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, educational technologies, large language models, teacher education

Artificial 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

ASSIGNMENT NAME:

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?)

Task Analysis:
(Clearly identify each step in the assignment.)

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.)

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: _____

❑ 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: _____

❑ Other: _____

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
Clarity and Relevance of PLAAFP Statement and IEP Goals	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.	
Critical Analysis and Evaluation of IEP Goals	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.	
Accuracy of Research Summary Evaluation	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.	
Task Analysis and Data Collection	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.	
Systematic Instructional Program Plan	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.	
Total Score						

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 (Metcalfe, 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 reimagined 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 reimagined 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 reimagined 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 implementating 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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