should align to a 3 <sup>rd</sup> grade math standard. Write the goal in a sentence that starts with Given ____, by next IEP date, student will. Include 3 objectives.
Reading Comprehension	You are a special education teacher trained in the Science of Reading. Write a 200-word passage for a 4 <sup>th</sup> grader who decodes at the 2 <sup>nd</sup> grade level. The passage should be about planets. Include 5 literal comprehension questions (who, what, when, where, how).
Math Problems	You are an experienced special education teacher who teaches 5 <sup>th</sup> grade math. Your students have a goal for solving two step word problems. Generate 5 word problems about bakery items that I can use to assess their understanding.

and universities across the country, is curating lists of sample syllabus statements and course policies related to AI. With genAI continuing to develop, some argue it is still at its infancy, state departments of education, preK-12 school districts, colleges and universities, and similar entities will continue to grapple with the development of policies and practices to facilitate the appropriate use of these growing innovations. For the teacher educator, these foundational policies and procedures will only be the first step in a stepping stones approach we will be required to follow considering the ever-changing nature of genAI and the fact that AI is now part of our daily reality.

### Accessing and Using GenAI

There are several options from which teacher educators and pre-service SETs can choose when considering integrating genAI into their practice. ChatGPT, Gemini, and Copilot are just a few of the genAI available with free options. While each platform has its strengths and drawbacks, they all serve the same basic function: generating prompt responses. For pre-service SETs to leverage genAI effectively, teacher educators need to teach prompt engineering. While there are many formulas to create an effective prompt, “AI for Education’s Prompt

Engineering Framework: The Five ‘S’ Model” is designed specifically for educators. According to the framework, effective prompting involves: (1) setting the scene, (2) being specific, (3) using simple language, (4) structuring the output, and (5) sharing feedback (AI for Education, 2023). See Table 2 for sample prompts.

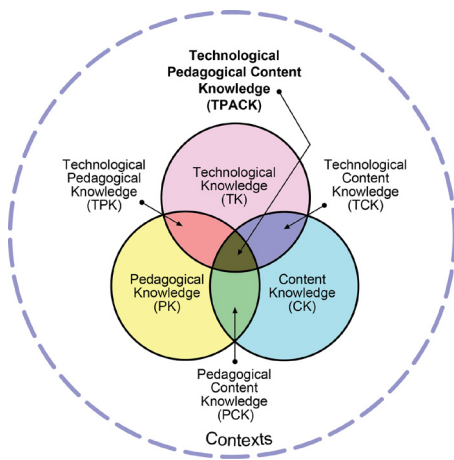
*It felt like only yesterday that she began to appreciate what an effective AI prompt was and how important it was in getting one’s desired output. Staying on top of this foundational skill kept her busy enough; it seemed every time she mentioned AI in class, a student shared another cool tool. There seemed to be countless opportunities to further the implementation of effective practices while enhancing inclusionary efforts and independence for students with disabilities.*

*As Dr. Williams returned to her office, she was reminded that the recent meeting focused on AI tools and ways to limit their use in teacher preparation coursework; but her role was to also promote student knowledge and skill growth. Her students needed to further their understanding of pedagogical and content knowledge. They needed to understand and be able to implement evidence-based practices and the growing high leverage practices that when inte-*

*grated, would enhance inclusionary efforts and the overall learning outcomes of students with disabilities. Looking at the technology puzzle from this lens, she was reminded about a framework she had been introduced to nearly a decade ago when one-to-one digital devices were increasingly becoming the norm in the local preK-12 grade classrooms.*

### The TPACK Framework in Special Education Teacher Preparation

Providing opportunities for pre-service SETs to learn about the available and emerging technologies is important. And yet, simply teaching them the technology through how-to lessons is ineffective for long-term success (Voithofer & Nelson, 2021). Instead, teacher-educators need to prepare pre-service SETs to use these technologies, specifically genAI, through (1) direct instruction and modeling from the teacher-educator, (2) opportunities for pre-service SETs to use these technologies in their assignments and activities, and (3) opportunities for pre-service SETs to create lessons, assignments, and activities using these technologies and apply them to K-12 students, particularly those with disabilities (Farjon et al., 2019). However, efforts to align pre-service teacher education with similar recommendations

**FIGURE 1: TPACK Framework**

(Graziano et al., 2017) have often been challenging.

At the turn of the 21<sup>st</sup> century, for example, the United States government invested millions into the Preparing Tomorrow's Teachers to Use Technology initiatives. Grants were provided for over 100 institutions of higher education. The goal was to foster technology integration into teacher preparation (Polly et al., 2010). Over the past two decades with the explosion of digital learning (e.g., synchronous and asynchronous learning), the advancement in technology devices (e.g., iPad, handheld mobile devices), one-to-one technology device initiatives, and countless other technology-based learning programs, the need for to prepare classroom teachers to integrate these promising digital solutions has fostered several suggested strategies (Kopcha et al., 2020).

Before the COVID-19 pandemic, local schools were investing millions of dollars to equip all students with iPads and then Chromebooks. Google classroom and similar learning management systems were becoming the norm, and Dr. William's graduates were expected to enter their employment having a basic knowledge of the ever-changing technology-based tools. Similar to her recent reflections, she was faced with having to embrace some level of technology to en-

sure that her college students were being prepared for these technological expectations. At the time, the state education department shared information about the TPACK Framework (Technological Knowledge (TK), Pedagogical Knowledge (PK), and Content Knowledge (CK)) (Mishra & Koehler, 2006; see Figure 1). Dr. Williams recalled how the TPACK offered a means to address the growing technology tools without being required to become an expert in every app, learning management system, or even learning the basics of the various digital devices (e.g., iPad).

TPACK and similar frameworks guide the integration of digital solutions (e.g., Gen-AI) into teacher development and support the subsequent application of this technology into the instructional, behavioral, and social-emotional development of the preK-12 learner; students with disabilities are often the primary beneficiary of such innovations. The TPACK framework, undergirded by the three named components, underscores the importance of using TK to support CK and PK and the importance of weaving them together in instruction effectively. With nearly 20 years of related research and over 1,200 journal articles (Mishra, 2019), the TPACK framework is a key component in preparing teachers to use technology effectively in their future classrooms (Irwanto, 2021). It also advocates for teacher candidates to have knowledge of and the integration of technology, content, and pedagogy (Foulger et al., 2019). Much of the research surrounding the framework has centered around K-12 education, but it is gaining traction in higher education (Graziano et al., 2017).

Each component has to be thought of in isolation (TK, PK, and CK separately) and considered in the overlap (e.g., TK+PK, TK+CK, TK+PK+CK), with the overall purpose being to find a way to integrate growing technologies

that support education into classroom pedagogy and content effectively. Tools beyond computers, such as speech-to-text, interactive projectors (e.g., Epson Brightlink™, SMART board), and extended reality (i.e., virtual reality, augmented reality, mixed reality) would fit within the TK component. CK varies based on the grade level and type of teacher, as well as the standards and grade-level materials. For instance, CK for an elementary math teacher would include fractions, adding and subtracting with regrouping, and one-to-one correspondence. This differs from CK for a high school U.S. history teacher, which includes the Declaration of Independence and the events that led up to the Civil War. PK is the knowledge specific to teaching, such as differentiated instruction, flipped classrooms, and cooperative learning techniques. For example, the use of interactive graphic organizers to support written expression integrates TK (the interactive graphic organizer) with PK (the knowledge that students with disabilities benefit from graphic organizers to support their writing), and CK (the overall focus on written expression). And, while AI is technically considered an emerging technology, its capabilities and promises go beyond the TK component of the framework and influence the PK and CK components of the TPACK, as well.

The TPACK allowed her to include growing innovations within her knowledge and expertise in pedagogical and content instruction. As she opened her laptop, she promised herself to review the basics of the TPACK and to once again look to this framework as a means to harness an innovation, in this case, AI, to support her college students and, in turn, support their ability to understand and use the promising features of AI with preK-12 students with disabilities.

AI has the potential to transcend all

**TABLE 3: TPACK and AI Alignment**

Category	Definition	Rationale	Specific AI Tools	Guiding Questions/ Specific Queries
Technology Knowledge	Knowledge of specific technology	Pre-service SETs need to be taught to find resources for themselves  On-demand tech support	There's an AI for That  AI Tool Report  AIEducator.Tools  ChatGPT  Gemini  Perplexity	What are you looking for the AI to do?  If you were to describe your problem to the IT person, what would you say?
Pedagogy Knowledge	Knowledge of instructional approaches	A need to personalize learning to improve student outcomes  Pre-service SETs should not be expected to be experts in everything	Magic School AI  Ludia UDL AI  <a href="#">Teachology.AI</a>  <a href="#">Plainitteachers.ai</a>  <a href="#">ToTeach.AI</a>	I'm having difficulty with ____, what can I do to improve?  Can you operationalize ____ for me?  How do I teach...
Content Knowledge	Knowledge of specific subjects	Increasing in co-teaching where Pre-service SETs may not have content knowledge expertise  Pre-service SETs should not be expected to be experts in everything	Read Trellis  Albert Bro  TutorAI	Can you explain ____ to me?  What happened in chapter 4 of ____?  Here's the math problem I'm struggling with...

the components of the TPACK framework (Mishra et al., 2023). Thus, this article describes how AI can and should be an integrated topic within SET preparation. We describe how AI can and should be integrated within the three components of the TPACK framework as a part of SET preparation. With the weekly, if not daily, advances in AI classroom, teachers need the knowledge and skills to integrate these ever-advancing tools meaningfully into instructional interventions to improve learner outcomes further.

### AI and its Alignment to the TPACK Framework

Effective integration of AI into pre-service teacher preparation curricula includes (1) direct instruction and modeling by teacher-educators, (2)

opportunities for pre-service SETs to practice using AI in their assignments, and in-class activities, and (3) having pre-service teachers create lessons, assignments, and activities with AI and that leverage AI for use with K-12 students. Therefore, we propose that AI should be considered in each component of the framework (AI+TK, AI+PK, AI+CK), in the intersection (AI+TK+PK, AI+TK+CK), and fully encompasses the framework (AI\*TPACK; Irwanto, 2021) for teachers and students to reap its benefits fully. In this article, we explore the alignment implications of AI on the TPACK framework, specifically how AI can be integrated within each of the three components, examples of tools that support each aspect, and guiding questions that teacher-educators and pre-service SETs should consider

when using AI. We will provide teacher-educators with sample activities they can use with their pre-service SETs to introduce AI and effectively integrate it within their curriculum, framed within the TPACK.

While the discussion around the importance of integrating the TPACK framework into SET preparation (e.g., Anderson & Putman, 2023; Anderson & Putnam, 2020) is not novel, what is new is the consideration of how AI fits within, or as we suggest in this article, fully encompasses the framework. Researchers are beginning to conceptualize and integrate AI into the TPACK framework and are looking to alter or expand the framework in light of this disruptive technology (e.g., Celik, 2023; Mishra et al., 2023; Ning et al., 2024). To that end, in the following sections, we detail how



faculty in pre-service special educator preparation programs can begin to integrate and align AI to the TPACK framework (see Table 3).

### ***Technology Knowledge (TK) and AI***

Defining what TK is can be challenging, according to the TPACK authors Koehler and Mishra (2009), due to the fact that technology is always changing. The term technology encompasses everything from a pencil to an iPad and everything in between and beyond. Educational technology, a broad category encompassing all technologies students use in the classroom (Mao et al., 2019), can be further categorized into instructional technologies and assistive technologies. Instructional technologies, as described by Howorth & Kennedy (2021), encompass tools used within the learning environment, such as websites, game-based learning platforms, and mobile device carts (e.g., iPads or Chromebooks). Assistive technologies, on the other hand, are specialized tools that support students with disabilities in accessing and engaging with the curriculum (US Department of Education, 2024). These can include adaptive switches, augmented and alternative communication devices, text-to-speech software, and word prediction software. Beyond defining technology, effective TK includes an understanding that technology has inherent biases, constraints, and potentials and impacts how and when it should be used (Koehler & Mishra, 2009). The recent National Educational Technology Plan (2024) suggests that TK should include an understanding of how technology can enhance learning and design learning experiences. Additionally, it includes the knowledge and ability to advocate for equity in access and content.

Research suggests that pre-service SETs are more likely to develop competencies in the area of TK in stand-alone

technology courses and/or from faculty with expertise in the technology field (Foulger et al., 2019). While it may not be feasible or even possible for pre-service programs to encompass TK fully, they must prepare future teachers to seek TK independently. Examples include providing them with resources to find technologies that support their instruction and positively impact their students' outcomes (i.e., Edutopia's Technology Integration section or There's an AI for That) and staying up-to-date on technology policy and best practices (e.g., the U.S. Department of Education's Office of Educational Technology or Common Sense Media).

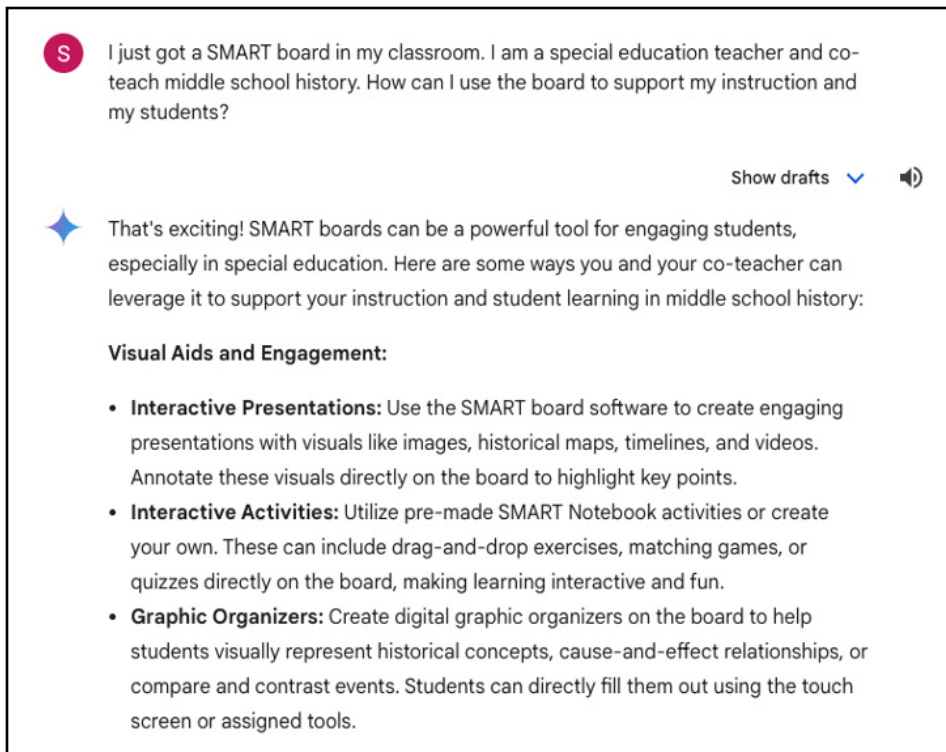
As classrooms continue to explode with new technology, pre-service teacher preparation programs are not able to provide training to in-service teachers who are also seeing an increase of technology in their classrooms. Therefore, just as SETs need training as to how to integrate innovations into their classrooms, so do in-service teachers. While the investment into acquiring more classroom computing devices has provided teachers with the opportunity to personalize learning and further integrate digital literacy into their classrooms (US Department of Education, 2024), without effective professional development and training in the integration of such technologies, teachers are left to learn on their own or, in some cases, underutilize the technology they have.

Though SETs are experts in their fields, they may not consider themselves TK experts (Anderson & Putman, 2020). Research supports that frequently, teachers learn about new ways to utilize classroom technologies from other teachers (Winter et al., 2021). Another way for teachers to consider new and innovative ways of using the available and emerging technologies in their classrooms is through collaboration with genAI. As shown in Figure 2, genAI can provide

several suggestions for further technology integration in their classroom. To do this, teachers can use a simple prompt that explains the technology they are looking to integrate and the subject and context in which they teach. For instance, SETs ask genAI for examples of ways to use a classroom set of iPads to support addition fact fluency for second graders with and without disabilities. Or, SETs can ask how to leverage wearable virtual reality headsets (i.e., the Oculus) to help middle school students with social skills deficits.

Additionally, it is important to consider that when using technology, things inevitably go wrong, making TK and troubleshooting knowledge necessary (Anderson & Putman, 2020). In a recent study, pre-service SETs identified one challenge with technology integration is that technology does not always work as planned (Valtonen et al., 2020). Teachers must sometimes make troubleshooting decisions within a split second before their class becomes impatient and disorder ensues. Current options include pivoting to a different activity, which might be disappointing for some and is an added rocky transition, or calling the school or district IT for support and hoping they can help. Both options are not ideal and present a bevy of challenges for teachers, including lost instructional time, difficult transition, and elevated student behaviors due to interruption and disruptions to typical routines.

While AI cannot replace professional development and teacher-to-teacher collaboration, AI can provide teachers with on-demand tech support and troubleshooting. Simply using ChatGPT or another genAI application, teachers can get tips, tricks, and step-by-step guides to get their tech-forward classrooms back up and running. While the AI chatbot may not be able to troubleshoot and solve every problem that arises with classroom technology, it can provide the

**FIGURE 2:** Using Generative AI to Integrate Technology into Instruction

first level of consultation and possibly save the teacher's lesson. For a sample troubleshooting output produced by Gemini about how to fix a projector that is not working, see Figure 3.

In isolation, it is important to understand how to leverage genAI best. As a new technology, users need to learn the nuances required to prompt or ask questions to get the desired outputs. Often, users will need to ask a question several times in different ways, before the genAI provides them with the exact response they were hoping for. While prompt practice is becoming a popular area of professional development related to AI (see <https://www.codecademy.com/> or <https://www.aiforeducation.io/>), using it in isolation is ineffective at meaningfully integrating AI into curricula.

### Content Knowledge (CK) and AI

CK can be defined as math, science, reading, writing, or any other area addressed by the curriculum (Mishra & Koehler, 2006). Content knowledge is

fundamental within special education, and teachers are expected to be experts in several content areas. One SET may support students in their Algebra 1, U.S. History, and Biology courses. This means that special education students must understand the course material, including central facts, procedures, and rules of evidence (Mishra & Koehler, 2006).

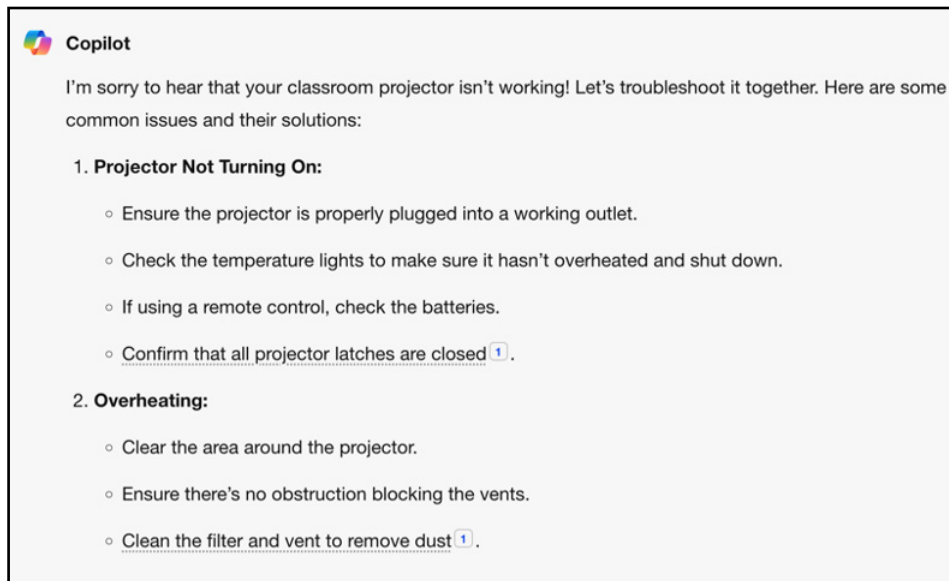
Being an expert in all subjects is nearly impossible. Several AIs support the CK (Goldman, Taylor, et al., 2024). GenAI can generate novels at differentiated reading levels, answer comprehension questions, and identify key vocabulary (Goldman et al., in press). For example, the reading level of the popular upper elementary school novel *Wonder* by R.J. Palacio may be too complex for struggling readers. SETs can prompt genAI to produce an abridged version of the text at particular grade levels to remove barriers. With AlbertBro, a math AI, SETs can upload images of math problems and receive step-by-step instructions on

how to solve them.

While meaningful integration of genAI is the ultimate goal, it is also imperative for SETs to understand the CK of genAI. This includes topics such as AI literacy and prompt engineering. AI literacy is defined as the knowledge and skills necessary to critically use, understand, and evaluate AI tools and systems in order to use them safely and ethically (Mills et al., 2024). An important aspect of AI literacy is an understanding that SETs should not take legal, ethical, or compliance advice from the AI. While the AI can provide overarching guidance, it remains the teacher's responsibility to ensure the information is correct through more traditional search methods. Examples of this include checking the references and websites the AI cites and cross checking the information provided by one AI with other genAIs for agreement. To learn more about AI literacy, SETs can visit Digital Promise ([DigitalPromise.org](https://www.digitalspromise.org)) or Common Sense Education ([CommonSense.org](https://www.commonsense.org)).

Prompt engineering refers to the skillset required to obtain high-quality outputs from interactions with genAI (Knoth et al., 2024). While the process of prompting can sometimes involve trial and error (Knoth et al., 2024), employing prompt engineering frameworks, such as those developed by AI for Education (see <https://www.aifored-ucation.io/>), can enhance the likelihood that the genAI's responses align with the SETs request. According to AI for Education, high-quality prompts should provide context (e.g., "you are a special education teacher" or "you are a 3<sup>rd</sup> grade student"), be specific (what do you want it to do), use simple language (avoid jargon), provide the requested structure (e.g., paragraph, bullet points), and provide feedback (e.g., tell the genAI what you want it to change).

Beyond its use in preK-12 education, genAI can support pre-service SETs

**FIGURE 3:** Using GenAI to Troubleshoot Technology

with the required content of being a SET. SETs are expected to be experts in the Individuals with Disabilities Education Act (IDEA, 2004), policies and procedures related to Individual Education Programs (IEPs), informal and formal academic assessments, and aligning areas of need to evidence-based practices and interventions. The expectation of special education CK is astronomical for a seasoned SET, let alone a novice one.

Several AIs exist to support SETs with special education CK. A Platform for Open Education (Poe; see <https://poe.com/>), has numerous AI trained to complete specific tasks. For example, WritingIEPgoals assistant (see <https://poe.com/WritingIEPgoals>) is an expert at developing personalized goals to support student learning. Another example is the SPEDTeacher (see <https://poe.com/SPEDTeacher>), which is an expert at guiding families through the IEP or 504 process. Both tools allow teachers to break down parts of the IEP and classroom materials to reduce time and create a more positive environment.

### **Pedagogical Knowledge (PK) and AI**

PK is the understanding of instructional supports, techniques, and strategies

(Mishra & Koehler, 2006). Where CK is understanding *what* you are teaching, PK is understanding *how* to teach it. This includes having strong classroom management skills, an understanding of child development, and a repertoire of tools and strategies that can be applied to a variety of situations and lessons (Shulman, 2013). More specifically, this includes SETs having an understanding of proximity, modeling, and assessment. Pre-service teachers report the most confidence in PK, specifically related to their abilities to motivate their students and engage them in activities, and report challenges with managing lessons and time management (Valtonen et al., 2020).

PK includes an understanding that student learning outcomes are improved when lessons are designed for the variability within their classrooms rather than a one-size-fits-all approach (Smith et al., 2019). Several AI supports can help teachers personalize learning, add interactively to their lessons, and support the variety of learners in the classroom. One example that is gaining a lot of traction amongst K-12 teachers is [MagicSchool.ai](https://app.magicsschool.ai/) (see <https://app.magicsschool.ai/>). This AI supports teachers in creating choice boards, dif-

ferentiating assignments to support the variety of learners by summarizing and leveling text, and providing support in giving targeted feedback to students.

[Magicsschool.ai](https://www.magicsschool.ai/) is a free website for teachers to streamline their workload and their ability to understand and implement successful pedagogy. Another great resource is Diffit (see <https://web.diffit.me/>), which differentiates curricula to create individualized and target resources. Examples of some of the tools within Diffit include the creation of differentiated activities, designing graphic organizers that align with lesson targets, and adapting articles to student reading levels.

### **Integrating AI and the TPACK Framework into Special Education Teacher Preparation**

While each area of the TPACK framework has merit and benefits from the AI supercharge, it is when the various components of the framework interact that teachers and students truly benefit. Research suggests that pre-service teacher preparation should work to make the various aspects of the TPACK framework concrete so that SETs can experience and reflect on the framework and its application in their future teaching (Valtonen et al., 2020). Below, we detail considerations for SET preparation faculty when bringing AI into courses and offer suggestions for assignments faculty can use in their curricula (see Table 4).

### **Examples of Integrating Technology Knowledge (TK), Content Knowledge (CK), and AI**

One key aspect of SET preparation classes is learning the core principles of IDEA (Clausen et al., 2023) and how they manifest within the IEP and IEP meetings. Future SETs must be prepared to respond when the principles of IDEA are not being followed. One suggestion for helping them with this task is to evaluate vignettes (Cheatham et al., 2012).

**FIGURE 4:** Screenshots of Vignette Assignment with Copilot

**Scenario:**

*Name:* Emily

*Background:* Emily is a 10-year-old student with autism spectrum disorder (ASD). She has difficulty with social interactions, sensory sensitivities, and transitions.

*School Situation:* Emily attends a public elementary school. Her parents have requested an Individualized Education Program (IEP) meeting to discuss her needs and accommodations.

*Violation of “Zero Reject”:* The school denies Emily’s parents’ request for an IEP meeting, claiming that her needs are not severe enough to warrant special education services. They argue that Emily can manage in a regular classroom without additional support.

*Consequences:* By denying Emily’s parents’ request, the school violates the “zero reject” principle. Emily’s right to FAPE is compromised, as she is not receiving the individualized support necessary for her educational success. This situation could lead to academic struggles, social isolation, and emotional distress for Emily.

Remember that this scenario is fictional, but it illustrates how a violation of the “zero reject” principle could occur. In reality, schools should provide appropriate services to all eligible students with disabilities, regardless of the severity of their needs. 🍌+

One way to do this is to give vignettes with critical errors to pre-service SETs and have them identify the violated principle, supporting their thinking by citing evidence from the vignette and then providing alternative solutions to the issues. This method assumes that pre-service SETs have the confidence and special education-specific knowledge (e.g., understanding of the law) to determine the errors in the vignette and the experience and knowledge to make necessary recommendations to improve it.

Instead, consider having pre-service SETs use genAI to determine the error in the vignette and suggest strategies and interventions to support better outcomes. First, pre-service SETs can generate their own scenarios using AI. Examples of prompts include: “Generate a scenario that violates one of the six principles of IDEA, but don’t tell me which principle” or “Generate a scenario that violates the ‘zero reject’ principle of IDEA”. See Figure 4 for a sample of this interaction.

Next, have pre-service SETs switch vignettes with others in the class. After, have them identify the principles that were violated in the vignette. To do this, students can feed the vignette into the AI

and use prompts such as “Which IDEA principle does this violate and why”. With the explanation provided by the AI, instruct them to identify the sentence(s) that point to the violation by highlighting the sentence in the vignette and indicating which of the six principles it violates. Finally, pre-service SETs can work in tandem with the AI to generate suggestions and/or solutions to combat these violations through prompts such as “Give me suggestions of what I could do instead” or “What is a better way to handle this situation”. Remind pre-service SETs that they are the ultimate experts and, while the AI can offer supports and suggestions, it does not know their individual students or situations. After interacting with the AI, have pre-service SETs re-write the scenario so that it does not violate the principle. Figure 5 shows this activity.

### **Examples of Integrating Technology Knowledge (TK), Pedagogical Knowledge (PK), and AI**

Another common project within SET preparation courses is having pre-service SETs understand the categories of disability under IDEA by researching

a disability and creating handout that details important aspects of that disability, with a focus on strategies to support students in the general education classroom. In this original assignment, students researched their disability category using the internet, journals, books, and the library.

In the age of genAI, it is important to consider how pre-service SETs can leverage this technology to learn about the various disability categories and ways to best support the variability in classrooms. Pre-service SETs should be encouraged to embrace genAI to access resources about the various disability groups quickly. A recent study comparing traditional and ChatGPT-generated handouts found no statistically significant difference in responses (Goldman, Smith, and Peyton, in preparation). Thus, using ChatGPT to generate this content proves to be an accurate means of obtaining the information and saves time. Other AI models, like Copilot, include citations to back up their responses. Educators can use this AI guidance as a starting point and explore the cited websites and articles to deepen their understanding and ensure accuracy. As mentioned earlier, SETs should not use genAI as their sole source for legal, compliance, or ethical advice. SETs can also leverage more specialized AI tools that offer greater control over the source and curation of information. For example, School AI (see <https://schoolai.com/>) has specialized assistants that pre-services SETs can use to learn more about disability categories.

Prompts for it to create the necessary information for the handouts include: (1) “Explain the characteristics of (insert disability category)”, (2) “What supports might a student with (insert disability category) need to be successful in the general education classroom?”, (3) “What strategies can I, as the teacher, use to further support a student with (insert disability category)?”, or (4)

**FIGURE 5:** Sample Vignette Assignment

10-year-old Michael struggles with reading comprehension in Ms. Garcia's fifth-grade class. Michael has been diagnosed with dyslexia and receives some support from a reading specialist during pull-out sessions twice a week. Ms. Garcia, however, feels strongly that all students in her class should be at the same reading level by the end of the year. Concerned about Michael falling behind, Ms. Garcia decides to exclude him from participating in class discussions and group activities related to reading comprehension. She believes this will incentivize Michael to focus more on his reading interventions and "catch up" with the rest of the class.

*Violates Least Restrictive Environment*

*Despite Michael's struggles with reading comprehension due to dyslexia, Ms. Garcia, his fifth-grade teacher, is determined to keep him engaged in the general curriculum. She utilizes technology strategically. During independent reading, Michael uses text-to-speech software to follow along with the text and focus on comprehension. Visual aids like graphic organizers and interactive whiteboards with key vocabulary and images enhance his understanding. Ms. Garcia also differentiates assignments, offering him alternative ways to demonstrate learning, such as presentations, audio summaries, or participating in peer discussions where he can contribute his knowledge without relying solely on written responses. Through these inclusive strategies, Michael can actively participate and access the curriculum alongside his peers.*

“What are some strengths of students with (insert disability category)”. To further integrate TK and PK, pre-service SETs can use prompts such as “What educational or assistive technologies might a student with (insert disability category) benefit from?” or “How can I use technology to support students with (insert disability category)”.

### Examples of Integrating TK, PK, CK, and AI

A culminating experience in many special education preparation courses is developing a Universal Design for Learning (UDL)-aligned lesson plan. The UDL framework (Rose, 2000) has teachers consider the variability within their classrooms through multiple means of representation, engagement, and action/expression (Smith et al., 2019). Rather than designing a lesson and then adapting it to meet the needs of the various learners in the classroom (e.g., those with disabilities, English Language Learners, gifted learners, etc.), UDL encourages teachers to design

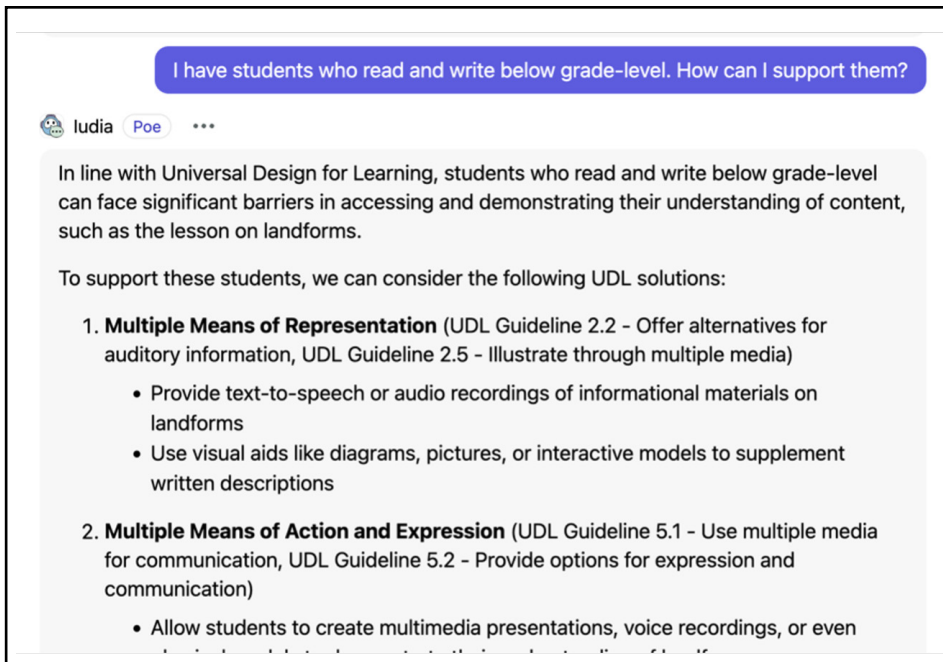
for variability from the onset to reduce barriers to learning (Smith et al., 2019). This assignment integrates all aspects of the TPACK framework as pre-service SETs are asked to integrate their PK and CK of the curriculum and students with disabilities. Additionally, pre-service SETs are encouraged to leverage their TK and include resources that support student learning outcomes. They are asked to create a lesson plan that embraces the UDL framework, accounting for the unique needs of an identified case study student, while considering the unique and diverse classroom needs. While the experience of designing and implementing a UDL-aligned lesson is valuable, there are several barriers pre-service SETs face with this assignment including (1) only a surface-level understanding of the overall framework, (2) minimal understanding of the scope and sequence of the curriculum, (3) a novice understanding of pedagogy and strategies to support student outcomes, and (4) an inability to integrate these concepts to create a cohesive lesson

plan. The purpose of this activity is not to master designing a lesson plan, but rather to show mastery of applying the UDL framework to their content area. Using AI, teacher educators can work with their pre-service SETs to overcome these barriers and design lessons that improve student learning outcomes.

Creating engaging, accurate, and complete lesson plans is often a tedious and stressful task for pre-service and novice teachers. However, several AI lesson plan supports currently exist. First, pre-service SETs can use ChatGPT, or other genAI chatbots, to craft their lessons. Prompts include “Design a UDL-aligned lesson plan for 2<sup>nd</sup> graders working on adding and subtracting with regrouping” or “What are some ideas to address multiple means of representation in a 4<sup>th</sup>-grade reading comprehension activity?”

Another option is using LUDIA (see <https://poe.com/ludia>), an AI designed to integrate the UDL framework into its responses. Pre-service SETs can use prompts such as “I am creating a lesson for 3<sup>rd</sup> graders about landforms”. LUDIA’s embedded instructions ask users to include relevant information such as student language profiles, interests, strengths, and cultural identities. Figure 6 shows a sample chat with LUDIA where a pre-service teacher is working in tandem with the AI to develop a lesson plan on landforms. As the goal of the activity is to integrate their understanding of UDL into their desired content area, creating a standard lesson plan is one option for expressing their knowledge.

Another method would be to provide students with an empty UDL framework to fill in with the co-created lesson pieces developed with LUDIA. See Figure 7 for a sample. Additionally, teachers can use resources within Magic School (see <https://app.magicschool.ai/>) to find AI-based tools that support the ideas

**FIGURE 6:** Sample LUDIA Chat

generated from LUDIA or ChatGPT. For instance, Magic School has a choice board creator and text-leveler, which are essential when considering multiple means of representation, engagement, and action/ expression. Throughout this assignment, pre-service SETs work through an iterative process of prompting the AI to generate ideas, using their thoughts on the topic, other relevant information from the course, and their experiences in the teacher preparation program. The use of AI allows pre-service SETs to refine their skills in designing lesson plans with personalized support.

### Implications

To adequately support students with disabilities, teacher preparation programs need to intentionally prepare pre-service teachers to utilize technological innovations, such as genAI (Dawson et al., 2019). The innovation of AI, particularly genAI, represents a technological shift that can impact all aspects of education. However, as AI technology improves preparation programs, they must consider integrating AI

meaningfully into the teacher preparation curriculum. To fully harness genAI, SETs need to conceptualize it within the context of the TPACK framework. This involves identifying its functions within the three components and understanding how its abilities can co-exist in those components. With this knowledge and increased access to tools, the potential of AI's continued growth and impact on education is infinite.

By integrating AI, teacher preparation programs can build and enhance the capacity of their SETs to better prepare them for a future teaching career that blends traditional teaching methods with technology. Moreover, increased efficiency in lesson planning and content creation can save time and frustration, as well as provide lessons that work to ensure improved outcomes for all learners. These examples represent just a snapshot of what genAI can offer the teaching profession, particularly SETs, if integrated meaningfully and effectively.

With all these wonderful opportunities for SETs, it becomes imperative to ensure teacher preparation programs

integrate AI, TK, CK, and PK into the curriculum to harness its potential impact on the teaching profession fully. SET preparation curriculum and faculty must align CK and PK coursework with the TPACK framework and model how AI can be used. This means creating direct experiences with AI and embedding practical application opportunities. Further, faculty must collaborate on the integration of AI to ensure that faculty and pre-service SETs are not just getting “prompt” practice, but are given the opportunity to manipulate and interact with a variety of useful AI tools. In short, student learning needs to go beyond asking a genAI a question to learn how to integrate AI into the curriculum fully.

### CONCLUSION

As the integration of AI continues to permeate the education environment, the need to align the use of the technology with a research-based framework like TPACK emerges as critical. The three components of TPACK are long-recognized (Mishra & Koehler, 2006) and provide ideal alignment to the features and opportunities afforded by AI. Leveraging genAI tools, such as ChatGPT, CoPilot, Gemini, and others, provides SETs unprecedented access to tools that provide on-demand support, instantaneous feedback, and the ability to create and differentiate instructional activities and opportunities. With this new and increased access, AI can enhance classroom practices, learning, and interaction while empowering educators to address the diverse and unique learning needs of all students more effectively. As SETs navigate this intersection of AI and teacher practice, it becomes clear that more training is needed at the SET preparation level to keep up with the ever-changing educational technology landscape.

Aligning AI integration and the

**FIGURE 7:** Example of UDL and LUDIA Worksheet Representation Column

Provide Multiple Means of Representation
Provide options for <b>Perception</b> - Provide text-to-speech or audio recordings of informational materials on landforms - Use visual aids like diagrams, pictures, or interactive models to supplement written descriptions
Provide options for <b>Language &amp; Symbols</b>
Provide options for <b>Comprehension</b> Jigsaw Activity: - Divide the class into "expert" groups, each responsible for learning about a specific type of landform. - Within the expert groups, have students work together to research the landform and prepare a short lesson to teach the rest of the class. - Then, reorganize the students into "learning" groups, where each member brings their expertise on a different landform to share with the group. - This structure encourages students to actively listen, take notes, and learn from one another in a more accessible format.
Resourceful & Knowledgeable

TPACK framework is ideal for addressing integration for pre-service special education faculty. Pre-service faculty could strategically align TK, CK, and PK with AI technology to enhance the educational experiences of their future SETs. By providing experiential activities such as crafting UDL-aligned lessons, changing text complexity, and personalizing activities based on student profiles using AI, pre-service SETs can deepen their understanding of the tools and cultivate the capacity to glean the full realm of what AI has to offer. Further, by acknowledging the critical relationship between the pre-service SET user and the AI, preparation programs can instill skills such as adaptability, collaboration, and continuous professional development in their SETs. Therefore, as we continue down the path of AI integration, SET preparation programs must embrace the expertise of their pre-service SETs and the pivotal role AI will continue to play in the success of their future students and classrooms.

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# Remixing Special Education Practices with Artificial Intelligence: UDL, EBP, and HLPs

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## ABSTRACT

This article presents engaging and practical methods of helping educators to “remix” the evidence-based and high-leverage practices they are already familiar with to include the new capabilities of artificial intelligence (AI). Transformational modern technologies can be powerful and disruptive, possessing the potential to impact multiple areas of society, including education. One of the best ways for educators to implement AI in their teaching is using it to help support and extend their current practices (Mishra et al., 2023). Similar to how a new remix on the radio can make an old favorite song fresh again, educators can use AI to uphold and enhance their existing instructional strategies and skills. However, adapting to the new paradigm of AI in education may be challenging for teacher preparation programs in special education. The authors of this article apply some of the strategies from “Leveraging Emerging Technology to Design an Inclusive Future with Universal Design for Learning” (McMahon & Walker, 2019) to effectively implement AI in education. Rather than needing to start fresh or relearn how to teach while incorporating AI, teachers can view this article as a foundation for how to apply AI tools to support current practice. The recommendations are based on Universal Design for Learning (UDL) and strategies for adapting AI tools to support high-leverage practices and established evidence-based practices. The authors aim to inspire special educators to start using AI to help “remix” and innovate the implementation of their existing instructional strategies.

## KEYWORDS

**artificial intelligence, evidence-based practices, high-leverage practices, special education, Universal Design for Learning**

**D**iscussions of artificial intelligence (AI) and its potential to improve special education are not new. Yin and Moore (1987) discussed many of these ideas in their article “The Use of Advanced Technologies in Special Education: Prospects from Robotics, Artificial Intelligence, and Computer Simulation” in the *Journal of Learning Disabilities* all the way back in 1987. While the tools used in their study may not meet our current definitions of AI, this is a prime example of how it is not a new concept in our field. However, what has changed in the last few years is the explosion of new AI tools that have strong educational applications. For instance, large language models (LLMs) such as ChatGPT are designed to assist users by providing information, answering questions, and generating text based on the input they receive. ChatGPT generates responses using a large dataset of text, which helps it understand and produce human-like text (OpenAI, 2023).

AI in education refers to the integration of machine learning and cognitive computing technologies to enhance and personalize the learning experience (Udvaros & Forman, 2023). It further involves the application of algorithms and data-driven approaches to assist in the instructional process (Basham et al., 2020a). This can include the automation of administrative tasks, the development of personalized learning experiences tailored to individual student needs, the use of intelligent tutoring

**TABLE 1:** Recommended AI Guidance

Recommendation	Explanation in Practice and Considerations for Preservice Teachers
<i>Human-Centered AI</i>	Prioritize human-centric AI design and operation, which considers the unique needs and abilities of all students, including those with disabilities. AI systems should complement human educators' efforts, not replace them, and should be designed to enhance personalized learning experiences.
<i>Inclusive and Equitable AI Use</i>	Ensure that AI systems promote equity and inclusivity, managing harmful biases that might exacerbate existing disparities. For special education, it is critical that AI tools do not disadvantage students based on their learning needs or backgrounds. For preservice teachers, as they explore AI tools to deploy in their classrooms, they need to learn to vet them for a range of diversity, equity, and inclusion issues.
<i>Measuring Trustworthiness</i>	Implement measures to ensure the reliability and validity of AI systems used in special education. This includes regular testing and verification to confirm that AI tools are performing as intended and are robust against failures. Ensuring the safety and security of AI systems is crucial to maintaining the trust of educators, students, and parents.
<i>Privacy and Security</i>	Maintaining stringent data privacy and security measures to protect sensitive student information is a fundamental concern in educational settings, especially when dealing with vulnerable populations such as children with special needs. Data security is very important in all technology applications but is even more critical for educators to be aware of with AI. Across the many AI platforms, there are a wide variety of data privacy practices and many unanswered questions about how long data is retained and used.

systems, and the provision of real-time feedback to students and educators. AI technologies can also analyze large amounts of educational data to identify trends, predict learning outcomes, and provide insights to help educators make informed decisions (Udvaros & Forman, 2023). By automating routine tasks and adapting to the unique learning pace and style of each student, AI in education aims to optimize learning outcomes and increase educational efficiency (Holmes et al., 2019). While AI in education holds tremendous promise, it introduces many concerns as well. As Zhao et al. (2023) point out, without significant training and design work, LLMs “are likely to generate toxic, biased, or even harmful content for humans” (p. 6). AI tools like ChatGPT can also provide widely incorrect hallucination responses, some of which may even be dangerous (Alkaiissi & McFarlane, 2023).

Currently, there is an overall lack of information about the use of AI tools in teacher preparation programs. An analysis of the literature from 2000–2023 by Sperling et al. (2024) indicated that very little research has been conducted on AI

use and literacy in education. Hopcan et al. (2024) also point out in their literature review of AI that “most of the studies were concerned with the functionality of using AI regarding learning activities of students with special education needs” (p. 7349). Teacher preparation programs are trying to catch up, but only a small amount of information has wended its way into education courses. In answer to this, Trust et al. (2023) recently provided suggestions for integrating ChatGPT in teacher preparation. However, their editorial lacked concrete examples of the types of programs, applications, and sources that teachers might use.

### AI IN EDUCATION POLICY

The 2024 *National Educational Technology Plan* (NETP) underscores the role of AI in transforming learning through technology (U.S. Department of Education, 2024). It emphasizes AI’s potential to enhance personalization in learning experiences by catering to diverse learning preferences and needs, which is particularly beneficial for students with disabilities. AI’s integration into educational technology is targeted

to achieve more equitable and effective learning outcomes, ensuring that tailored educational content and interventions are accessible to all students (U.S. Department of Education, 2024). The NETP further highlights the importance of responsibly deploying AI technologies to improve instructional practices and educational decision-making. The plan advocates for the development of guidelines and frameworks to assist educators in effectively integrating AI within the learning environment. This approach aims to ensure that AI tools are aligned with educational goals and that they augment rather than replace the human elements of teaching and learning (U.S. Department of Education, 2024).

State education agencies are also working to responsibly implement AI in education. One example is the Washington Office of the Superintendent of Public Instruction’s (OSPI) strong emphasis on AI risk management based on the National Institute of Standards and Technology’s *Artificial Intelligence Risk Management Framework* (U.S. Department of Commerce, 2023). This document focuses on the broad application of

**TABLE 2:** Emerging Technology Propositions and Connections to Teacher Preparation

PROPOSITION	DESCRIPTION	CONNECTIONS TO AI AND SPECIAL EDUCATION PREPARATION
<i>Don't (techno) panic</i>	This proposition encourages educators not to overreact to the rapid changes and potential disruptions caused by new technologies. It advises maintaining a balanced perspective and avoiding fear-driven reactions or “technopanics” about new technological tools.	In the context of AI and teacher education for special educators, this proposition emphasizes the importance of remaining calm and pragmatic when faced with new AI technologies. AI will not end the need for teachers, nor will it fix all the challenges in education. Preservice teachers should be taught to approach AI with a measured mindset, understanding that while AI offers significant potential, it also requires careful and informed implementation. By avoiding technopanics, educators can focus on integrating AI tools thoughtfully and effectively to enhance teaching and learning outcomes for students with disabilities.
<i>Don't believe (all of) the hype (cycle)</i>	This proposition reminds educators to stay grounded and not get carried away by the excitement that typically surrounds new technologies. It refers to understanding the “hype cycle” of technology adoption, which describes the overenthusiasm and subsequent disappointment that often accompanies new technologies before they find a practical and effective role in education.	In the context of AI and special education teacher preparation, this proposition highlights the need to maintain a balanced perspective amidst the excitement surrounding new AI technologies. Preservice teachers should be trained to critically assess the capabilities and limitations of AI tools, recognizing that not all AI advancements will have immediate practical applications in the classroom. Understanding the hype cycle helps educators navigate initial overenthusiasm and subsequent disappointment, allowing them to adopt AI tools that have proven effective and sustainable in special education settings.
<i>Swish and flick (and click)</i>	This proposition encourages educators to actively engage with new technologies, experiment with them, and explore their potential uses in the classroom. It emphasizes the importance of hands-on experimentation and learning by doing, akin to practicing magical spells in a playful and exploratory manner.	This proposition highlights the necessity for preservice teachers to engage hands-on with AI technologies, experimenting and exploring their potential uses in the classroom. By using AI tools during their training, preservice special educators can develop practical skills and confidence in using these technologies to enhance instructional strategies. Encouraging a playful and exploratory approach enables teachers to discover innovative ways to support students with disabilities, fostering a mindset of continuous learning and adaptation.
<i>Superheroes assemble</i>	This proposition calls for collaborative efforts in implementing technology. It stresses the importance of gathering a diverse team of educators, developers, students, and other stakeholders to work together in designing meaningful and inclusive educational experiences. As we adapt to the reality of AI in education, we are going to need more stakeholders at the table as we navigate new challenges.	Collaboration is key in implementing AI technologies effectively in special education. This proposition advocates for the formation of diverse teams, including preservice teachers, experienced educators, developers, and other stakeholders, to collaboratively design and implement inclusive educational experiences. In teacher education, fostering a collaborative environment prepares future special educators to work with interdisciplinary teams, ensuring that AI tools are used to their fullest potential to support diverse learning needs.
<i>Are you ready for the remix? (build on what we have)</i>	The final proposition encourages educators to integrate new technologies with existing evidence-based educational practices. It suggests using new tools to enhance and extend proven educational strategies rather than completely replacing traditional methods. AI should not upend all of current instructional best practices which are backed by extensive research evidence. Instead, we can “remix” some of our existing skills and strategies to effectively incorporate AI and assist special educators to address students’ needs.	Preservice teachers should be encouraged to integrate new AI technologies with existing evidence-based educational practices rather than completely replacing traditional methods. This proposition supports the idea of remixing proven instructional strategies with AI enhancements to address the unique needs of students with disabilities. By building on established practices, preservice special educators can effectively incorporate AI tools into their teaching repertoire, ensuring that these technologies complement rather than disrupt their pedagogical approaches.

AI technologies and risk management across various sectors, including implications for education. Some relevant recommendations and key points drawn from the framework may be particularly useful for special education preparation programs that are addressing AI in their courses. Ultimately, special education preparation programs need to proactively teach AI skills while simultaneously working to mitigate real-world risks. The Washington OSPI embraced this approach in their implementation of an AI risk management framework as explained in their policy document *Human-Centered AI Guidance for K-12 Public Schools* (Washington OSPI, 2024). Table 1 provides a summary table of selected key recommendations.

## AI IN SPECIAL EDUCATION

The recommendations from the Washington OSPI align with the principles of Universal Design for Learning (UDL) and assistive technology practices, aiming to create an inclusive educational environment that supports all learners. Integrating these strategies into special education teacher preparation programs can help harness the potential of AI to improve learning outcomes while managing associated risks effectively. McMahon et al. (2024) presented a webinar for the Council for Exceptional Children titled *Artificial Intelligence and Teacher Education* in which they provided a range of AI applications and strategies. One of their principal recommendations was for educators to find ways of using AI to enhance their existing instructional evidence-based practices. Transformational modern technologies can be powerful and disruptive, possessing the potential to impact multiple areas of society, including education. The use of AI in special education teacher preparation offers numerous innovative opportunities to enhance instructional practices and provide novel support for

students with diverse needs (Basham et al., 2020b).

In the article by McMahon and Walker (2019) titled “Leveraging Emerging Technology to Design an Inclusive Future with Universal Design for Learning,” the authors present five propositions to help educators effectively use emerging technologies in education. These propositions are designed to foster a culture that supports educators as they create inclusive educational experiences using innovative technologies and are critical for faculty in special education teacher preparation programs to consider as they work to teach preservice teachers about AI. Table 2 outlines the five propositions along with our own connections explaining why each is critical to integrating AI in special education teacher preparation. These propositions are part of a broader discussion on how educators can navigate the challenges of integrating rapidly advancing technologies into inclusive educational practices. They serve as practical guidelines for educators to consider and apply in their professional environments to enhance learning through technology.

As AI rapidly expands into a wide range of technologies and across educational settings, these five propositions remain critical considerations for educators. AI “technopanics” have been present in movies and media for decades and, more recently, many AI tools have faced outright bans because of potential misuse (Harrison et al., 2023). Nevertheless, AI will likely not immediately live up to all of its hype. Humans remain an essential part of professional judgment and critical thinking, at least so far. The third proposition focuses on providing educators with enough time to practice and become adept at using new educational technology tools (McMahon & Walker, 2019). This is critical for AI because many of these tools require practice and trial and error before a teacher

should feel confident about the results they will experience in a classroom full of students. In addition to practice and professional development, another critical strategy that helps prepare special educators to use AI is matching (or remixing) existing instructional practices with the addition of AI tools.

## CONNECTING AI TO EXISTING PRACTICES IN SPECIAL EDUCATION

Special education teacher preparation programs are confronting two separate AI challenges. The first is AI misuse and cheating. These stories are unfortunately common and involve students who use an AI platform to write an entire essay or otherwise rely too heavily on AI use for composition (Riech, 2022). We hope such misuse is rare in teacher preparation programs. The much larger challenge for teacher preparation programs is adapting to the rapidly changing AI landscape to prepare special educators to use these tools effectively. To address this challenge, we turn our attention to ways special education instructional practices can be “remixed” using AI (McMahon & Walker, 2019).

Evidence-based practices (EBPs), high-leverage practices (HLPs), and UDL are all instructional practices that special educators frequently deploy in the classroom to support students with disabilities. While each of these domains is a large topic on its own, we will highlight a few examples for each. This list is not designed to be exhaustive and special education preservice teachers and their instructors can likely think of many more examples. Following are some practical ways that AI tools can support selected examples of existing research-supported practices.

### Using AI to Support Universal Design for Learning

Universal Design for Learning (UDL)

is a framework designed to improve teaching and learning for all people based on scientific insights (Meyer et al., 2014). The *National Education Technology Plan* describes UDL as a way to provide multiple means of engagement, representation, and action and expression to accommodate a wide range of learners. UDL is based on the premise that learner variability is the norm, not the exception, and that curriculum should be designed to meet the needs of all learners from the outset (U.S. Department of Education, 2024). By proactively designing learning environments and experiences that are accessible and engaging for all, educators can reduce barriers and maximize learning opportunities (Meyer et al., 2014).

One long-term hope for special education is harnessing AI to enhance personalized learning, an instructional practice identified by the Institute of Education Sciences' What Works Clearinghouse (2016) as meeting its Tier 2 of evidence based on a study conducted by the Bill & Melinda Gates Foundations (2014). Personalized learning is tailored to each student's interests, strengths, and needs (Patrick et al., 2013). A goal for AI in the classroom is to build educators' skills and strategies for implementing personalized learning that supports specially designed instruction (SDI) for students with disabilities. Personalized learning supported by AI could address many issues of learner variability. Dedicated efforts are needed to effectively implement AI in a way that builds on the evidence-based practice of personalized learning and its related recommendations from the *National Educational Technology Plan* (U.S. Department of Education, 2024).

AI also provides educators with new technological capabilities that can make some of the design work of UDL easier and faster. Most of these capabilities are framed as time-saving teaching tools or

ways to enhance student engagement (Hargrave et al., 2024). While enhancing engagement is laudable, much more can be done with AI. For instance, one of the three foundational principles of UDL, provide multiple means of representation, emphasizes creating curricula that provide options for perception, language and symbols, and comprehension (Meyer et al., 2014). The flexible nature of AI is particularly useful in providing options for perception within classroom contexts. Various AI programs can rapidly create new displays of educational content in science, mathematics, social studies, history, and art. For example, the AI tool Diffit (<https://web.diffit.me>) can quickly create a variety of text and associated images for hard-to-understand topics. When asked to create a fifth-grade-appropriate discussion about geological time, the website created a brief description of the concept, a graphical representation, and definitions at a 5th-grade reading level within five seconds. For students who have difficulty in understanding and decoding symbols and text, both Diffit and ChatGPT (<https://chatgpt.com>) are useful tools. Like Diffit, ChatGPT can easily rewrite text to match students' reading level. In addition, Canva's Magic Write (<https://www.canva.com/magic-write/>) enables students and teachers to add video and images to text to support better comprehension. For overall comprehension, both Khanmigo (<https://www.khanmigo.ai/>) and Cathoven (<https://www.cathoven.com>) provide K-12 content that can be adjusted to meet the needs and reading levels of students.

These tools can be a great boon to teachers as they promote differentiated instruction matched to the individual capabilities of students. For example, teachers often assign students to different reading groups depending upon their evaluated reading ability. These students may read different texts written

at a level that is appropriate for the entire subgroup. Instead, a teacher could use the same text for the entire group but adjust its level for each student. The teacher may also periodically readjust the reading level for each individual student without reorganizing the subgroups within the class. This practice allows the class to stay together, read the same story or informational content, and discuss concepts and ideas as a whole. This not only provides students with a better experience but helps the teacher in terms of time and classroom management.

Furthermore, there are a variety of existing AI applications that can support options for recruiting student interest, one of the UDL guidelines aligned with the principle of providing multiple means of engagement (Almusaed et al., 2023). For example, Eduaide (<https://www.eduaide.ai>) can help teachers gamify lessons, create interactive lesson seeds, and develop message boards with support in both English and Spanish. When addressing the UDL guideline of sustaining effort and persistence, teachers may find Eduaide useful along with other platforms such as Brainly (<https://brainly.com>), which provides step-by-step instruction and encouragement for subjects such as mathematics, science, and reading. Brisk Teaching (<https://www.briskteaching.com>), while originally intended for teachers, has a targeted feedback generator that students can use to help them keep track of their own progress and develop skills for self-regulation, aligned with yet another UDL guideline.

The ability to provide step-by-step instructions and immediate feedback to students quickly and easily can be immensely helpful for teachers in a modern classroom. A teacher using these programs could readily create curricula for multiple groups of students who are working at various levels of understanding or ability. By using Brainly

**TABLE 3: UDL Guidelines Enhanced with AI Strategies and Tools**

UDL Guideline	AI-Enhanced Strategy	Relevant AI Tools
<b>UDL Principle: Provide multiple means of engagement</b>		
Recruiting interest	AI can help educators rapidly adapt materials to include additional high-interest elements personalized for a student. For example, a 5 <sup>th</sup> grade student working on fraction problems could complete word problems created by their teacher with the assistance of AI that relate fractions to the student's favorite topic of horses by incorporating calculations of horse feed and paddock areas.	ChatGPT Eduaide Goblin Tools
Sustaining effort and persistence	By periodically providing encouragement along with a scaffolded learning environment, AI can foster students' persistence on what might be seen as difficult tasks and concepts to master (e.g., algebra).	Brainly
Self-regulation	AI can provide immediate feedback on student work which helps students with understanding and self-regulation.	Brisk Teaching Magic School
<b>UDL Principle: Provide multiple means of representation</b>		
Perception	Teachers can use AI image generation tools to create infographics that explain complex topics through an alternative to auditory information.	DALL-E Diffit Gemini
Language and symbols	In order to support their understanding and decoding of symbols and text, students can use AI to help explain complex plots, ideas, or subjects. For instance, AI could take a subject such as pre-algebra and explain the meaning of variables and equations.	Diffit Bard Canva's MagicWrite
Comprehension	For a student reading below grade level, AI can produce similar content at a lower reading level. For example, AI could take an 8th grade student's science passage on parts of the plant cell and reduce the reading level to 4th grade.	Khanmigo Cathoven
<b>UDL Principle: Provide multiple means of action and expression</b>		
Physical action	This guideline addresses physical action and assistive technology use. Special educators and families will need to determine in which situations AI qualifies to be used as an assistive technology.	likely to be determined on a case-by-case basis
Expression and Communication	Allowing students to demonstrate their learning using multiple forms of media provides additional opportunities and methods to be successful at school. Rather than writing a paper on a topic, students could use AI tools to help author infographics, presentations, and other media that demonstrate their understanding.	Canva Midjourney Parlay Goblin Tools
Executive functions	AI can help students make decisions, plan out projects, and self-monitor their responses to challenges within content and the classroom.	Siri Alexa Rabbit R1

in combination with Brisk Teaching, a teacher could have individuals or groups of students working on self-paced material that adjusts to their particular needs while the teacher interacts with specific students who need additional support. The teacher could also utilize these programs to aid with transition times in class or when class periods are shortened, lengthened, or canceled,

a common occurrence in the modern classroom.

In terms of the third UDL principle, provide multiple means of action and expression, AI offers vast options. For assistance with communication, Parlay (<https://parlayideas.com>) not only helps monitor student communication but also supports continuing discussion and engagement by providing writ-

ing prompts, collaboration ideas, and student grouping based upon interest and ability. The ChatGPT suite of applications provides several ways for students to express their ideas. For instance, the Glibatree Art Designer uses optimized search coding to program the Midjourney image maker (<https://www.midjourney.com>) to provide artwork for any subject or question.

**TABLE 4:** Sample of EBPs in Special Education with AI Implementation Examples

EBP	AI Application	AI Tool
Social narratives	Use AI to craft personalized social narratives that are based on individual student data and can be used to help students understand and engage appropriately in social interactions.	Claude
Task analysis	Use AI to decompose complex tasks into simpler, step-by-step instructions that can aid students in performing tasks independently.	ChatGPT
Video modeling	Use AI to automate the creation and editing of instructional videos that model desired behaviors or academic procedures and can be tailored to the student's learning preferences.	InVideo's AI Video Maker
Technology-aided interventions and instruction	Use AI to adaptively modify educational content and problem difficulty based on real-time student performance to optimize learning outcomes.	ChatGPT's Math Tutor

Because of the built in restrictions of ChatGPT, students can create computer-generated artwork that is acceptable for the classroom. A teacher could have students utilize ChatGPT to express their ideas about science, mathematics, history, or language art content in ways that are both flexible and unique for the individual student. Of course, with ChatGPT or any other AI platform, the teacher must monitor the accuracy of any information generated and work with students to be aware of issues of plagiarism using these platforms.

Overall, the adaptability of AI complements the UDL principles by offering varied means of engagement, representation, and action and expression while accommodating learner variability. In addition, all of these resources easily fit within the context of inclusive classroom instruction and can bridge the gap between self-contained and general school environments and instruction. Table 3 presents several additional examples of how AI applications might be used in alignment with specific UDL principles and guidelines.

### **Example UDL and AI Activity for Special Education Preparation**

In a preservice teacher education course, groups of students are assigned a specific topic and one of the nine UDL guidelines and instructed

to transform traditional lesson content using AI tools. Each group focuses on a single UDL guideline, such as providing options for recruiting interest (aligned with the principle of engagement), perception (aligned with the principle of representation), or physical action (aligned with the principle of action and expression). For example, students assigned to the guideline on providing options for perception might use AI tools like text-to-speech, image generators, or Magic School (<https://www.magicschool.ai/>) to change a set of math word problems to include a student's preferred topic like dinosaurs or horses. This assignment allows preservice teachers to take a deep dive into UDL lesson planning and AI resources and helps them learn to create accessible and inclusive lessons.

### **Using AI to Support Evidence-Based Practices**

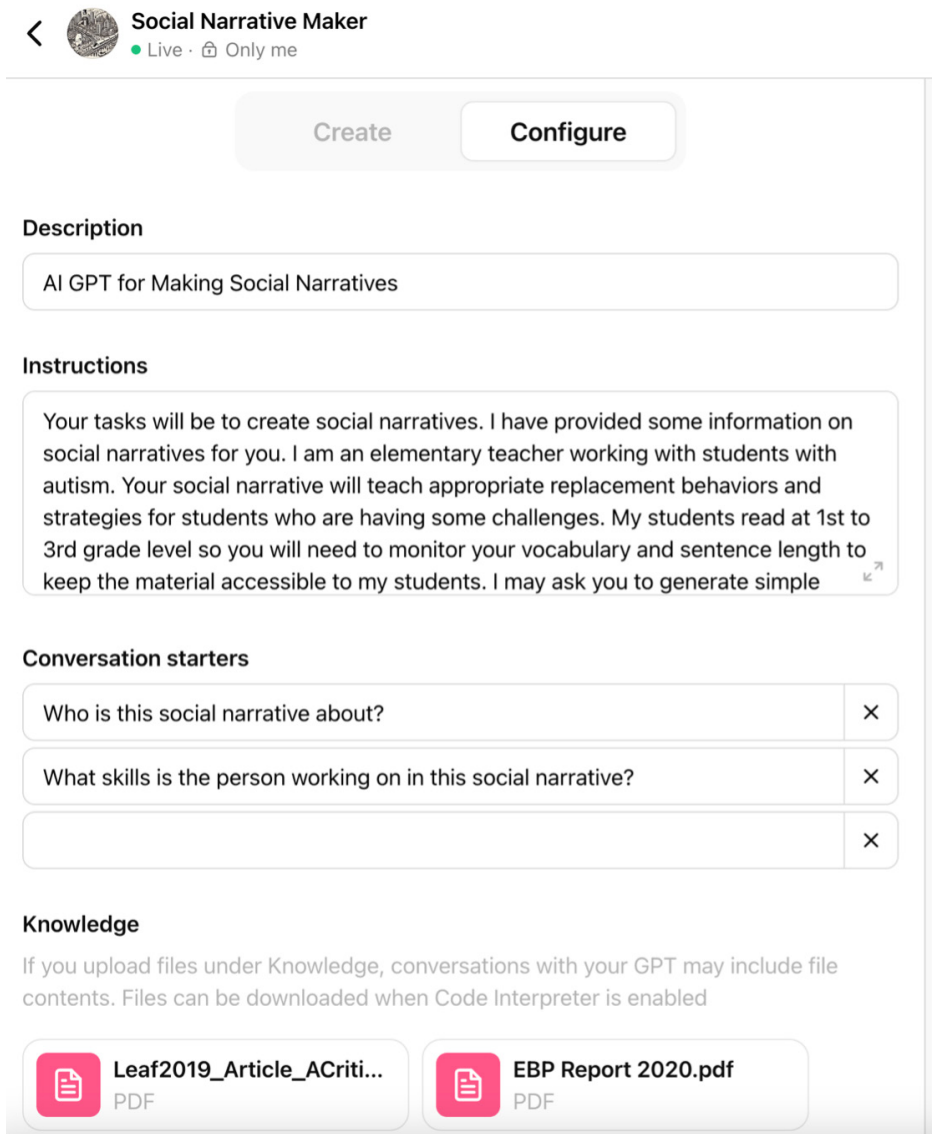
The field of special education continues to work to identify evidence-based practices (EBPs) that are effective when used with students with disabilities (Odom et al., 2005). While the process of identifying EBPs has been defined in the literature, there is comparatively less information on implementation strategies (Cook & Cook, 2013). As preservice teachers learn about EBPs in special education, they can also be

directly taught how to utilize AI in the implementation process. Table 4 provides examples of EBPs identified by Steinbrenner et al. (2020) as effective for use with students with autism. This table highlights how AI tools can enhance the implementation of specific EBPs by providing tailored support and interactive experiences for students.

Special education teacher preparation programs can and should continue to equip preservice teachers with the skills to create task analyses, video models, social narratives, and other EBPs without the support of AI. However, similar to how using a calculator allows many people to solve known math problems faster or to double-check their work, AI can enhance the capabilities of professionally prepared special educators. One strategy for effective AI implementation is to support educators in developing their own AI digital literacy skills by customizing their own LLM or other AI tools to address specific classroom needs. These needs are often unique to the individual student, class, and community. Therefore, teachers can learn to tailor AI tools and LLMs to address the diverse demands of their pedagogical environments. The following vignette illustrates this process:

*Imagine a first-year special education teacher named Amanda who is teaching Rebecca, a third grader*



**FIGURE 1:** Example Educator-Created LLM

with autism. One morning, Rebecca suddenly starts to display a new attention-seeking behavior of throwing wood chips on the playground. Amanda has had success teaching replacement behaviors to Rebecca using social narratives and decides to use this strategy again. Amanda uses her planning time to work on this challenge, using AI to assist her. She uses the paid version of ChatGPT to create her own customized LLM called “Social Narrative Maker.” She trains the LLM on social narrative research and examples and then gives it a test run. Amanda spent only

five minutes creating her LLM and is fairly happy with the initial results. She continues to provide the LLM prompts to refine a narrative for Rebecca and within just a few minutes, she is happy with the results (see Figure 1). Amanda next asks the AI to generate a few pictures. She finds the first few examples to be less diverse than she would like and asks for some additional changes. Fairly quickly, she is able to generate an improved social narrative with accompanying visuals that will meet her needs and support Rebecca in learning appropriate replacement behaviors.

### Example EBP and AI Activity for Special Education Preparation

In a special education course, preservice teachers individually select an EBP such as creating video models, making social narratives, or writing task analyses using AI. Students present their work to the class, share the positives and negatives of their experiences with AI, and learn about the range and quality of responses generated by AI. Preservice teachers might discover and discuss tips for writing better prompts or they might compare multiple AI tools (e.g., Microsoft Copilot, Gemini, Claude) in terms of supporting the implementation of a specific EBP. Notably, all AI responses will need to be reviewed in light of real-world classroom settings. This activity is likely to generate many examples of why educators must evaluate the content generated by AI.

### Using AI to Support High-Leverage Practices

The Council for Exceptional Children has identified 22 high-leverage practices (HLPs) as essential educational strategies that promote effective teaching and better learning outcomes for all students, including those with disabilities (McLeskey et al., 2017). These practices are foundational, supported by research, and aimed at enhancing student engagement, learning, and achievement across various educational settings. HLPs encompass a wide range of techniques, from explicit instruction and collaborative learning to formative assessment and behavior management (McCray et al., 2017). They are divided into four primary aspects of practice: collaboration, assessment, social/emotional/behavioral practices, and instruction. The CEC emphasizes these practices as critical tools for special educators to ensure that their teaching is inclusive, effective, and responsive to the diverse needs of students with disabilities, thereby

**TABLE 5:** Sample In-Class Activity on HLP Implementation Supported by AI

Domain	HLP	Example of HLP Implementation with AI
Collaboration	HLP 2: Organize and facilitate effective IEP meetings with professionals and families	Transcripts and meeting notes generated by AI digital assistants such as Otter AI or the AI meeting companion feature of Zoom can help capture ideas and notes from IEP meetings.
Assessment	HLP 6: Use student assessment data to analyze instructional practices and make necessary adjustments	AI-powered tools such as Dreambox or other adaptive learning platforms can be used to support instructional adjustments based on student data.
Social/Emotional/Behavioral	HLP 8: Provide positive and constructive feedback to guide students' learning and behavior	Students can be taught to use AI feedback tools such as Grammarly, Copilot, or similar writing supports that provide immediate, personalized feedback on students' written work, enhancing learning outcomes. A student recently said, "A red underline from your teacher feels worse than a red underline from my computer helping to catch an error".
Instructional	HLP 12: Systematically design instruction toward specific learning goals HLP 18: Use strategies to promote active student engagement	Tools from Magic School or other AI curriculum planners allow educators to design and tailor instruction based on specific learning objectives, student needs, and interest inventories. AI-based engagement platforms like Nearpod and Pear Deck can analyze student responses in real-time to adjust lessons and increase interaction.

fostering an equitable learning environment (McLeskey et al., 2017). As preservice educators learn about HLPs, they can simultaneously learn to use AI to support and potentially enhance their implementation. Because the recent HLP update includes an increased emphasis on cultural considerations in relation to HLP implementation (Aceves & Kennedy, 2024), preservice teachers must be aware of diversity, equity, and inclusion issues that can arise with AI use. Teacher preparation programs can teach HLPs and explore cultural considerations within the known issues of AI bias and limitations (Fesakis & Prantsoudi, 2021) through informative activities and vibrant class discussions.

Due to the rapidly developing nature of this technology, it would be incredibly difficult to maintain an up-to-date list of AI tools matched to the 22 HLPs. In a world where millions of people can create and share their own AI tools just like our teacher Amanda did in the vignette above, there is little chance that any special education preparation program could

keep on top of them all. This introduces an opportunity for instructors in special education teacher preparation programs to adopt a "Guide on the Side" approach. Instructors could have preservice teachers work in groups to identify how different AI tools might support individual HLPs or other instructional practices. These could be designed as in-class group activities, perhaps dividing the class between the four HLP domains of Collaboration, Assessment, Social/Emotional/Behavioral, and Instructional practices. Table 5 displays how such an in-class activity in a special education course could explore ways of using AI to support HLP implementation. Ideally, this would provide the class with opportunities to reinforce both their HLP knowledge and their AI literacy skills. Again, these examples are not exhaustive.

#### ***Example HLP and AI Activity for Special Education Preparation***

Teacher preparation programs can include assignments like an AI-Powered Lesson Planning Workshop designed to

equip preservice special education teachers with the skills to effectively integrate AI tools into their lesson planning in alignment with the HLPs. In this workshop, participants begin with an introduction to various AI educational tools, such as AI lesson planners and adaptive learning software. They are then divided into small groups, with each group selecting a specific HLP, such as explicit instruction or providing constructive feedback. Using their chosen AI tool, each group collaboratively creates a detailed lesson plan that incorporates the selected HLP. The groups then present their lesson plans to the class, explaining the AI tool's role and how it supports the implementation of the HLP. The workshop concludes with a reflective discussion on the benefits and challenges of using AI in special education, fostering a deeper understanding of how technology can enhance instructional practices.

## **DISCUSSION**

The rapid development of artificial intelligence technologies, especially

LLMs, is poised to significantly disrupt special education practices in the coming years. As Marino et al. (2023) discuss, AI has the potential to act as a “cognitive prosthesis” for students with disabilities, providing new opportunities to access learning, develop skills, and demonstrate knowledge. AI-powered tools can generate personalized learning experiences, provide instructional support, and even serve as artificial tutors or companions. AI is a potential game changer not only in special education, but in all educational spaces. As noted earlier, while there is very little research about AI use in special education, even less is known in general education environments (Hopcan et al., 2024; Sperling et al., 2024). This lack of research is leaving all education stakeholders flat-footed when it comes to AI’s impact on classrooms today and its potential impact tomorrow.

However, the increasing use of AI in education also raises important ethical considerations around data privacy, bias, transparency, and the changing roles of educators (Marino et al., 2023; U.S. Department of Education, 2024). Special education teacher preparation programs must evolve to equip preservice teachers with the knowledge and skills to leverage AI effectively and responsibly. This includes understanding the affordances and limitations of AI tools, learning to evaluate them critically, and strategizing how to integrate them into evidence-based instructional practices.

The examples explored in this paper, such as using AI for writing support, personalized learning pathways, and accessibility accommodations, represent just a few of the many potential applications of AI in special education. These are intended to be a starting point to help special educators to explore, pilot, and evaluate AI capabilities. Additional research is needed to establish guidelines, evaluate impact, and define best practices for implementing AI to enhance

learning outcomes for students with disabilities.

Although we mention some specific AI tools in this manuscript, we recognize that in this rapidly changing technology landscape, there is no guarantee that these companies will all be around in even a few years. The names and features of these AI platforms are likely to change over the coming years. However, we strongly believe that AI applications are only going to increase in availability and will rapidly expand in capabilities. Additionally, AI policies vary dramatically from one district to another and the tools and access to AI resources may be more regulated in some schools than others.

Ultimately, realizing the promise of this emerging technology in special education will require an ongoing assembly of and collaboration among educators, researchers, technology developers, policymakers, and most importantly, individuals with disabilities themselves (McMahon & Walker, 2019). The field of special education can harness the power of AI to design a more inclusive, effective, and empowering future for all students. Teacher preparation programs need to be leaders in AI implementation so we can design a more inclusive educational experience for all learners.

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# Using an Artificial Intelligence (AI) Agent to Support Teacher Instruction and Student Learning

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## ABSTRACT

The options for Artificial intelligence (AI) tools used in teacher education are increasing daily, but more is only sometimes better for teachers working in already complex classroom settings. This team discusses the increase of AI in schools and provides an example from administrators, teacher educators, and computer scientists of an AI virtual agent and the research to support student learning and teachers in classroom settings. The authors discuss the creation and potential of virtual characters in elementary classrooms, combined with biometrics and facial emotional recognition, which in this study has impacted student learning and offered support to the teacher. The researchers share the development of the AI agent, the lessons learned, the integration of biometrics and facial tracking, and how teachers use this emerging form of AI both in classroom-based center activities and to support students' emotional regulation. The authors conclude by describing the application of this type of support in teacher preparation programs and a vision of the future of using AI agents in instruction.

## KEYWORDS

**Artificial intelligence, biometric, computer science, disability, special education, teacher education**

**A**s Artificial intelligence (AI) technology advances, researchers are increasingly adopting these new methodologies, particularly in student learning systems, which is leading to the development of automated adaptive learning as a standard feature in intelligent tutoring systems. An AI or intelligent agent is a software entity that perceives its environment and takes actions to achieve specific goals. These agents operate autonomously, making decisions based on data and predefined programmed algorithms. They utilize AI techniques to interact with the environment. The benefit of an AI agent in the classroom is its autonomy in taking action without the support of humans. An important aspect when preparing teachers to use AI agents is the social capacity of students to bond with the agent and the potential bias built into the system being used (Castelfranchi, 1998). Yet other researchers argue that AI-powered agents provide options to help make online learning and learning cost-efficient while increasing learning gains (Goel, 2020). Some recent researchers suggest a future where not only will students be supported by AI agents, but AI agents will serve as potential team teachers to help augment areas of content or instructional needs (Lan & Chen, 2024).

Dai and Ke (2022) highlighted the emergence of virtual agents powered by AI, benefiting from advancements in natural language processing and generative AI, as a significant trend in educational applications. These AI agents are evolving to become more convincing and expressive, capable of responding to student emotions with advances in multimodal data collection, recognition algorithms, and signal processing. Studies by Baker et al. (2008), Nakano and Ishii (2010), Prepin et al. (2012), and Yu et al. (2013) have explored automating positive relationship detection by analyzing conversational behaviors. However, most of these studies are either at the higher education level or fail to include neurodiverse students in their testing populations

In this article, we describe the application of AI agent support in teacher preparation programs and a vision of the future of using AI agents in instruction.

and training data (Memarian & Doleck, 2024). While there is broad research support for the effectiveness of affective virtual agents supporting student motivation and self-efficacy (Dai et al., 2024; Guo & Goh, 2015), research supporting the generalization of affect measurement techniques and virtual agent design for neurodiverse students is rare.

Integrating AI agents into educational settings has garnered significant attention recently (Barz et al., 2024), particularly in enhancing teaching methodologies and student engagement. AI agents can provide virtual representations of users while offering a unique avenue for interaction and learning in digital environments. The use of AI agents in the classroom has been explored across various studies (Dai et al., 2024; Jeon, 2022), highlighting its potential to create immersive and interactive learning experiences.

The effectiveness of AI agents in education is further supported by the work of Schroeder and Axelsson (2006), who examined the impact of AI agents on social presence in virtual learning environments; a more recent study found positive use in heart patients' self-care in the field of nursing (Wonggom et al., 2020). Charlton and colleagues (2020) noted the impact on social initiation for students identified with Autism spectrum disorder (ASD). Their findings suggest that AI agents can facilitate a sense of community and belonging among students, a crucial aspect of effective learning. As facilitated by teacher AI agents, this sense of presence can bridge the gap between traditional and digital learning

spaces, making education engaging and accessible.

Moreover, AI agents' adaptability provides a personalized learning experience catering to students' diverse needs. With further advances in multimodal data collection, recognition algorithms, and signal processing, these AI agents are becoming more convincing, expressive, and responsive to student emotions. Previous research has found ways to automate positive relationship detection through the collection and analysis of conversational behaviors such as verbal turn-taking, body posture, facial expression, and eye gaze behavior (Baker et al., 2008; Nakano & Ishii, 2010; Prepin et al., 2012; Skantze, 2021; Yu et al., 2013). Anagnostopoulou et al. (2020) explored the customization of teacher AI agents and its impact on student motivation and engagement. The study found that personalized AI agents could cater to individual learning preferences, enhancing the educational experience. This personalization aspect of AI agents signifies a shift towards more student-centered learning approaches, where the educational content and delivery methods are tailored to meet the unique needs of each learner.

Considering the specific area of social and communication skills development for students with ASD, initial efforts suggest emerging facial recognition technology can be used effectively to help students identify and learn discrete facial expressions (Garcia-Garcia et al., 2022; Ali et al., 2023). Further, using a social virtual agent can increase student initiation of conversation (Li et

al., 2023). Yet, most of these systems focus on direct training of facial emotion recognition without the complexities of participating in a responsive social dialogue (Garcia-Garcia et al., 2022; Harrold et al., 2014). Examining the role of AI virtual agents in more natural social interactions remains an emerging area of study.

### AI Agent Implementation by Teachers

Although AI tools hold promise for teachers, their implementation is not without challenges. Technical issues, such as the requirement for robust digital infrastructure and the risk of reduced human interaction, create barriers to widespread classroom adoption. Educators need to prioritize reliable technology and balance virtual and human interactions when integrating AI agents into their teaching practices.

Teachers' use of AI agents in the classroom presents a promising avenue for enhancing educational experiences. The literature suggests AI agents can significantly improve student engagement, foster a sense of community, and provide personalized learning experiences. However, successfully integrating AI agents into educational settings requires careful consideration of technical and interpersonal challenges.

The authors provide a summary of an ongoing research study being implemented in four elementary schools attempting to create a teacher-driven AI-agent model for working with students to learn coding while supporting students in self-regulation (specifically on-task behavior), positive interactions, and communication skills during math class. The research team shares an overview of the study, a vignette, and steps for using AI agents in the classroom. The team then shares the struggles and pitfalls of using AI agents as well as considerations for teachers working to integrate personalized AI tools into classroom settings.

## FIGURE 1: Implementation Steps for Consideration of using an AI Agent in the Classroom

When implementing an AI agent effectively in the classroom to support student learning and on-task behavior, teachers can follow these guidelines:

### Purpose and Scope:

- Understand the specific purpose of using an AI agent in the classroom. The AI agent should enhance student engagement, provide personalized assistance, and promote positive behavior.
- Ensure that the AI agent aligns with the educational goals of the classroom and complements existing teaching methods.

### Guiding Principles for AI Agent use:

- Use the AI agent to address individual student needs, such as providing additional explanations, answering questions, providing affirming statements, or offering study tips.
- Leverage the AI agent to encourage positive behavior, reinforce on-task actions, and provide timely feedback.
- Ensure the AI agent adheres to student privacy regulations and maintains a safe online environment.
- Communicate the AI agent's role, capabilities, and limitations to students, fostering trust and understanding.

### Ensure Teacher-Student Collaboration:

- Introduce the AI agent to students, explaining its purpose and how it will assist them.
- Encourage students to provide feedback on their interactions with the AI agent. Adjust its behavior based on student input.
- Monitor student interactions with the AI agent to identify any issues or challenges.
- Intervene when necessary to ensure a positive experience.

*Remember, the purpose of using an AI agent is to enhance the learning environment, promote student engagement, and contribute to a supportive classroom atmosphere.*

## Study Overview

Project RAISE represents a collaboration led by UCP of Central Florida in collaboration with the University of Central Florida and the University of Kansas. UCP of Central Florida is a nonprofit organization and is a network of inclusive public charter schools. The U.S. Department of Education Office of Special Education Program (OSEP) funds the project through a Stepping UP Grant. Project RAISE aims to improve the social skills of students with disabilities (SWD) by creating an AI-driven socially assistive character, ZB™ in K-5 classrooms and an online robot, Ray-Z, that teaches basic coding skills. At its core, Project RAISE aims to improve communication skills and time on task for SWD while enhancing these students' educational experiences by focusing on coding, science, technology, engineering, and mathematics (STEM) content.

Central to this initiative was the development of ZB™, an AI agent type designed to support SWD in acquiring so-

cial skills and fundamental coding skills. The AI agent, ZB™, supports students through three study phases. These range from learning basic coding from ZB™ to coding with a peer and having ZB™ in the classroom to support on-task and communication skills. Implementation of ZB™ initially occurred using multiple setups of an iPad, programming a physical robot using Blockly, and a teddy-bear-like AI agent that was initially controlled by a human-in-the-loop. The student also wore a biometric device to help trigger the changing colors of the heart and face of the AI agent to mirror that of the participant. Using iterative development cycles of the AI agent, the team made several changes based on teacher feedback. These changes are aligned with supporting new teachers in preparing for this changing world of using AI agents in the classroom.

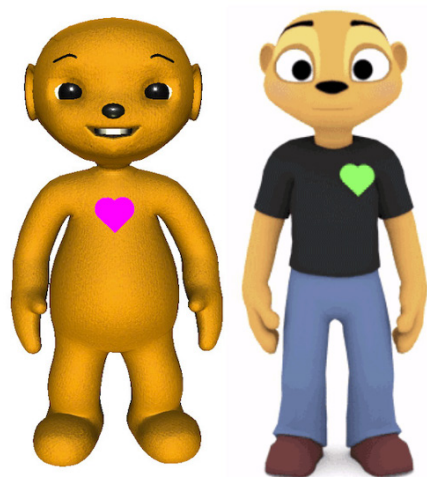
As the project evolved and the AI agent became automated, the following vignette shows how such an agent is used in classrooms:

*A teacher, Mr. Aiden, wants to use an*

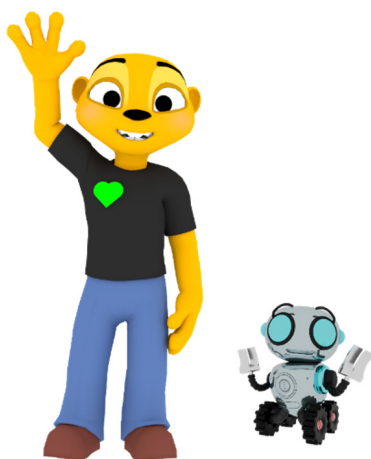
*AI agent to help students learn coding. First, he decides to see if his students who might struggle in working with peers could learn to code a simple square with an online robot and an AI agent coaching the student. After he finds success with the basic coding, he decides to build further the relationship of the student who struggles with the AI agent by having the student teach a peer how to create the same simple square with the support of the AI agent. The teacher then realizes the power of the relationship of the AI agent in supporting the students and knows this agent can provide affirming statements to students during instruction. He decides to investigate whether this is helpful to students' self-regulation and confidence in class participation. He finds that if he goes through the use of the agent over time and the relationship is built, the agent has value in the classroom. Initially, he used the agent for student affirmation but found the connection was too foreign and actually was distracting. However, after students learned with and taught*



**FIGURE 2:** The original AI Agent ZB and the Revised ZB from Student Input



**FIGURE 3:** The AI agent ZB™ and his partner, Ray-Z



*with the AI agent, their relationship was established, and the agent provided a positive connection and not a distraction in the classroom setting.*

This example reflects what the team has learned from their project, which is reflected in Mr. Aiden's use of AI agents. This form of AI will not work for all students, but it can be helpful if the student sees a positive relationship with

the agent, which is a critical step for teachers to consider when using agents in the classroom. Figure 1 provides steps to consider when using an AI agent to support student learning.

### Changes in Project RAISE and Alignment with Teacher Preparation

Other lessons were learned that teachers should consider. Initially, the appearance of the AI agent selected was considered too juvenile for the upper elementary grade levels, so the team decided to create a revision of the AI agent. They decided to let the students select from several models of an agent. They then had students in the partnership elementary school site vote on their favorite avatar, with the team paying specific attention to the votes of children with disabilities since this was the project's focus. The objective for this revised avatar was to create a "more" mature AI agent. See Figure 2 for images of the original and revised avatars. As teacher educators prepare new teachers to work with those with disabilities, they should consider the authenticity and age-appropriateness of any AI tool being implemented.

This team also learned several other lessons as they ventured into AI agent use with SWD. Initially, existing natural language processing was used to create the dialogue, but the team found that natural language models needed to reflect the unique dialogue presented by the students. The content and complexity of verbalizations can be analyzed using natural language processing (NLP) techniques. Natural Language Processing emerged from interdisciplinary fields and combines computer science, artificial intelligence, and linguistics to enable computers to understand, interpret, and manipulate human language. The use of NLP can help identify patterns of speech, which in this case were used

to program the AI agent using authentic text from the students with ASD.

Using NLP, the team decided to pilot the tool for 2 years with a human-in-the-loop to help create dialogues for the AI agent that were simple, precise, and friendly to the nuances of errors, patterns of speech, and questions posed by SWD. After carefully analyzing the way a skilled human interacted with children who were neurodiverse, the team then used natural language software (Otter.ai) to create an appropriate dialogue for the AI agent.

As teachers are being prepared in special education, new AI agent tools that are considered for use should be analyzed for their ability to respond to potential speech impairments and to ensure the dialogue used is at a level of comprehension and natural exchange for the range of SWD they serve. Teachers also should be aware of the bias that exists in all AI tools, and should specifically find tools that include representation of the range of students with disabilities they might be serving in their future classrooms (e.g., communication board, limited speech ability, lack of clarity in articulation).

Two important lessons were learned to guide teacher educators as they prepare the next generation of special education teachers using AI. First, when AI models are built, be aware they often are built on the "typical" and hold not just race, class, and potential gender bias but often are void of any representation of people with disabilities. Before adopting AI tools, educators should consider biases that may be present based on how they were developed. Second, "less is more" when planning to use AI tools with SWD. In the early development stages, the project team used an iPad, Blockly the robot, a taped square, and a biometric device, and students were taken into another room with a tech coach to conduct this study. Realizing a need to consolidate the tools and time, the team

created Ray-Z so all tools needed for the project were available in one space (See Figure 3 for images of ZB™ and Ray-Z the AI tools used in the project). This containment in one setting and one platform on the computer gave the team a focused setting to use facial tracking to mirror the student's emotions in the AI agent ZB™. Students could still see the AI agent while coding the robot on the iPad. A biometric device, the Polar Verity Sense, was also placed on the student to help understand stress, but in the future, the goal is to eliminate this added device and move to an iPad or laptop that can pick up these same biometric signals using just a camera. The team also learned that providing the AI agent within the classroom may be difficult with logistics for space and time, internet and Bluetooth connections, and teacher time; however, it works better for the students and reduces the overall classroom disruption of students leaving and entering the classroom. A final challenge of the project is to make this easy for teachers to use, which has been the recent focus.

Initially, this project was delivered by a research team but evolved to teachers directly overseeing all project phases in Fall 2023. From the start of the project, the team wanted to help students and teachers understand the stress of SWD by using biometric devices connected to the AI agent to generate a customized response to the learner. The team progressed in comprehending the nature, utilization, and intricacies of biometric data concerning children and its role in activating AI agents to help teachers (Hughes et al., 2022; Ali et al., 2023).

### **Research Goals**

To investigate the potential of the AI agent in supporting student communication and self-regulation goals, the research team focused on increasing interactions and time on task of participants.

In the area of communication, the team specifically studied verbal reciprocity. In the development stage, the team examined Phase 1 conversations between the participant and the AI agent. Once the project's pilot stage was underway, the team studied interactions in Phase 2 between participants and peers working together to code the robot. In Phase 3 the emphasis shifted to participants' interactions with their teacher and peers during mathematics instruction with the AI agent providing social-emotional support. During mathematics instruction, the teachers implemented a think-pair-share strategy to ensure student communication could continue with their peers and prompted by the AI agent. The team provided professional development to ensure teachers understood the think-pair-share strategy and the importance of implementation fidelity at this stage. During Phases 1 and 2 of the study, the learning was student-driven, with ample opportunities to initiate a conversation with either the AI agent or, in Phase 2, a peer and the agent. In Phase 3, the teacher conducted the classroom routine, with the AI agent providing social-emotional support to the participant.

Teacher educators can support teacher candidates in learning new AI tools, but grounding them in evidence-based and high-leverage practices is important to ensure positive outcomes even when integrating an AI tool. Teacher preparation programs need to help teachers today not just think about room arrangements for grouping but also the logistics behind charging devices, integrating devices into instruction, creating centers for learning coding, or using evolving AI tools that are student-driven and teacher-independent. One aspect of Project RAISE is that the tools used are evidence-based practices but require limited teacher time and interaction. These AI tools used in the classroom can set new teachers up for success and create a

more robust learning environment for differentiation for students with disabilities.

### **Findings to this Point and Teacher Application**

After a comprehensive analysis of the data from 2023, it became evident that quantifying the frequency of student opportunities to initiate conversations or to respond to others would provide more insightful findings. Further assessment revealed improvements across all communication aspects, from pre-observations to post-observation evaluations. Instances of teacher-led peer-to-peer interaction opportunities surged from 127 across teachers to 220 with the same teachers in 2023, while SWD responses demonstrated a slight increase. Notably, student engagement with peer inquiries achieved a 100% response rate, with peer-generated questions rising from 14 to 23. Student-initiated interactions with both teachers and peers demonstrated significant growth, escalating from 111 to 207 and from 122 to 220, respectively. These results highlight a substantial improvement in communication dynamics across all assessed categories from the initial to the final assessments ensuring teachers used a simple think-pair-share strategy and providing support from an AI agent during mathematics instruction.

A few barriers to consider in working with new and innovative ideas based on this project were identified as persistent issues as the project was scaled to multiple schools and districts. First, school-based instability still exists with basic internet connectivity. This instability impacted the ability of teachers to access the web-based platform and, at times, caused them to become frustrated with the project system. In this project the team found solutions such as providing hotspot devices to ensure dependability during the research sessions, but that is not an option usually available to a

teacher. A second barrier, especially early in the study, was implementation fidelity. Although training was provided, some teachers required follow-up discussions to ensure the think-pair-share strategy was being used as intended. Based on the year 4 teacher survey results, the think-pair-share strategy utilized in the study was shown to be valuable to teachers beyond the project. This emphasizes how good teaching practices are beneficial to students with disabilities beyond the scope of this study and are still needed even with AI-driven or supported instruction.

The support for using these strategies by administrators has been positive, with administrators and teachers choosing to sign up to use the AI agent. Administrative and technology support are essential for AI use, but knowing how to show the strengths, limitations, and safeguards of tools being adopted is essential to preparing teachers for this new frontier of potential use or misuse of emerging tools. Helping teacher candidates understand how they can engage students with technology and provide needed accommodations or modifications should be part of a preparation program in special education. Teacher educators need to prepare teacher candidates for the safe and ethical use of AI, and a great resource to consider is the ISTE Standards (2000). Also, vetting the tools used and knowing how to work with administrative and technology teams, as well as ensuring privacy and safeguards for the tools used, are critical considerations for the field.

### **Use of AI agents in Classroom**

Based on our research, this team supports using AI agents in classrooms to provide support in teaching content and supporting students' social-emotional needs. The team further believes that these tools can help alleviate the stress many teacher candidates feel (Brady et

al., 2023; Saloviita & Pakarinen, 2021; Leko et al., 2024) and perhaps help with a critical need in the recruitment and retention of special education teachers (Rock et al., 2023). However, the process for using these tools and understanding what is “under the hood” of any AI agent used needs to be a part of the discussion in teacher preparation programs. For example, machine learning models have great promise in education, both for student success and as tools to aid teachers in better understanding their students. These algorithms can provide teachers with information on their students' physical presence, stress levels, and focus. Using physical presence, the AI agent can encourage more involvement by the student if he or she loses focus, which can often be assessed by eye gaze (Stiefelhagen et al. 1999, Massé et al. 2017). For teachers to understand the specific benefits of AI tools such as these, more specific applications must be presented and readily available. The current project includes these metrics to drive the dialogue and expressions of an AI virtual companion (AIC) dedicated to an individual student.

### **Challenges in AI Use for Emotional Responses**

While physical presence and focus based on eye gaze are objective measures easily determined by vision-based algorithms, stress can involve many measures that vary by individual. e.g., heart rate, blood pressure, respiration, facial expression, frequency, variability, intensity, and timing of speech (Nemcova et al., 2020; Rojo Lopez et al. 2021). Some of these can be assessed with simple non-invasive solutions using a camera (facial expression), and a microphone (speech attributes). The others (heart rate, blood pressure, and respiration) have commonly been measured using biosensor devices (Shen et al. 2021). However, recent advances in

vision-based approaches have mitigated and, for many applications, replaced biosensors with analysis of facial camera input (Perepelkina et al., 2020). In this project, an AI-based method can detect emotions using biosensors, vision-based physiological signal, and facial expression analysis.

In this real-time application, barriers to use were identified. One limitation is that participant faces may be occluded due to head and body movements and low illumination. Similarly, background noise can make voice signals noisy in classroom environments. The project team moved to physiological signals acquired from biosensors to detect emotion and stress levels in such scenarios. Moreover, using multiple modalities is now a common approach in machine learning to determine emotion, providing more robust solutions to variable classroom environments (Sharma & Dhall 2021).

Unfortunately, the interpretation of emotion indicators, whether through unimodal or multimodal data, can be highly subjective, as baselines for people vary, and generalization of the machine learning algorithms to unseen data is challenging. As a result, biases can arise based on many human attributes, including age (Kim et al. 2021), skin tone (Halberstadt et al. 2021), culture (Li & Deng 2020), and neurological differences (Yitzhak et al. 2020).

In this project, the approach was to be supportive and never critical, much like what is taught to teacher candidates using positive behavioral support models (Sugai & Horner, 2009). The AI agent's interaction with the participants aligned with the overall philosophy of PBIS, which was to create a safe and predictable environment for student success. This supportive model used by the AI agent involves uttering encouraging messages and maintaining a positive facial expression and body pose. In cases

**TABLE 1:** Microsoft Co-Pilot’s Response to the Future of AI in Teacher Preparation

“The integration of AI-agents with biometric data in teacher preparation holds significant potential for transforming education.

**1. Holistic Student Development:**

- AI can accelerate students’ holistic development by providing personalized learning experiences. It can analyze biometric data (such as heart rate, facial expressions, and attention levels) to gauge student engagement and well-being.
- Teachers can receive real-time insights into students’ emotional states, allowing them to tailor their teaching approaches accordingly.

**2. Equitable Education:**

- AI can help identify learning gaps and adapt content to meet diverse student needs. By integrating biometric data, it can recognize when a student is struggling or disengaged.
- Teachers can then intervene promptly, ensuring that no student falls behind.

**3. Teacher Professional Development:**

- Biometric data can enhance teacher training. For instance:
  - During practice teaching sessions, AI-agents can analyze teachers’ facial expressions, voice tone, and body language to provide feedback on their effectiveness.
  - Biometric data can also assess stress levels, helping teachers manage their well-being.
- By automating routine administrative tasks, AI could streamline teacher workflows, giving them more time to build relationships with students and foster their learning and development.

**4. Ethical Considerations:**

- While the benefits are promising, we must address ethical concerns related to privacy, consent, and bias.
- Transparent guidelines are essential to ensure responsible use of biometric data in education.

In summary, AI-agents with integrated biometric data can revolutionize teacher preparation, making education more inclusive, personalized, and effective.” (Microsoft Co-Pilot, 2024).

where the algorithm detects a continued lack of attention, the AI companion gently says a phrase such as “Boy, it can be hard to stay on task, but let’s try.” In cases where stress seems to increase, the team’s approach always treats a machine-determined emotion category as a suggestion, not necessarily a fact. Using this point of view, our system triggers the AI agent to behave in a way that would support an individual who is stressed but in a manner that is also supportive of any learner.

As a simple example of handling apparent stress, the AI agent might indicate

that it needs some help getting its focus back and ask the participant to help it do breathing exercises. The system can then use respiration data from the student to affect the AI agent’s breathing rate (chest expansion and contraction). If the student is breathing too fast, the AI agent could suggest that it would like to relax. This approach puts the control in the hands of the student, is non-disruptive to the class, and is a strategy we feel is preferable to the AI agent labeling the child’s emotion in a way that may be interpreted as the AI agent being dominant or using potential bias.

### **Future Connections of AI Agents to Teacher Education**

Using AI agents in the classroom could involve a complex system like the one created by Project RAISE, an open-source, free tool designed for use by teachers. Alternatively, teachers may increasingly have the opportunity to create simple AI tools for skill or social-emotional acquisition using an ever-increasing array of online tools. New voice-generated AI tools by OpenAI or Google Gemini and other companies will support the potential for teachers to have AI agents, much like a Pet Rock or

a Furbee of the past. Teachers can create more sophisticated AI agents, chatbots (e.g., <https://mizou.com> creates bots in 50 languages or <https://chaindesk.ai> creates a custom chatbot with no programming), and robots (e.g., Moxie, Dash or Loona) to provide behavioral and learning support. For teacher educators, this means modeling the use of current technology, and, for teachers, it requires openness to trying new tools while keeping in mind data privacy, bias, and security issues. For example, Project RAISE has made all tools web-based with the option to “just use” the tool without recording or using biometric data. The integration of AI tools is the future and teachers and those who prepare them need both acceptance and access to these tools to assist them and the students they teach.

The future use of AI agents and biometrics in teacher education is unknown, but results of the following prompt provided to Microsoft Co-Pilot, “What is the future use of AI agents with integrated biometric data in teacher preparation?” and provided in Table 1 offers a glimpse of what could lie ahead in the area of AI.

Integrating Project RAISE, focusing on socially assistive AI agents like ZB™ and Ray-Z, the robot, into teacher preparation programs could significantly enhance future educators’ competency in leveraging technology for inclusive education. Considerations for project use of RAISE and other AI-agent usage in teacher preparation programs are provided.

**Curriculum Development.** Teacher preparation programs can include modules or courses on designing and implementing technology-based interventions for students with disabilities. Project RAISE can serve as a case study or a core component of these modules, providing insights into the development, application, and impact of socially assistive

technology in educational settings.

**Hands-on Training.** Future teachers can receive hands-on professional development (PD) in using socially assistive AI agents and robots within the classroom. This PD could involve simulations and role-playing exercises in controlled environments, such as in TeachLivE (Dieker et al., 2023) housed at the University of Central Florida in the Center for Research in Education Simulation and Technology, to practice engaging students with diverse learning needs through these technologies.

**Enhancing Understanding of Executive Functioning.** Programs can use these tools to discuss how to help students with executive functioning skills and their importance in educational success. Teacher candidates might reflect upon how technologies, like those in Project RAISE and other off-the-shelf AI agent tools, could be used to support these skills. By understanding the principles behind Project RAISE’s approach to enhancing executive functioning, teacher candidates can design interventions tailored to their future students’ needs.

**Interdisciplinary Collaboration.** Teacher preparation programs could foster interdisciplinary collaboration by involving special education, psychology, and computer science experts to provide a holistic view of how technology can support students with disabilities. This approach mirrors the collaborative effort seen in Project RAISE, offering future teachers a model for working across disciplines to enhance educational outcomes including promoting collaboration with a range of general education teachers.

**Research and Innovation in Educational Technology.** Teacher educators should encourage teacher candidates to engage in research projects that explore the effectiveness of socially assistive AI agents in supporting students with disabilities. This research could involve

assessing the impact of AI agents on social skills, executive functioning, and academic achievement, contributing to the evidence base for best practices in the use of educational technology.

**Innovation Labs.** Teacher educators should consider creating in-person or online innovation labs where future teachers can develop their own educational technologies, potentially including the tools from Project RAISE. They should also consider reviewing other OSEP Stepping Up grants that involve many novel technological tools. These innovation labs could provide a creative space for prototyping new tools and methods for inclusive education, fostering a culture of innovation among teacher candidates in the rapidly emerging world of AI.

**Professional Development and Continuous Learning.** Teacher educators should ensure their programs include components that stress the importance of ongoing PD in educational technology. Graduates need to be equipped with the skills to continually assess and adopt new technologies, like those developed in Project RAISE, to meet the evolving needs of their students. Yet, with a critical lens and understanding of national standards and guidelines, teachers can be prepared to protect students’ privacy and identify potential bias in AI tools being used. By integrating online and free open education resources, like Project RAISE, into teacher preparation programs, future educators are not only equipped with knowledge and skills to use advanced technology in the classroom but they are also inspired to innovate and contribute to the effective use of AI in the support of student learning and the field of inclusive education. This approach prepares them to meet the diverse needs of their students, fostering an inclusive, engaging, and supportive learning environment for all.

The Project RAISE initiative, by

integrating the socially assistive AI agent ZB™ and Ray-Z robot into classroom settings, provides a foundation for exploring the use of AI agents to support executive functioning skills among students with disabilities. Considering the project's focus on enhancing social skills through interactive and collaborative learning experiences, extending its application to include executive functioning is a natural progression.

To effectively implement this extension, the design and programming of AI agents must be informed by pedagogical principles and evidence-based strategies targeting executive functioning. This includes creating tasks requiring planning, organization, task initiation, and emotional regulation. Additionally, incorporating feedback mechanisms that reflect on the student's performance and decision-making processes can further support the development of these skills.

Integrating executive functioning skills into Project RAISE involves strategically using the socially assistive AI agents, ZB™, and Ray-Z robot. These agents can facilitate activities that specifically target and develop crucial cognitive abilities (e.g., coding) or support social-emotional regulation.

### **Future Implications of AI in Teacher Preparation and Educational Settings**

There is a great deal of public excitement and concern surrounding the use of AI in education based on the abilities of ChatGPT, Llama, Gemini, Microsoft Co-Pilot, and other Large Language Models (LLMs). Given the right textual prompts, these tools can produce credible and sometimes jaw-dropping text. Even more impressive are AI agents built on these platforms, such as Dall-E (photorealistic images) and Sora (short photorealistic videos). But, all AI tools can also provide what is termed

“hallucinations,” which provide false information. Think about when you ask your smart home device what the weather is, and it gives information for the wrong city, or you ask for a specific question, and you get a vague, wrong, or no response. With this potential dichotomy of outcomes from AI, caution and human review of all information produced is essential.

Many students are tempted to use these tools to do assigned work without even checking the outcomes' validity (often lacking). Others realize these are just learning companions that can help get the creative juices flowing. This view sees AI-enabled systems as advanced versions of existing, accepted tools like search engines and Wolfram Alpha, each of which can guide your thinking or be used just to get answers.

At this stage, many teachers consider using AI tools in creative activities like writing and art as cheating, whereas others are embracing the inevitable and encouraging the use of these as sources of inspiration. Creative teachers are now using AI to inform their classroom activities, develop assignments, and produce informative visuals, just as some more enterprising members of the public use these tools to quickly draft holiday letters.

The threat that AI enables false narratives to be created and spread at blinding speeds and can share false information, videos and images of events that never happened continues to exist. Historically, every advancement comes with downsides. The key is universal education and a re-emphasis on open, productive dialogue among humans, who are now aided by new digital partners.

Another persistent challenge of using AI is that generative AI requires large amounts of data. In this stage of rapid advancement, AI is built based on large data sets that are readily available. However, these datasets may not accurately reflect students in specific educational

contexts, especially inclusive educational contexts with students who are neurodiverse. As we build better data sets with attention to representing diverse students, AI virtual agents are likely to improve and become more responsive to individual students, learning how to differentiate agent behavior to maximize student learning. As multimodal data collection and signal interpretation improve, AI virtual agents will likely make decisions based on individualized data with increased confidence. In the future, AI virtual agents may become as varied and unique as the students with whom they work. Future research should continue exploring AI agents' potential in education, focusing on innovative solutions to overcome the barriers to their effective implementation.

### **CONCLUSION**

This current interdisciplinary team sees the potential of AI-agent use in classrooms to support both teacher and student learning. Yet, even with 4 years of immersive work in this area, the team cautions the field that the use of AI with students has as many questions as there are answers. This team enthusiastically embraces the potential support these tools can provide with mindful preparation of teachers and the administrators who will support them to ensure that this evolution of AI does not further stress an already overtaxed and understaffed profession, teachers in special education. This team believes the power of AI lies in teachers thinking differently about instruction by being prepared differently to think about the potential of these evolving tools to fill gaps in areas of deficit and to allow students to create in areas of strength. The power of AI and any biometric data should lie with the students' use of this information to help them as learners, which is the ultimate goal of teacher preparation in any discipline.

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# Navigating AI-Powered Personalized Learning in Special Education: A Guide for Preservice Teacher Faculty

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## ABSTRACT

Integrating Artificial Intelligence-Powered Personalized Learning (AI-PPL) in special education teacher preparation represents a shift toward tailoring educational experiences to meet the unique needs of preservice teachers and students with disabilities. This article explores the implementation of AI-PPL tools in teacher preparation programs, highlighting their potential to customize learning experiences, provide adaptive feedback, and enhance engagement through interactive content. This review of current AI-PPL functionalities, such as adaptive learning environments and customized feedback mechanisms, demonstrates how AI-PPL can impact teaching practices and student learning outcomes. The article introduces critical attributes for successful AI-PPL integration, such as ensuring accessibility and inclusivity. It calls for further professional development to enhance educator competency and skills. By presenting real-world examples and guiding questions for special education faculty, the authors offer practical insights for educators and faculty members to effectively navigate the complexities of adopting AI technologies in teacher preparation programs.

## KEYWORDS

**Accessibility, adaptive learning, artificial intelligence, personalized learning, special education, technology integration**

Integrating artificial intelligence (AI) in educational contexts marks a shift towards accommodating students' learning needs. AI-Powered Personalized Learning (AI-PPL) can facilitate learning environments that dynamically adapt to each learner's unique requirements, particularly in the context of special education teacher preparation. AI-PPL offers a pathway to tailor educational experiences, providing opportunities for preservice teachers to develop the skills needed to support all students in achieving their full potential. The *National Educational Technology Plan* identifies critical areas for development, including enhancing educational technology design, to bridge significant divides in current educational practices (U.S. Department of Education, 2024). This article meets this need by providing practical examples for integrating AI into teaching, specifically addressing the needs of preservice teachers and special education faculty.

AI-PPL tools comprise various components and functionalities, including:

- **Adaptive learning environments:** These environments are designed to tailor educational experiences to individual pacing and comprehension levels using adaptive algorithms. For example, Hashim et al. (2022) found that adaptive learning systems improved mastery of STEM concepts by providing content that aligns with students' current knowledge and learning preferences.
- **Customized feedback mechanisms:** AI-PPL platforms also integrate mechanisms that provide personalized feedback based on learners' responses. Hasibuan and Azizah (2023) conducted a study demonstrating that personalized feedback using natural language processing and machine learning can enhance student understanding and retention.

**TABLE 1:** Additional AI-Related Terms, Regulations, and Initiatives

Term	Definition
<i>AI-Powered Personalized Learning (AI-PPL)</i>	An educational approach that uses AI technologies to tailor learning experiences to individual students' needs; examples include adaptive learning environments and real-time performance analytics.
<i>Adaptive learning environment</i>	A system that adjusts the difficulty and type of content based on the learner's performance; for example, a math program might provide more challenging problems as a student demonstrates mastery.
<i>Real-time performance analytics</i>	Tools that provide immediate feedback on student performance, allowing for targeted interventions; for example, an AI system might identify areas where a student struggles and suggests additional practice.
<i>National Educational Technology Plan</i>	A 2024 U.S. Department of Education initiative that outlines a vision for technology in education and emphasizes the importance of accessibility and personalized learning.
<i>Web Content Accessibility Guidelines (WCAG)</i>	Guidelines for making web content accessible to people with disabilities; AI tools should adhere to these guidelines to ensure inclusivity.
<i>Section 508 of the Rehabilitation Act of 1973</i>	Part of U.S. federal law requiring that electronic and information technology be accessible to people with disabilities; AI tools used in education must comply with this law to be effective and inclusive.

- **Real-time performance analytics:** These tools offer educators detailed insights into student progress, allowing for targeted interventions. For instance, Gligorea et al. (2023) reviewed several studies and concluded that real-time performance analytics can identify learning gaps more effectively, thereby improving targeted support and interventions.
- **Interactive and engaging content:** AI-PPL tools often incorporate multimedia simulations and game-based elements to make learning more engaging for students with disabilities. Chen et al. (2021) conducted a meta-analysis showing that interactive and engaging content can increase student engagement and improve comprehension of complex concepts.

Table 1 provides additional explanations of AI terminology, regulations, and initiatives relevant to the use cases and real-world examples provided in this article.

## USE CASE 1: SUPPORTING TEACHING PRACTICES AND STUDENT LEARNING

Integrating AI-PPL tools into teacher preparation programs can enhance preservice teachers' skills and significantly influence their teaching practices. Educators equipped with AI-PPL tools can offer more targeted support, identify learning gaps more efficiently, and tailor their instruction to meet the unique needs of each student (Zawacki-Richter et al., 2019). The following real-world example highlights the use of Microsoft's OneNote with Immersive Reader in special education teacher preparation programs.

**Objective:** Enhance preservice special education teachers' ability to use AI tools to improve accessibility and comprehension in their future classrooms

### Implementation Steps:

#### 1. Setup and preparation

- Faculty integrate OneNote into the curriculum for preservice teachers.
- Faculty create simulated student

profiles, noting specific reading disabilities and preferences for use in training.

#### 2. Introduction to preservice teachers

- Faculty conduct workshops introducing preservice teachers to OneNote and its features, including the Immersive Reader and Math Assistant.
- Faculty provide hands-on training sessions where preservice teachers explore how to use these tools effectively.

#### 3. Practical application

- Preservice teachers create lesson plans that incorporate OneNote's AI tools.
- Preservice teachers engage in role-playing exercises to practice using OneNote with simulated students.
- Preservice teachers participate in peer review sessions to give and receive feedback on their lesson plans.

#### 4. Daily use in simulated classrooms

- On Day 1, preservice teachers use Immersive Reader to help simulated students with reading disabilities understand mathematical problems.
- On Days 2-4, preservice teachers conduct practice sessions using OneNote's Math Assistant to solve equations and receive step-by-step guidance.
- On Day 5, preservice teachers conduct a simulated class quiz using OneNote's practice quizzes to assess understanding and progress.

#### 5. Evaluation

- Faculty collect and analyze preservice teachers' feedback.
- Faculty use OneNote's analytics to track preservice teachers' progress in creating accessible lesson plans and identify areas needing further support.

**Cost:** Included in Microsoft Education products typically available to educational institutions; licensing agreements vary in cost but generally provide economical access to numerous educational tools.

**Efficacy Measurement:** The efficacy of OneNote in preparing preservice teachers to enhance students' mathematical understanding is judged through improvements in lesson plan quality, test scores from simulated classroom activities, and positive feedback on engagement and confidence in handling mathematical problems.

### USE CASE 2: FACILITATING CONCEPTUAL UNDERSTANDING

Tailored educational content adjustments based on learners' skills can substantially boost conceptual understanding. Capuano and Caballé (2020) discussed how adaptive learning, which is closely related to AI, accelerates a

learner's performance with automated and instructor interventions. Jing et al. (2023) highlighted the rapid advancements in adaptive learning research, identifying key areas like deep learning and AI education models that revolutionize educational practices. This integration of adaptive learning and AI enriches educational practices and greatly enhances students' conceptual understanding by providing personalized, skill-based content adjustments. The following real-world example demonstrates how to implement Google's Socratic app for differentiation and inclusion in special education teacher preparation programs. Figure 1 illustrates a possible daily structure for this example.

**Objective:** Train preservice special education teachers to use AI-powered tools like Socratic to improve accessibility and comprehension of various subjects for students with diverse learning needs

#### Implementation Steps:

##### 1. Initial assessment

- Faculty conduct a pretest with preservice teachers to gauge their understanding of using AI tools for differentiation and inclusion.
- Faculty collect information about preservice teachers' experiences and expectations with personalized learning technologies.

##### 2. Demonstrate personalized learning paths

- Faculty use Socratic to demonstrate how to create individualized learning plans for students based on their specific needs and interests.
- Faculty develop interactive problems and activities that preservice teachers can use in their future classrooms.

##### 3. Interactive training sessions

- Preservice teachers engage with

hands-on activities using Socratic to solve various subject problems. The app provides real-time feedback and adjusts the difficulty level based on the user's inputs.

- Faculty include multimedia elements such as videos and step-by-step explanations to show how AI tools can cater to different learning preferences.

#### 4. Ongoing support

- Preservice teachers can access Socratic's scaffolding and additional resources to learn how to support students with varying needs.
- Faculty monitor the progress of preservice teachers through Socratic's analytics features, identifying areas where they need further training.

#### 5. Final assessment

- Faculty conduct a posttest to measure preservice teachers' improvement using AI tools for differentiation and inclusion.
- Faculty collect feedback from preservice teachers on their training experience with Socratic.
- Faculty analyze pre/posttest results to evaluate the effectiveness of the training program in preparing teachers to use Socratic and make data-driven decisions for enhancing the teacher preparation program.

**Cost:** Socratic is a free app available on Android and iOS platforms, making it accessible to all preservice teachers.

**Efficacy Measurement:** The efficacy of Socratic is measured through pre/posttest results, student engagement levels, and qualitative feedback from students and teachers.

**Outcomes:** The activity improved preparation of preservice special education teachers in using AI tools to differentiate instruction and include students with diverse learning needs. The

**FIGURE 1:** Example Structure for Use Case 2

**Day 1:** Introduction to Socratic. Preservice teachers interact with the app to solve problems related to their subject areas.

**Days 2 - 4:** Daily interactive sessions where preservice teachers use Socratic to provide personalized learning experiences for simulated students.

**Day 5:** Final assessment and feedback collection. Faculty review analytics to identify preservice teachers' progress and areas needing further support.

**FIGURE 2:** Guiding Questions for Integrating AI Tools into Special Education Teacher Preparation Programs

#### Customization to the Classroom Environment

- Have I tailored the AI tool to align with my teacher preparation program's specific dynamics and unique needs?
- In what ways have I modified the AI tool's settings or content to better suit the diverse learning needs and preferences of preservice teachers?

#### Compliance with Educational Standards

- Does this AI tool comply with the educational standards and curriculum requirements of my institution and any relevant accrediting bodies?
- How does the AI tool support the learning objectives and goals of preservice teachers, especially in special education?

#### Required Adaptations for Accessibility and Inclusivity

- What adaptations are necessary to ensure the AI tool is accessible to all preservice teachers, regardless of their abilities?
- Have I considered all the possible barriers preservice teachers might face in engaging with this AI tool, and how can I address these challenges proactively?

#### Critical Analysis of Effectiveness

- Have I critically evaluated the AI tool's effectiveness in meeting the diverse needs of preservice teachers?
- In what ways does the AI tool facilitate personalized learning experiences and support the development of critical skills for preservice teachers?
- Are there any aspects of the AI tool that could potentially exclude or disadvantage any preservice teachers, and if so, how can I mitigate these issues?

interactive and personalized approach increased engagement and confidence among the preservice teachers.

### USE CASE 3: AIDING MEMORY RETENTION

Quizlet is a digital tool that offers study and learning options, including flashcards, learn, write, spell, test, and match, and is designed to aid in memory retention through repetitive and

adaptive learning strategies. This tool can demonstrate to preservice teachers how adaptive memory consolidation can be implemented in educational scenarios. The following real-world example features the use of Quizlet in special education teacher preparation programs.

**Objective:** To prepare preservice teachers to use adaptive and repetitive learning strategies to reinforce learning

and retention of complex concepts in their future classrooms.

#### Implementation Steps:

##### 1. Introduction to Quizlet

- Faculty introduce preservice teachers to Quizlet and its features, including adaptive learning modes and progress tracking.
- Faculty conduct hands-on workshops where preservice teachers create their own Quizlet study sets based on special education content.

##### 2. Practical application

- Preservice teachers design lesson plans incorporating Quizlet to support students with diverse learning needs.
- Preservice teachers engage in role-playing exercises using Quizlet to simulate teaching scenarios, focusing on how to adapt content for students with learning disabilities.

##### 3. Ongoing support

- Faculty monitor preservice teachers' use of Quizlet through classroom observations and feedback sessions.
- Faculty provide additional resources and support for integrating Quizlet into inclusive teaching practices.

##### 4. Evaluation

- Faculty collect and analyze preservice teachers' feedback on using Quizlet.
- Faculty use Quizlet's analytics to track preservice teachers' progress in creating effective study tools and identify areas needing further support.

**Cost:** Quizlet offers a free version with basic features; however, Quizlet Plus is available for approximately \$35.99 per year per teacher account and covers all classes with enhanced features

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### **Jessica Hunt, Ph.D.**

*Jessica Hunt's research supports a re-conceptualization of research and instructional practice using practices from both mathematics education and special education such that students with disabilities can build mathematics proficiency. Specifically, she designs and tests asset-based learning environments and interventions such as game-enhanced curriculums to understand, support, and extend processes of student learning. Jessica Hunt's work has three focal areas: documenting initial or informal conceptual understandings of students with learning disabilities (LD) within targeted mathematical areas (e.g., number, rational number), documenting and refining trajectories of how conceptual growth within the targeted areas occurs and can be nurtured through instruction, and designing and testing new instructional programs and practices based upon students' trajectories of learning.*

### **Yacine Tazi, Ph.D.**

*Yacine Tazi is currently earning his Ph.D. in Education (Methodology, Measurement, and Analytics) from the University of Central Florida. As a TJEEI Fellow, Yacine brings in his experience and knowledge in computer programming, data visualization, and analytics. Yacine is thrilled to continue working with Toni Jennings Exceptional Education Institute throughout his doctoral program, serving the needs of children and adults through interdisciplinary research, practice, and partnerships. When he isn't working or researching, Yacine enjoys traveling and meeting people from different cultures and backgrounds.*

beneficial for teachers and students.

**Efficacy Measurement:** The platform allows teachers with a paid subscription to track students' progress, see which terms students struggle with, and adjust the frequency and difficulty of the review materials accordingly.

## CHALLENGES AND CONSIDERATIONS IN IMPLEMENTING AI-PPL

Despite the potential for AI-PPL to transform special education teacher preparation programs, several challenges must be navigated. Accessibility and inclusivity remain paramount, so AI-PPL tools must be designed using universal design principles to accommodate a broad spectrum of learning disabilities and preferences (Zawacki-Richter et al., 2019). Additionally, educators' professional development is critical, as teachers must be adept at integrating AI-PPL technologies into their instructional practices and balancing the use of technology with pedagogical strategies that foster a supportive and inclusive learning environment (Dogan et al., 2023). See Figure 2 for a list of questions faculty might consider when integrating AI tools into their teacher preparation programs.

AI represents an asset in enhancing educational practices, especially in special education settings, where it can significantly improve interactions and learning outcomes for students with special needs. AI-driven tools provide tailored educational experiences vital for addressing these students' unique challenges, supporting a more inclusive and effective educational environment (Neeharika & Riyazuddin, 2023). The primary aim of these tools is to complement, rather than substitute, the existing pedagogical efforts of teachers. Consequently, to ensure AI's effective and meaning-

Aligning AI-enhanced curricula development with UDL principles inherently addresses many accessibility concerns, facilitating the creation of educational environments that are more inclusive and engaging.

ful use in special education contexts, it is imperative to offer guidance to teachers on essential considerations as they adopt and integrate AI technologies (Marino et al., 2024).

Incorporating Universal Design for Learning (UDL) principles into AI-enhanced curricula is one essential way to create inclusive and adaptable technologies. UDL aligns with AI to dynamically adjust content presentation, interaction methods, and engagement strategies to suit individual preferences and needs by providing multiple means of engagement, representation, and expression. This adaptability not only enhances accessibility but also fosters a more profound and more personalized learning experience crucial for individuals with disabilities. AI-driven personalization features are pivotal in meeting the accessibility requirements stipulated by the Web Content Accessibility Guidelines (WCAG; 2023) and Section 508 of the Rehabilitation Act (1973), ensuring that digital curricular content is perceivable, operable, understandable, and robust. Aligning AI-enhanced curricula development with UDL principles inherently addresses many accessibility concerns, facilitating the creation of educational environments that are more inclusive and engaging. AI can help tailor learning experiences to individual student profiles, maintaining interest and motivation through interactive technologies like simulations, virtual reality (VR), and augmented reality (AR). Such technologies immerse learners in highly interactive environments that simulate real-world scenarios, making learning more engaging and hands-on.

## CONCLUSION

Adopting AI-PPL in special education teacher preparation programs holds the potential to revolutionize the educational landscape for students with disabilities (Marino et al., 2024). By fostering an adaptive, personalized learning environment, AI-PPL tools can enhance student engagement, facilitate a deeper understanding of complex concepts, and support the acquisition of procedural knowledge and skills. However, successfully implementing AI-PPL requires careful consideration of several key factors, including the customization of AI tools to fit classroom dynamics, adherence to educational standards, and the necessity for adaptations to ensure accessibility and inclusivity. Analyzing AI's effectiveness in meeting diverse student needs is the most pressing concern. As we navigate the future of education, educators and faculty members must equip themselves with the knowledge and skills to integrate AI technologies thoughtfully and effectively into their teaching practices, thereby enriching the learning experiences of students with disabilities and paving the way for a more inclusive educational system.

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