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Artificial Intelligence Integration in Teacher Education: Navigating Benefits, Challenges, and Transformative Pedagogy

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Abstract

This article explores the potential uses, benefits, and challenges of artificial intelligence (AI) tools for teacher educators and their teacher candidates. It begins with a brief introduction to the topic, followed by a discussion of existing literature concerning the impact of AI on K–12 education; the importance of preparing AI-literate teachers; and specific issues related to AI's use in teacher education, which includes studies on perceptions about AI utilization in education. The author also examines the challenges of AI implementation in the preparation of teachers; poses critical questions and ethical, pedagogical, and philosophical concerns faculty and students must consider; and provides ideas on using AI tools in courses through exemplar activities. The various activities illustrate the integration of AI- and non-AI-based activities to promote AI literacy among teachers. The goal of these activities is to support candidates' competency development to become effective teachers while understanding the potential of AI tools for assisting in planning instruction and creating curricula. The exemplars also focus on developing critical thinking, creativity, and collaboration in carrying out pedagogical tasks. The author advocates for embracing AI tools in education cautiously and strategically by recognizing their power to transform teaching and learning for teachers and students.

Keywords: artificial intelligence, AI, teacher education, teacher preparation, ChatGPT

1. Introduction

A variety of words describe how educators feel about generative artificial intelligence (AI). At recent conference presentations on the uses of AI in teacher education and the education of multilingual students, K–12 teachers, administrators, and college professors were asked to express their feelings and thoughts about generative AI in 1–3 words. Educators' responses included that they were curious, anxious, excited, worried, and overwhelmed. For instance, college professors remain concerned about students using generative AI such as ChatGPT to cheat in class; a growing number of faculty have chosen to encourage its limited use in classroom assignments. Moreover, research has indicated seasoned teachers feel like rookie teachers all over again (Miller, 2023).

Based on a definition generated on ChatGPT, AI chatbots can be explained as follows:

> Computer programs designed to simulate conversation with human users. They use natural language processing and machine learning to understand and respond to user input. ChatGPT is an artificial intelligence (AI) language model developed by OpenAI. It is designed to generate human-like text responses in a conversational manner, making it capable of engaging in written or text-based conversations with users (ChatGPT, 2023).

The launch of ChatGPT in November 2022—and other chatbots that followed—sparked a continuous debate about the integration, benefits, and challenges (e.g., ethical concerns) that have educators nervous. These debates have led to strong reactions from certain governmental and educational institutions. For example, the New York City Department of Education initially blocked access to ChatGPT on school devices due to concerns regarding the safety and accuracy of content (Elsen-Rooney, 2023), and universities in Australia reportedly returned to pen-and-paper exams after students were caught using ChatGPT to write essays (Cassidy, 2023).

Educators and students still in the early stages of learning and experimenting with Chatbots have discovered the technology can be instrumental in supporting users in addressing small and larger tasks (Elbanna & Armstrong, 2023). For instance, users ask AI to respond to their prompts for simple conversations and explanations and to

generate ideas for complex tasks, such as developing multipage essays on existing literature. The rapid evolution of AI integration in society indicates educators are facing the possibility of learning how to navigate and be knowledgeable about the uses of AI and integrating it into many aspects of curriculum and instruction instead of resisting its use as their only option. AI will be part of people's careers and working environments, so knowing how to use AI technologies and being literate in AI capabilities and uses are imperative (Prothero, 2023). Instead of viewing AI as a replacement, teachers use these tools to enhance their teaching methods, allowing for more personalized student interactions and supporting individualized instruction. By becoming AI literate, teachers can better prepare their students for a future shaped by AI, using it to improve educational outcomes and equip students with essential skills for an AI-driven world. The brief review of the literature includes the impact of AI in K–12 education, the need for developing teachers' AI literacy, and AI use in teacher education.

2. Generative AI in K–12 Education

A review of the literature on the impact of AI on teachers' use and perceptions revealed great variation and divided opinions on wanting to use the tools. One national survey conducted approximately 3 months after ChatGPT became public with approximately 1,000 K–12 teachers and 1,000 12- to 17-year-old students showed most teachers and one third of students were already using ChatGPT (Impact Research, 2023). Key findings included that approximately one third of teachers used ChatGPT for developing lesson plans, coming up with ideas for classes, and building background knowledge for classes. The Impact Research (2023) survey also reported 88% of teachers and 79% of students who had used ChatGPT said it had a positive impact. In addition, results pointed to the fact that teachers are allowing or encouraging students to use ChatGPT, and more than 65% of teachers and students agreed it would be important to integrate ChatGPT into schools in the future. According to the brief report, "ChatGPT is an example of why we need education to modernize" (Impact Research, 2023, p. 2).

Another survey of 1,054 K–12 educators, including teachers and administrators, revealed most K–12 educators believed lesson plans should include materials to help students learn about AI tools. Most K–12 educators had at least heard of generative AI, but a majority had not used these tools. K–12 educator respondents simultaneously downplayed the impact of generative AI in the classroom, expressed concerns about its use, and still believed it should be part of the curriculum. Moreover, many K–12 educators recognized the potential benefits of using generative AI in the classroom but felt most passionately about the potential pitfalls (aiEDU, 2023).

Different authors have agreed on the benefits of using AI in education. Annus (2023) highlighted the potential of AI to provide personalized and rapid assistance to students and teachers by offering various answers and explanations; for instance, ChatGPT can tutor students individually and provide customized feedback. The technology can offer personalized tutoring and adjust its teaching methods based on a student's performance, making its methods interactive and adaptive (Baidoo-Anu & Owusu Ansah, 2023). The personalization and tutoring capabilities are particularly helpful for multilingual learners, as text-to-text AI generators can provide writing assistance to these students (Chan & Zhou, 2023; Ka Juk Chan & Hu, 2023), enabling them to brainstorm ideas and receive feedback on their writing through applications such as ChatGPT (Atlas, 2023).

Moreover, educators can use ChatGPT to analyze student performance data and identify areas where students struggle with concepts (Rahman & Watanobe, 2023). A report by McKinsey & Company (2020) suggested that AI's initial benefit could be to improve teaching jobs by reducing low-level burdens in administrative or clerical work. Research has suggested that recovered time from AI-enabled technology should lead to more effective use of their time, reducing the average 11 hours of weekly preparation down to only 6, including 5 to 10 hours for lesson and resource preparation. It will enable teachers to foster one-on-one relationships with students, encourage self-regulation and perseverance, and help students collaborate with each other. Finley (2023) identified six categories of tasks where AI can support teachers in completing common tasks. These categories include: (a) planning instruction, (b) creating materials, (c) differentiating curriculum, (d) writing personal and professional correspondence, (e) developing assessments and rubrics, and (f) requesting feedback on writing and content. AI tools assist teachers in brainstorming ideas for lesson plans, creating and adapting learning materials, gathering relevant resources, identifying engaging student-centered activities and teaching strategies, developing assessments (e.g., rubrics), generating customized guides and explanations, creating quizzes and games, and developing outlines and step-by-step presentations.

2.1 AI-Literate Teachers

To integrate AI into the classroom effectively, teachers need to develop AI literacy. This process begins with understanding key AI concepts, such as large language models (LLMs), machine learning, and natural language processing. For instance, teachers should understand how LLMs work by analyzing vast amounts of text data to learn patterns in language. In a systematic review of literature on AI literacy in K–12, Casal-Otero et al. (2023)

outlined important approaches authors have taken when discussing AI literacy for teachers. These approaches have included an understanding of LLM processes beyond grasping basic AI concepts. AI-literate teachers must possess the knowledge and skills to integrate AI into core subjects such as science and language, thereby enhancing students' learning (Shin, 2021; Wang, Liu, Han, & Wu, 2020). Moreover, teachers must understand the ethical and social implications of AI, which are essential for teaching students to think critically about AI technologies (Eguchi, Okada, & Muto, 2021; Henry, Hernalesteen, & Collard, 2021). It is critical that teachers engage in interdisciplinary collaboration, which can help apply and reinforce AI concepts across various contexts (Russell, 2021) and use pedagogy such as project-based learning that involves real-life AI applications to enhance practical understanding (Lee, Ali, Zhang, Dipaola, & Breazeal, 2021; Vartiainen, Tedre, & Valtonen, 2020). Professional development in the aforementioned areas is crucial for keeping teachers updated on AI advancements (Wei, Li, Xiang, & Qiu, 2020; Xia & Zheng, 2020).

2.2 Specific Benefits and Challenges for AI Utilization in Education

Even after the introduction of ChatGPT in 2022, teachers at all levels of education have continued to grapple with the idea of "embracing" or "resisting" the use of AI for teaching and learning. Since its launch, educators have recognized AI's power to curate a range of educational resources. These resources include assisting teachers in developing instructional materials, giving students feedback on assignments, building rubrics, composing emails to parents, creating prompts for discussion, and generating presentations by simply providing a short prompt with keywords to the AI tool (Langreo, Mcfarlane, & Meisler, 2023; Poth, 2023). Moreover, the technology can generate new creative content in the form of texts, videos, audio, images, and simulations, potentially revolutionizing the way teachers and students create content. For instance, AI tools can determine the preferred learning style of each student by analyzing their interactions and responses and generating visual aids such as diagrams, charts, and videos to enhance teaching and improve retention for students who learn best through visuals (Flores et al., 2023). Teachers now have access to an increased number of tools and resources to identify students' learning styles, interests, and abilities and use this information to develop lessons tailored to each student's individual needs (Jamal, 2023; Nataraj, 2022; Qadir, 2022).

For assessment, teachers may use AI tools to evaluate student learning in various ways, such as creating quizzes (e.g., Quizziz), using voice-enabled assignments and assessments (e.g., Sherpa), monitoring interactions with educational chatbots (e.g., Mizou), creating slide presentations for in-class assessments and interactions (e.g., Curipod), and developing customized rubrics (e.g., ChatGPT, MagicSchoolAI). Research has shown that assessment tools like ChatGPT reduce the time needed for grading, ensure consistency in scoring, and provide immediate scores and feedback on students' writing skills (e.g., Mizumoto & Eguchi, 2023). Candidates in preparation programs must be provided with opportunities to practice using AI to engage support their future students effectively.

As teachers and teacher candidates adopt AI tools to augment teaching and learning, they become aware of the challenges they and their students face, including common issues found in other fields like health and medicine (e.g., accuracy and reliability). These issues can be particularly harmful if the dataset on which a model was trained contains biased elements (Harrer, 2023). AI systems, though powerful, have the potential to produce biased or inaccurate responses, leading to significant concerns about their ethical use and the integrity of the data they generate. As highlighted by van den Berg and du Plessis (2023) and Kasneci et al. (2023), these risks require ongoing human oversight, continuous checking, and quality assurance to prevent misuse and ensure the reliability of AI outputs. Finley (2023) further emphasized the critical importance of verifying AI-generated information for accuracy before it is presented to students, underscoring the need for vigilant human intervention in educational contexts to maintain ethical standards and protect learners. As a result, it is paramount that candidates acquire expertise in pedagogy they can use to evaluate AI-generated information.

Additional concerns among educators include plagiarism and the lack of accurate detection tools (Keegin, 2023). Copying and pasting text without critically analyzing or properly citing original sources has become a common practice, leading some to believe AI-generated text is unsuitable for academic writing. Moreover, the detection of AI-generated text has been unreliable, making it difficult to distinguish between fact and fiction in AI-generated content, which students can easily copy and paste into their assignments (Chatterjee & Dethlefs, 2023; García-Peñalvo, 2023; Khalil & Er, 2023). For instance, a survey indicated about two thirds of high school teachers and college instructors—66%—were rethinking their assignments in response to concerns that students will cheat using ChatGPT. Of the educators changing their approach, more than three quarters—76%—were requiring or planning to require handwritten assignments. Additionally, 65% reported having students type assignments in class with no Wi-Fi access or plan to do so, and 87% had or planned to have students complete an oral presentation along with their written work (Klein, 2023).

Other challenges include educational inequities for some students with limited access to hardware and software, which may require significant investment in technology infrastructure, especially in schools serving marginalized communities. These challenges lead to an increase in the digital divide, where some students have access to cutting-edge educational technology, whereas others do not. Limited professional development on the use of technology may also create a divide between schools that provide training for their teachers and those that do not. Promoting collaboration between educators and educational technology experts is one way to implement effective and equitable integration of AI in education (Kasneci et al., 2023).

These challenges are important to consider in the preparation of future teachers who need to develop a deep understanding of the technology to ensure they are capitalizing on the benefits of AI and finding ways to address the challenges in preparing their students for the digital age.

2.3 AI in Teacher Education

Literature on AI in the context of higher education, specifically teacher education, is emerging. Teacher educators face similar issues with AI as those encountered by K–12 teachers. It is important that college faculty establish close connections with what teacher candidates are experiencing in their school placements and what they will encounter in their future classrooms regarding AI. Langreo (2023) emphasized:

> It is critical that schools of education act quickly to ensure that prospective teachers have a foundational understanding of AI, know how to use it effectively for instruction, and can infuse AI literacy into every subject, so they are ready when they enter the classroom (p. 22).

However, preservice programs, especially in elementary teacher education, have not adequately kept up with integrating AI concepts into their curricula for preservice elementary teachers (Grover, 2024).

In a study on AI in teacher education, participants generally agreed that AI has had a significant impact on problem solving in the field (Köprülü, Oluwatosin Oyebimpe, Başarı, & Besim Ayhan, 2023). By analyzing data on learners' performances and choices, Köprülü et al. (2023) found, as with K–12 teachers, AI helps instructors create specialized lesson plans and assessments that align with each learner's unique abilities and constraints. Their findings indicated that AI facilitates planning in teacher education saving time, creating better learning plans, providing essential technological support to instructors, and adjusting the time allotted for lessons to accommodate learners' needs. Undoubtedly, AI supports teacher educators and candidates in personalizing lessons tailored to the individual needs of students.

In addition, Jamal (2023) stated:

> AI can play a crucial role in improving the quality of teacher education… AI can provide teachers with access to high-quality educational resources and learning materials that are tailored to their individual needs. AI can also help teachers identify knowledge gaps and provide feedback on areas where they need improvement. Teachers can seek the help of AI to improve their teaching skills (p. 140).

A second study that analyzed the effects of applying a three-stage professionalism improvement program—which consisted of AI literacy education, AI-linked subject education, and micro-teaching for preservice teachers—showed a positive change in AI awareness after taking the course in the 1st semester (Yue et al., 2024). As a result, to enhance teachers' readiness and attitudes to incorporate AI knowledge into their curriculum for fostering students' AI literacy, preparation programs should ensure teachers are aware of learning standards, the curriculum, guidelines, and resources relevant to AI.

Highlighting the difference between humans and machines in the educational context is paramount when preparing new teachers. It is essential for them to understand their roles are not going to disappear; rather, their jobs will be transformed. Even with automated curricula, a teacher's intuition to identify where students are struggling and to adjust the curriculum accordingly remains critical (Prothero, 2023). The act of teaching is complex, and although technology will inevitably influence teachers' judgment and practices, it is impossible to reduce that complexity to a set of algorithms (Batchelor & Petersen, 2019). Teachers can bring creativity, invention, and originality into the classroom through their rich experience. AI, run by preprogrammed algorithms, lacks the talent, experience, originality, and critical perspective a teacher offers (Jamal, 2023; Mhlanga, 2023).

3. Issues of Generative AI Implementation to Consider

When supporting the development of teacher candidates in becoming AI literate by designing and implementing AI and non-AI curricula and instruction, teacher educators must consider several problems. One critical issue college faculty are experiencing is students' heavy reliance on AI tools for replacing their own ritical thinking and writing. For example, when students use AI to edit for syntax and grammar, generate ideas, provide specific

examples, or help organize their thoughts, they often copy and paste the language, sentence structure, and voice characteristics of AI-generated text into their assignments. As a result, students use these responses without analyzing them for appropriateness, accuracy, or ensuring the content reflects their own thinking and writing style.

Moreover, students are increasingly delegating tasks to AI, such as writing personal connections to material, expressing values and opinions, and providing peer feedback—often by inputting only a few words to guide the AI tool in generating responses. A phenomenon emerging from this shift is the loss of students' own voices in their writing and the creation of student products that use similar language and ideas. Faculty members have begun exploring ways to address these issues, identifying assignments and activities to prepare students to think critically and create independently. Unfortunately, this task is not easy, as teachers and students have discovered that AI tools and capabilities to produce academic work have continued to grow exponentially. For instance, asking students to connect their lives to the ideas in a PDF article may backfire because students can easily upload the PDF and provide a few prompts to the AI tool, which then generates responses about these supposedly personal connections. Consequently, the concepts of cheating and plagiarism have taken on a new meaning for educators, as students can now ask AI to tailor responses or different types of writing when completing tasks and assignments.

It is difficult and unrealistic to ignore how AI is changing the nature of education, so teacher educators and all educators must operate from a new paradigm for teaching and learning. These new paradigms will help them evolve into innovative ways of facilitating learning in person and online, assessing students' acquisition of competencies, and finding new methods to develop critical thinking. Educators will need to reexamine practices through a fresh lens by asking questions such as: Is creating annotated bibliographies essential to the process of student educational research? Is creating lesson plans and activities from scratch key to becoming an effective teacher? In reflecting on ensuring candidates acquired teacher competencies, instructors will also need to evaluate their assignments, consider AI tools and capabilities, assess if assigned tasks can be completed in a matter of seconds, and modify them if that is the case.

In the 2000s teachers have "borrowed" lessons and activities from thousands of specialized websites which has triggered a growing concern that candidates today may not be able to develop lessons independently. How can teacher educators ensure candidates create lessons that meet the specific needs of their students? Teacher educators might want to design in-class activities that require candidates to discuss, write, and complete tasks without the use of AI as much as possible, which may be difficult in online courses. However, in the age of AI, it may be more critical for candidates to use their acquired knowledge and criteria for effective praxis to analyze existing lesson plans for appropriateness and modify them accordingly, rather than writing them from scratch.

New and experienced teachers now have tools to create and tailor lessons and activities by differentiating and address the needs of students at grade level and adapt language and content for special populations (e.g., students with disabilities and multilingual learners). In addition, lessons that address specific objectives, content standards, and different modalities can be generated in seconds. AI tools can augment activities the candidates themselves generate without using AI and provide additional step-by-step, extensive details on how to implement them, tailored to the characteristics of specific students and classrooms—including the variety of resources that can be used.

4. Blending AI With Traditional Teaching in Teacher Education: Building Competency, Ethics, and Practice

The next section presents ideas for integrating AI in ways that support teacher candidates in acquiring the competencies required for their credential or master's degree. These ideas are designed to address educators' concerns regarding students' use of AI to complete assignments at the expense of their own learning, critical thinking, and creativity. Some activities promote candidates' development as AI-literate educators in the effective and ethical use of these tools for educational purposes. Furthermore, the activities support the idea that new teachers must be prepared to enter the school system equipped to leverage AI technology as an instructional assistant and guide students on how to use AI effectively.

To ensure future teachers use AI to benefit themselves and their students, they must understand and critically evaluate the technology and have multiple opportunities to practice and reflect on the process and the quality of AI-generated products. Candidates must be capable of applying the knowledge and skills learned in their courses to evaluate AI-generated responses, and faculty should guide them to ensure the accuracy of information and the appropriateness of suggestions. AI-generated content can vary in quality, so faculty must ensure all activities meet a certain standard and are pedagogically sound.

Instructors should provide a thorough orientation on interpreting and refining AI-generated content, examples, and practice sessions to help candidates become more comfortable with AI outputs. Clear criteria for AI-generated

activities should be established, and a framework for evaluating them should be provided. Faculty should regularly review AI outputs to ensure they align with course objectives and instructional strategies. It is crucial that candidates acquire the necessary expertise to evaluate AI generated lesson content, strategies, or interventions, as failure to do so may result in ineffective pedagogical practices that could harm students.

Integrating AI-generated activities with traditional teaching methods can be complex, and faculty must engage students in reflecting on their use of AI for academic purposes by posing questions such as:

(a) How did you use AI tools to complete your assignment, and what specific tasks did the AI assist you with?

(b) How did the use of AI impact the quality and effectiveness of your assignment? Do you think it enhanced your learning experience? Why or why not?

(c) What challenges did you encounter while using AI tools for your assignment, and how did you address them?

(d) What ethical considerations did you consider while using AI for your assignment? How did you ensure the integrity and originality of your work?

(e) Based on your experience, how do you plan to use AI tools in future assignments? What improvements or changes would you suggest for better integration of AI in your academic work?

(f) How can you ensure that the use of AI complements rather than replaces your professional judgment and expertise in English language development (ELD) instruction?

Furthermore, faculty should explore the ethical considerations of using AI-generated content for educational purposes and how to ensure that using AI complements rather than replaces professional judgment and expertise when designing standard-based curriculum units.

The following exemplars include activities that require credential and master's candidates to think critically and creatively, including analyzing, developing instruction, and practicing with AI tools. The activities reflect a balanced use of technology with conventional pedagogical approaches and provide examples of how AI-generated activities can complement traditional methods. The activities encourage candidates to blend AI tools with hands-on teaching strategies and provide opportunities for them to practice this integration.

5. Integration of AI in Learning and Teaching: Exemplars (Note 1)

5.1 Category: Supporting Candidates to Become AI Literate

5.1.1 Exemplar 1

Purposes for Using AI. Explore AI educational sites to learn about potential uses of AI tools (e.g., ChatGPT, MagicSchool.ai, Eduaide).

Objective. Teacher candidates will practice using AI tools, identify their potential uses, and critically analyze the generated content for appropriateness. Practice may include generating worksheets, songs, depth of knowledge (DOK; Webb, 2002) based questions, report card comments, rubrics, text translations, lesson plans and units, math story problems, letters of recommendation, games, vocabulary lists, examples of theory into practice in the real world, and context, exemplars and non-exemplars.

Activity Sample. Candidates use AI to generate a letter for families. The letter is written based on what student–teacher candidates are observing or teaching in their placement, or on a written scenario provided by their instructor. The letter to families addresses the child's behavioral issues and describes their behavior, such as throwing tantrums and expressing reluctance to be in school. Based on culturally responsive strategies for communicating with families learned in the course, candidates critically think about and analyze the appropriateness of the language and messages generated.

Prompt AI. (Candidates prompt AI): "Write a culturally responsive email or letter using asset-based language to families or guardians addressing their child's behavior in the classroom and on the playground. The letter should describe the child's behavior, such as throwing tantrums and expressing reluctance to be in school. Include a friendly introduction with a warm tone, mention the child's artistic and math talents as strengths, emphasize the value of collaborating in supporting the child, welcome suggestions from the parents to help the child succeed, offer examples of how the teacher can provide assistance and support using specific strategies to address the behavior, suggest ways to communicate via email or in person, and express gratitude in the closure."

Follow-Up Activities. (a) Without the use of AI, candidates analyze the language generated by AI and paraphrase the ideas to reflect their own voice and/or to simplify academic terms for parents whose second language is English and who may have beginner or lower intermediate proficiency levels in speaking. (b) Candidates compare letters

generated by two different AI tools.

Potential Outcomes. Candidates learn how to use AI tools to help them with a common task: communicating effectively with diverse families. With instructor guidance, they critically evaluate the generated content, considering theory and effective practices covered in the course. They practice modifying the letter to ensure it conveys the intended messages in their own style. Exposure to various AI tools designed for educators will increase students' familiarity with these technologies, enabling them to leverage AI for communicating with families, lesson planning, resource creation, and enhancing student learning experiences. By experimenting with different prompts and analyzing AI's responses, candidates will gain a nuanced understanding of the strengths and limitations of AI in educational contexts, helping them use these tools more effectively and ethically.

Potential Challenges. For the specific exemplar provided, AI-generated letters may use a tone that comes across as impersonal or lacking empathy. They often use language that is too formal and academic for parents to understand, even when prompted several times to "simplify language for parents who understand basic English." The text may also lack the personal touch that comes from knowing the student and family or cultural nuances, potentially missing the mark in respecting the families' cultural values. AI-generated letters might include general advice that is not suitable for the specific needs of the child or the classroom environment. This problem is also common to tasks that require deep knowledge of students and that call for "human touch" that AI tools are not able to provide yet.

Reflection Questions. Did the letter maintain an appropriate and sensitive tone? How well did it balance addressing concerns with maintaining a positive and supportive perspective? In what ways did the letter feel impersonal or generic? How did you personalize the content to better fit the specific needs of the student and their family? Based on what you learned about culturally responsive interactions, how effective was the letter in conveying the message? Did the generated letter acknowledge and respect the family's cultural background and values appropriately? What did you have to ask AI to change or add to create an improved letter?

5.1.2 Exemplar 2

Purposes for Using AI. (a) Practice AI prompt "crafting."

Objective. Teacher candidates identify effective and ineffective ways to prompt AI to generate desired content. Teacher candidates experiment with tools to generate content they can use in their field placements.

Activity Sample. Candidates are taught how to write descriptive prompts to generate specific AI outputs by reading articles (https://huit.harvard.edu/news/ai-prompts) and watching videos (https://www.youtube.com/watch?v=NuIKQgX71Fc) and by exploring AI sites like ChatGPT and other sites specifically designed for educators such as Magic School AI (https://app.magicschool.ai/tools) and Eduaide.ai (https://www.eduaide.ai/app/generator). Candidates are shown models/processes for effective and ineffective prompting by the instructor first, and then they are given a choice to prompt the AI tool about any topic that interests them. Candidates critically think and brainstorm ideas to:

(a) Improve the generated information based on specific aspects of education learned in class about two different educational systems, such as education structures and levels, curriculum standards, major policies and reforms, assessment and evaluation, access and equity, funding and resources, and teacher training.

(b) Apply the knowledge on how to improve prompts by being more specific, indicating what type of output is needed and how it should be presented (e.g., side-by-side comparison).

(c) Use "do" and "don't" to specify what needs to be included.

(d) Use specific, concrete, real-life examples.

(e) Specify the tone and audience (e.g., friendly for teacher candidates).

(f) Build on previous prompts to change the output or generate additional information.

Prompt AI. "Compare the education in the United States and Mexico" is an instructor's example of an ineffective prompt that is too general. As a second prompt, consider: "Compare the primary and secondary education systems in the United States and Mexico by analyzing the following aspects: (a) the structure and length of each level of education, (b) the curriculum and subjects offered, particularly in mathematics and science, (c) teacher qualifications and training requirements, (d) the accessibility of education for rural and urban populations, and (e) the influence of government policies on education quality. In addition, discuss the challenges each country faces in terms of educational equity and how these challenges impact students from low-income families."

The instructor demonstrates how effective prompts generate more specific information.

Follow-Up Activities. (a) Candidates research information about the U.S. and Mexican education systems more in depth nd evaluate the accuracy of the information generated by AI. (b) Candidates apply their improved prompting skills in their field placements, using AI tools to create lesson plans, study guides, or other educational resources. (c) Candidates collaborate on crafting prompts for K–12-related tasks of their choice.

Anticipated Outcomes. By analyzing and improving ineffective prompts, candidates further develop their critical thinking and analytical skills, learning to identify key elements that make prompts more effective and relevant. Candidates can apply their knowledge of effective AI prompting in their field placements and future teaching careers, using AI tools to generate tailored content and resources for their specific educational needs. They learn to troubleshoot and refine their prompts to achieve desired outcomes, thereby improving their problem-solving skills and adaptability in using AI tools.

Potential Challenge. When provided with too many criteria items, many AI tools become "confused" and continue generating general information. It tends to be more effective to break the information down by sections and ask AI to provide detailed content for each specific section separately. Candidates may struggle to find the right balance between being specific enough to generate relevant and detailed responses from the AI and being flexible enough to allow the AI to provide comprehensive and creative solutions. Overly rigid prompts may limit the AI's ability to provide useful insights, whereas prompts that are too vague may result in generic or irrelevant information.

Reflection Questions. (a) How did your initial prompts differ from the improved prompts in terms of specificity and clarity? (b) What aspects of the improved prompt contributed most to generating a more useful response from the AI? (c) How can you apply what you learned about effective prompting in your future teaching or field placements? (d) What strategies can you use to refine your prompts further if the AI-generated content is still too general (e) Reflect on a specific example where a more detailed prompt led to better results in your AI-generated content. How did you achieve this improvement?

5.1.3 Exemplar 3

Purpose for Using AI. Engage in dialogue about ethical considerations when using generative AI.

Objectives. Candidates will be able to examine the ethical implications of AI technologies critically. They will understand the advantages and potential risks of generative AI.

Example. Teacher candidates use AI tools to help edit the syntax and grammar of writing pieces they have developed for their courses. They engage in dialogue about the ethical aspects of asking AI tools to "edit." For example, what is considered cheating? Is this different from having the paper edited at a writing center? To what extent should teachers allow students to use AI for writing? On what tasks can AI be useful for teachers and students without raising ethical concerns? In what ways might AI impact privacy, data security, and bias or prejudice against specific populations?

Prompt AI. "The following document is an assignment I wrote on the impact of standardized testing on student learning outcomes. Please help me improve the syntax and grammar. Keep a similar tone, voice, and language."

Follow-Up Activities. (a) Candidates refine their prompts by asking questions such as, "Can you suggest more advanced vocabulary or provide additional concrete examples to support my arguments?" (b) Candidates continue the dialogue on ethical implications by discussing the potential impact of these AI-generated suggestions on their own writing development and the issue of plagiarism.

Potential Outcomes. (a) Candidates will have the opportunity to improve the quality of their writing assignments. (b) They will increase their awareness of the ethical considerations of using AI in their work and in K–12 students' work. (c) Candidates will develop additional skills in critically evaluating and refining AI-generated content to maintain academic integrity.

Potential Challenges. (a) Teacher candidates and K–12 students may become overly dependent on AI suggestions, which could affect their ability to develop their own writing skills and generate their own ideas. (b) Candidates may struggle to discern when AI use crosses ethical boundaries, particularly in terms of originality and academic honesty.

Reflection Questions. (a) In what ways will teaching and learning evolve, considering these new AI tools? (b) Are assignments, such as essays, still appropriate in the age of AI? (c) How can educators balance the use of AI tools with the need for students to develop independent critical thinking and writing skills? (d) What guidelines should be established to ensure that the use of AI in education supports learning without compromising academic integrity?

5.1.4 Exemplar 4

Purpose. Develop candidates' skills in critically evaluating AI-generated content.

Objective. Candidates will identify inaccuracies and "hallucinations" in AI-generated content based on what they learned in the course and will analyze the knowledge needed to evaluate accuracy.

Example. Candidates generate an annotated bibliography on an AI tool for their final research paper. They search for the references on Google Scholar and the Web to verify their existence.

Prompt AI. "Generate a bibliography in APA format for a research paper on the impact of socioeconomic status on educational achievement."

Potential Outcomes. Candidates become aware of how AI generates a list of references, including journal articles, books, and reports that may contain inaccuracies. Some references are accurate and correctly formatted, while others include fabricated sources or incorrect information, such as bogus authors and scholarly work. Candidates realize they cannot fully trust AI tools for certain tasks and the information they generate.

Potential Challenges. (a) Managing time efficiently when cross-checking AI-generated references for accuracy. (b) Balancing the convenience of AI assistance with the need for thorough verification. (c) Understanding all the limitations and potential biases in AI-generated content.

Follow-Up Activities. (a) Discussing the ethical implications of using AI in academic research and writing. (b) Students compare the AI-generated bibliography with a manually created one to spot discrepancies. (c) Creating a series of images to visualize a variety of K–12 content topics or concepts (e.g., the digestive system with labels) to illustrate how AI tools can generate inaccuracies in different formats.

Reflection Questions. How can you identify inaccuracies or "hallucinations" in AI-generated content? What steps can you take to verify the reliability of sources provided by AI? What are the potential risks of relying on AI for academic research and creating content? How can educators ensure the ethical use of AI in their classrooms?

5.2 Category 2: AI Supports for Teaching, Learning, and Assessment

5.2.1 Exemplar 5

Purpose for Using AI. Generate concrete additional examples for class readings.

Objective. Students will be able to visualize concepts covered in reading material with real-life, concrete, or scenario-like examples.

Example. Using AI, candidates find three additional effective strategies that illustrate the author's theoretical ideas in a journal article on challenging stereotypes and promoting diverse gender expressions. Candidates pair up to review each other's AI-generated examples. They provide constructive feedback on how well the examples illustrate the theoretical concepts in the article and suggest improvements or additional details.

Prompt AI. Based on the uploaded PDF article on the theory about stereotyping and gender roles, generate three real-life scenarios illustrating the key concepts under "stereotyping" discussed in the article. Ensure each example clearly aligns with the theoretical ideas presented by the author and includes specific details on how these concepts are applied in practice. Create relatable and relevant examples to current K–12 classrooms, particularly focusing on challenging stereotypes and promoting diverse gender expressions. Include examples of different gender identities, roles, and expressions, helping students understand and appreciate diversity.

Follow-Up Activities. (a) Students select one of the AI-generated examples and role-play the scenarios in small groups; (b) After each role-play, the group discusses how the example reflects the theoretical ideas and how it could be applied in a real classroom setting; (c) Students create posters, infographics, or digital presentations that visually represent their AI-generated examples and the related theoretical concepts and share them in a gallery walk format.

Potential Outcomes. (a) By sharing in class, candidates add a variety of high-quality, specific examples to each other's repertoire on the topic;

(b) They develop critical thinking and collaborative skills through peer review and feedback on generated examples based on concepts learned in class;

(c) Candidates increase their understanding and application of theoretical concepts through real-life examples;

(d) Candidates further develop their ability to communicate complex ideas visually through the creation of posters, infographics, or digital presentations.

Potential Challenges. The instructor may not be able to check the quality of all examples. As a solution, students

should submit their examples to the instructor, who will bring any innacurate examples to the students' attention.

Reflection Questions. How did the AI-generated examples enrich your understanding of the theoretical concepts discussed in the article? What challenges did you encounter when using AI-generated examples, and how did you address them? What insights did you gain from your peers' examples, and how can you apply these insights to your own teaching practice?

5.2.2 Exemplar 6

Purpose for Using AI. ELD lesson exploration

Objectives. Teacher candidates will develop a linguistically appropriate lesson plan based on their multilingual learners' (MLs) profiles and needs.

Example. In class, candidates develop an ELD lesson plan individually without the use of AI to address one of their focus MLs' needs in a language domain (i.e., listening, speaking, reading, or writing). The lesson plan follows a specific format and must include specific criteria for incorporating effective ELD strategies. The lesson addresses an area of need and a language objective based on the results of informal assessments that teacher candidates conducted with their focus multilingual learner in their placement. Candidates then use AI to evaluate their lessons based on a rubric provided by the instructor.

Prompt AI. "Evaluate my lesson plan for teaching parts of speech to help a beginner English learner write sentences. The learner can understand and produce simple sentences orally but struggles with more complex structures and detailed conversations. The rubric includes the following categories:

(a) Ability to incorporate 8 effective ELD strategies such as modeling, paraphrasing, visuals, total physical response (TPR), hands-on activities, realia, sentence frames, charts, graphs, collaboration, interaction, etc.;

(b) Instruction and assessment are appropriate to the students' proficiency levels I provided (beginner writer).

(c) Describes the lesson in detail (instructions, modeling, questioning, etc.);

(d) Instruction is aligned to objectives;

(e) Activities are engaging and taught in context;

(f) The lesson effectively follows the Gradual Release of Responsibility or GRR model."

Follow-Up Activities. (a) Ask AI to provide additional activity ideas, step-by-step instructions in simple language, and concrete examples of how to implement them in the classroom;
(b) In pairs, without using AI, candidates analyze one of their peers' generated activities to practice identifying critical strategies for effective ELD instruction. Using a checklist of effective ELD strategies, they identify scaffolding and comprehensible input elements tailored to the focus student's specific writing proficiency level. Candidates then provide specific suggestions their peer can use, along with the instructor's feedback, to revise their lesson.

Potential Outcomes. Teacher candidates demonstrate their ability to apply their knowledge of effective instruction for ELD by identifying the elements from the checklist included in the generated lesson. They revise their lesson based on their analysis, particularly what they missed. For instance, candidates may discover the lesson was too general or inappropriate in meeting the needs of their focus students and their proficiency level.

Potential Challenges. Teacher candidates may struggle to understand and interpret the AI-generated activities, especially if the AI output is not perfectly aligned with the instructional strategies they have learned and what is appropriate for beginner ML writers. It is critical that faculty review content, practice, and model with students how to analyze lessons and provide feedback to peers before asking them to do it on their own.

Reflection Questions. How did AI help you develop the lesson? Did you include AI-generated text in sections? Where? What were some challenges? How did AI promote or hinder your critical thinking and creativity? What did you learn from the AI tools that you may not have been able to produce or learn on your own? Based on what you learned in the course, what elements of the AI-generated activity would you revise to meet the needs of multilingual learners in more effective ways? How did your understanding of scaffolding and comprehensible input influence your revisions? How did the feedback you provided to your peer help you understand the application of ELD strategies better?

5.2.3 Exemplar 7

Purpose for Using AI. Analysis of an AI-generated scenario

Objective. Candidates will be able to apply trauma-informed practices to an AI-generated scenario.

Example. Based on the content learned in the course, in teams and without the use of AI, students analyze instructor/AI-crafted scenarios and brainstorm suggestions for addressing the specific needs of a student experiencing trauma in the scenario. Candidates are provided with different AI-generated scenarios and share their scenarios in expert groups through a jigsaw activity.

Prompt AI. "Create a scenario for a child in 5th grade who is experiencing trauma related to the loss of his grandmother, who has been a significant presence in his life." (To provide a more intentional scenario covering signs of trauma, the instructor may include specific challenges such as the child's emotions—including sadness, confusion, and anger; a decline in academic performance and grades; difficulty focusing on tasks; withdrawal and irritability; disengagement in class discussions; frequent headaches and stomachaches; and isolation from friends, preferring to spend recess alone while sitting quietly in a corner of the playground.)

Follow-Up Activities. (a) In teams, candidates analyze the scenario based on content-specific criteria learned. (b) Candidates use an AI tool to analyze the scenario using the same criteria. (c) Candidates compare the team's analyses and suggestions for strategies with the AI tools comparison. (d) Candidates generate their own scenarios based on real-life observations in their placements or life experiences, and peers analyze them in groups. (e) The instructor facilitates a discussion on the appropriateness of the AI tool's suggestions, including effective practices and potentially problematic issues to consider.

Potential Outcomes. (a) As a result of practice with the concepts and ideas in different formats, candidates recognize signs of trauma, such as behavioral changes, physical symptoms, social interaction issues, and academic performance declines. (b) Candidates identify strategies to include in a trauma-informed care plan (e.g., counseling/therapy, restorative practices, classroom accommodations, family involvement) for supporting students.

Potential Challenges. (a) Ensuring AI-generated suggestions are appropriate and sensitive for each case. (b) There may be a need for additional instructor guidance to ensure suggestions are feasible and ethical.

Reflection Questions. (a) How did the AI-generated scenario help you understand the signs of trauma? (b) How did the AI-generated scenario compare to the student-created scenarios in terms of identifying needs and strategies? (c) What insights did the AI tool analysis provide that were not covered in your collaborative analysis? (d) How did creating your own scenarios deepen your understanding of the challenges faced by trauma-impacted students? (e) What challenges did you experience when using AI to analyze and create scenarios?

5.2.4 Exemplar 8

Purpose for Using AI. Designing a Grade-Level Specific Project-Based Unit

Objectives. Teacher candidates will design a 2–4-week project-based learning (PBL) unit based on content standards from a specific grade level that integrates civic action as per the College, career, and Civic Life (C3) social studies framework. They will analyze the units using the elements for effective PBL, which they extrapolated from readings and incorporated into a mind map.

Example. Prior to the activity, candidates read articles on PBL. Then, in groups, they create a mind map with the following categories: (a) Elements of a high-quality PBL; (b) PBL connections to C3 social studies standards; (c) PBL topic ideas for K–5; (d) Advantages of PBL for GenEd students, multilingual learners, and students with special needs; and (e) Challenges of PBL for teachers and students. Candidates then use AI to generate a project-based unit in social studies based on Dimension 4 of the C3 social studies framework, focusing on informed civic action. Without using AI, individually or in groups, candidates engage in critical analyses of the AI-generated PBL units using the mind map of effective PBL unit design.

Prompt AI. "Generate a grade-level specific, project-based unit for elementary students (specify grade) on (specific topic). The PBL unit should include the following sections/criteria in this order: (a) driving question that reflects critical thinking; (b) project summary; (c) entry event to engage and motivate students about real-world issues; (d) description of ways the following 21st-century skills are integrated throughout the unit: communication, collaboration, critical thinking, creativity; (e) student product(s) and audience(s) for public presentation; (f) UDL options that include engagement, representation, and expression; (g) digital, print, and community resources; (h) formative assessments; and (i) summative assessment."

Follow-Up Activities. (a) Candidates individually analyze an AI-generated PBL unit using the provided checklist to evaluate its effectiveness and alignment with standards. (b) Candidates revise their PBL units incorporating feedback from their group discussions and share their updated units with the class for peer review and further feedback. (c) They provide the AI tool with additional prompts to add detail, modify for appropriateness, and obtain extra activities.

Anticipated Outcomes. (a) Teacher candidates demonstrate their ability to apply their knowledge of effective project-based unit design by identifying content and structure conducive to engaging all students in experiential learning. (b) They can produce and refine PBL instruction based on their personal analysis and group suggestions.

Potential Challenges. (a) In the additional activity, teacher candidates may not provide AI with correct or detailed enough prompts to construct an effective PBL unit. Tasks may require multiple prompts for some sections. (b) Results may not align with the standards, objectives, and assessments effectively. (c) Instructors may not provide sufficient examples of detailed prompts, review content, practice, and model how to analyze the units with students.

Reflection Questions. (a) How did AI help you develop the unit? (b) Did you include AI-generated text in any sections? Where? (c) What were some challenges you encountered? (d) How did this activity promote or hinder your critical thinking and creativity? (e) What elements of the AI-generated PBL unit did you revise to better meet the needs of students, multilingual learners, and students with special needs? (f) How did your understanding of the C3 Social Studies Standards help you use AI to create your PBL unit?

5.2.5 Exemplar 9

Purpose for Using AI. Using an AI tool to practice completing individualized education plans (IEPs) based on specific student data and educational goals.

Objectives. (a) To create tailored educational plans that meet the specific needs of students with disabilities. (b) To improve the efficiency and effectiveness of the IEP development process.

Example. After the instructor models how to conduct IEPs, candidates learn how to prompt AI tools to help them understand how IEPs are completed.

Prompt AI. "Generate a draft IEP for a 10-year-old student with dyslexia. Include goals for reading comprehension, accommodations for classroom activities, and strategies for improving reading skills. The student's current reading level is at a second-grade level, and they require additional support in phonemic awareness."

Follow-Up Activities. (a) Candidates review the AI-generated IEP for appropriateness based on criteria provided in the course and customize it as needed. (b) Candidates design instructional activities without using AI. (c) Candidates complete IEPs independently, without AI tool assistance.

Anticipated Outcomes. With the assistance of AI, candidates are expected to generate: (a) Specific, measurable goals for improving reading comprehension by one grade level within 9–12 months. (b) Accommodations such as extended time on tests, access to language applications, and the use of speech-to-text technology. (c) Strategies for enhancing phonemic awareness, including daily practice with a reading specialist and the use of multisensory reading programs.

Potential Challenges. (a) Ensuring the AI-generated content aligns with the school's specific IEP format and legal requirements. (b) Verifying the accuracy and appropriateness of the suggested strategies and accommodations to address the unique needs of students

Reflection Questions. (a) How did the AI tool improve the efficiency of developing the IEP? (b) What were the benefits and limitations of using AI in this context? (c) How can educators ensure that AI-generated IEPs are effectively implemented? (d) What additional support might be needed for educators to effectively use AI in developing IEPs?

5.2.6 Exemplar 10

Purpose for Using AI. Candidates use AI to develop customized rubrics that holistically assess K–12 students.

Objectives. Candidates will be able to a) gain proficiency in creating rubrics that accurately reflect the desired learning outcomes and assessment criteria provided by teachers; (b) apply the principles of rubric creation to various subjects, ensuring consistent, fair, and holistic student assessment; and (c) think critically about the necessary skills students need for effective participation in group work.

Example. After engaging in a group task in a course, candidates brainstorm aspects or elements for effective collaborative work that should be included in a rubric for self-assessment on teamwork skills. Candidates use AI tools to generate a rubric for students to self-reflect on their collaboration and teamwork, incorporating elements such as group work effectiveness, contribution to group goals, peer feedback, respect for others, and acceptance of group decisions. Candidates use the rubric to self-reflect about their own participation in the group task.

Prompt AI. "Generate a rubric for my participation in collaboration and teamwork group work that includes a detailed 3-point self-reflection rubric for assessing my performance. Include the following criteria: my work

effectiveness (contribute ideas, facilitate discussions, help resolve conflicts, and take the initiative to keep the group on task), contribution to group goals, providing effective peer feedback, respect for others when they speak, and acceptance of group decisions. Use first voice and 'I' to make it a self-reflection rubric."

Follow-Up Activities. (a) Candidates use AI tools to modify the language of the rubrics to address different grade levels and/or language proficiency of students in reading. (b) They develop a second rubric for individual assessment of the group work (as opposed to self-assessment) that requires the group members' reflection on equitable participation, members caring about peers' learning, respectful listening to others, and collaborating on improving the group's collective work. (c) In pairs, and without the use of AI, candidates refine the assessment criteria to improve the design and implementation of rubrics, adding additional prompts based on their ideas to generate a new rubric. (d) Candidates compare their self-reflection rubrics, discuss their experiences, and combine their ideas into an improved rubric. (e) They also use AI tools to generate rubrics for different types of group activities in the same subject or across multiple subjects (e.g., English, science, social studies) as needed for lesson plans and field experiences.

Anticipated Outcomes. (a) Students will learn how to customize rubrics in the context of various subjects and tasks to create assessment tools that accurately reflect the key competencies and skills being assessed. (b) Candidates will develop critical thinking skills as they consider what criteria are most important for evaluating behavior and performance. (c) By practicing the creation and use of rubrics, candidates will build confidence in their ability to apply rubrics effectively in both self-assessment and peer-assessment contexts. (d) They will also practice clear and thorough self-evaluation, enhancing their ability to work in teams effectively.

Potential Challenges. (a) Ensuring the self-reflection rubric is clear and easy to understand for students at their level of academic and language proficiency. (b) Some AI tools may require precise instructions about the format for the rubric, whereas others might generate it automatically in a specific format. (c) Additionally, ensuring the rubric is comprehensive enough to cover all aspects of effective group work and self-assessment is crucial.

5.2.7 Exemplar 11

Purpose. Candidates develop and refine their research questions to ensure well-structured, specific, and actionable research questions for effective and impactful action research.

Objective. Candidates will receive AI-based feedback on the strengths and weaknesses of their research questions.

Example. Candidates will be asked to identify a real-world problem in their educational environment and formulate an initial research question that addresses this problem. To assess their knowledge about how to effectively formulate an action research question, they will pair up and review each other's revised research questions, providing additional insights and suggestions for improvement based on criteria learned in the course. After receiving feedback, they will use AI to refine the question.

Prompt AI. "Please tell me if the following question is appropriate as an action research question. Be specific about strengths and weaknesses and provide clear explanations; Does technology improve student engagement in the classroom?"

Follow-Up Activity. Candidates conduct a literature review and modify their questions if needed based on their findings and newly acquired knowledge. They use the AI tool to refine the new question.

Anticipated Outcomes. A review of the research question that includes detailed feedback on the specificity and clarity of the question, the relevance and context of the research question, and the measurability and feasibility of the research question.

Potential Challenges. (a) There is a risk that students may rely too heavily on AI feedback and neglect critical thinking and peer review, which are also crucial in the research process; (b) Finding the right balance between being specific enough to be actionable and broad enough to be significant can be difficult for students; (c) Combining AI feedback with insights from literature and peer reviews can be challenging, as students need to synthesize diverse inputs into a coherent research question.

Reflection Questions. (a) How did the AI feedback help you in refining your research question? (b) How did the feedback process influence your understanding of what makes a strong action research question? (c) What improvements did you make to your research question based on the feedback?

5.2.8 Exemplar 12

Purpose for Using AI. To engage learners interactively with content to mimic real life, enriching candidates' understanding and practical application of acquired knowledge.

Objectives. Teacher candidates will explore having conversations with theorists and educators whose philosophical and pedagogical underpinnings are followed in their coursework.

Example. Teacher candidates engage in an interactive AI-facilitated dialogue with the renowned educational theorist Lev Vygotsky. The objective of this activity is to deepen their understanding of Vygotsky's theories on social development, particularly the zone of proximal development (ZPD), and to explore practical applications in their teaching practices.

Prompt AI. "Imagine you are Lev Vygotsky." Candidates create prompts based on content learned individually or in groups and may use questions to start a conversation, such as:

- "Mr. Vygotsky, how do you believe the concept of the zone of proximal development can be best applied in today's classrooms to improve student learning? Provide real-life examples and connections."
- "What specific strategies would you recommend for incorporating social interaction into lessons to support cognitive development?"
- "Can you elaborate on the role of language in cognitive development and how we can leverage it in our teaching?"

Candidates will develop their own dialogue based on Vygotsky's responses and their curiosity.

Follow-Up Activities. (a) Engage in structured discussions and debates on current topics related to Vygotsky's theories. For example, discuss the balance between standardized testing and formative assessment or the role of technology in social learning. (b) Participate in effective and ineffective role-playing scenarios where candidates simulate a classroom environment, applying or not applying scaffolding to support student learning. Rotate roles to experience different perspectives. (c) Conduct peer-teaching sessions where candidates plan and teach a mini lesson they would deliver in K–12 classrooms, focusing on the use of scaffolding and social interaction. Receive feedback and reflect on the experience.

Anticipated Outcomes. (a) Teacher candidates will develop a deeper understanding of Vygotsky's theories and their practical applications in the modern classroom. They will be able to articulate and apply concepts such as the zone of proximal development and scaffolding in their teaching practices. (b) Candidates will be better prepared to incorporate social interaction and language development strategies into lesson plans. (c) Candidates will be equipped to guide AI-student conversations in their planned lessons (e.g., a history lesson where students converse with Abraham Lincoln).

Potential Challenges. (a) Ensuring the AI-generated dialogue accurately represents Vygotsky's theories and provides relevant and practical insights. (b) Addressing potential difficulties in translating AI-generated insights into effective classroom practices.

Reflection Questions. (a) How has engaging in a conversation with AI representing Lev Vygotsky influenced your understanding of his theories? (b) What new insights did you gain about the application of the ZPD in your teaching practice? (c) How do you plan to incorporate the role of social interaction and language in cognitive development into your classroom activities? (d) What challenges did you face during the AI interaction, and how did you address them?

5.2.9 Exemplar 13

Purpose for Using AI. Engaging with content through multiple modalities to show understanding.

Objectives. (a) Candidates will use AI to create content in different modalities that represent the issue of disproportionate discipline practices in K–12 education. AI will be used to analyze and visualize data, highlighting how these practices disproportionately affect Black and Latino students. (b) Candidates will critically consider the factors contributing to disproportionate discipline and its long-term impacts on marginalized communities.

Example. After researching statistics in school districts (ideally on their own if the districts are culturally diverse), candidates use AI to generate a data visualization that compares the rates of suspensions and expulsions among different racial groups within a school district or between two school districts. They also create a digital story that follows a hypothetical student's journey through the educational system, highlighting how disciplinary actions shape their academic and social experiences.

Prompt AI. (a) "Represent the data found on School Districts A and B (write or upload data) visually to illustrate the impact of disproportionate discipline practices on students of color. Create a visual representation for each disciplinary action (e.g., suspensions, expulsions) across different racial groups." (b) "Craft a digital story based on the statistics for district A that explores and represents the consequences of these practices on a student's life."

Follow-Up Activities. (a) Candidates use AI tools to create additional representations, such as graphic organizers and PowerPoint presentations. (b) Without the use of AI, candidates discuss their peers' digital stories by answering questions such as, "What are the root causes of these disparities, and what alternatives might create more equitable outcomes?" (c) Candidates brainstorm more equitable disciplinary strategies to prevent unequal discipline practices and use AI to provide additional strategies afterward. (d) Candidates use AI to assist in designing an advocacy campaign or policy grant proposal aimed at reducing disproportionate discipline practices in their school or district, including suggestions for restorative justice practices.

Anticipated Outcomes. (a) Candidates gain practice representing content using multiple modalities that they can later model for their students to use. (b) Candidates will develop a greater awareness of how racial biases influence disciplinary practices in schools. (c) Candidates gain practice in interpreting and presenting data. (d) Candidates practice using tools such as Canva with AI features, DALLE by OpenAI, MidJourney, and Storybird to create multimodal presentations.

Potential Challenges. (a) Candidates may face challenges in organizing the information needed as a basis for displaying the data and interpreting it in different modalities. (b) Candidates may need additional support to understand the complex sociocultural factors that contribute to disproportionate discipline.

Reflection Questions. (a) What challenges did you encounter while creating your AI-generated content, and how did you address them? (e.g., challenges representing data in the modality you selected). (b) How did using AI help you understand the impact of disproportionate discipline practices on students of color? (c) How might these disciplinary practices affect a student's academic journey and future opportunities?

6. Critical Questions for Faculty and Candidates on AI Use in Education

As educators grapple with the benefits and challenges of generative AI, they must consider critical questions related to their fears and possibilities. Neebe (2023) posed questions educators should reflect on, including: (a) Why do we learn to do something that a machine can do? (b) How might reliance on AI affect human decision making, problem solving, and critical thinking? (c) How might uneven access to fee-based AI services exacerbate existing inequities among students? (d) What do students need to learn to use AI safely, ethically, and responsibly—and what does it look like for teachers to model these practices? (e) What unique aspects of human learning can and cannot be replicated by AI? (ISTE, 203; *Standards for learning*, 2.3).

These questions must be explored not only by teacher educators but also through honest dialogue with future teachers, either before or simultaneously with integrating AI into curriculum, instruction, and experiences. This article does not attempt to answer these questions in the depth they require, but it provides brief responses. The first question points to the need to reconsider the goals and objectives of schooling. We must reevaluate the purpose of asking students to write essays, summarize texts or media, and write letters. The second question highlights the importance of reimagining education and its approaches to create curricula and learning environments that are student-centered and meaningful to the real world. The third question requires an examination of who has access to hardware, software, and AI tools, along with opportunities to become AI literate. The fourth question invites discussion on what will be considered ethical, such as issues of plagiarism, and whether there should be limits on chatbot use to support a new type of teaching and learning. Closely related to the focus of this article, the fifth question calls for deeper reflection on what teachers and students can do that AI cannot. When asked about what these human traits would be, ChatGPT lists: (a) emotional intelligence, empathy, and compassion for tailored support; (b) critical thinking and creativity that go beyond pattern recognition and data analysis; (c) cultural and contextual understanding that AI might misinterpret; (d) ethical and moral judgment based on a deep understanding of societal values and individual circumstances; (e) building relationships and community based on trust, mutual respect, and shared experiences; (f) mentorship and role modeling, providing guidance, inspiration, real-life examples, and personal experiences; (g) intuition and gut feelings for making decisions in complex, uncertain situations; (h) hands-on learning and practical skills that require direct interaction and physical presence.

7. Conclusion

AI capacities are evolving too rapidly for teacher education to hesitate in deliberating whether to adopt or resist new AI tools. Students and faculty are increasingly eager to understand what language models can do and to explore how or whether they should be used to transform teaching and learning. Instead of waiting until they feel like experts, educators could explore AI together with their students in teacher preparation courses. Engaging in both AI-based and non-AI-based authentic activities/tasks, and reflecting on AI's benefits and challenges alongside students, can foster deep dialogue while balancing the teaching of course content. Educators must take responsibility for preparing AI-literate teachers who, in turn, will guide their students to use AI tools in thoughtful, ethical ways.

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Note

Note 1. ChatGPT was used to help generate ideas in this section.