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Pedagogical Biases in AI-Powered Educational Tools: The Case of Lesson Plan Generators

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Abstract

This paper examines pedagogical biases in AI-powered educational tools, focusing specifically on lesson plan generators. We investigate how these tools may implicitly embed outdated educational approaches that limit student agency and classroom dialogue. Through analysis of 90 lesson plans from commercial lesson plan generators, we found that AI-generated content predominantly promotes teacher-centered classrooms with limited opportunities for student choice, goal-setting, and meaningful dialogue. To mitigate this issue, we further experimented with intentional prompt engineering, which showed promise in significantly enhancing these dimensions in AI-generated lesson plans. We offer practical strategies for educators and developers to mitigate harmful pedagogical biases while promoting contemporary educational values. This work contributes to the critical conversation about how AI tools should be designed and used to support, rather than undermine, the future of education that values student agency and productive classroom dialogue.

Introduction

Artificial intelligence (AI) is becoming increasingly integrated into educational technologies, transforming the way students learn, teachers teach, and educational institutions operate. While AI offers the promise of efficiency, personalization, and scale, its incorporation into education is not value-neutral. AI systems carry *general biases*, such as cultural and linguistic biases that have garnered significant public attention. They also carry *pedagogical biases*, which encompass implicit or explicit beliefs, assumptions, and preferences regarding how teaching and learning should be organized, delivered, and assessed. Although mitigating general biases is crucial, we contend that addressing pedagogical biases in AI-powered tools is equally important, as they directly shape instructional decisions, classroom interactions, and educational outcomes.

This issue has deep historical roots. Educational technologies have consistently embedded biases through cultural, linguistic, pedagogical, and value-driven frameworks that reflect dominant societal norms and institutional priorities. These biases manifest in design decisions on content focus, technological features, and information delivery, which frequently sideline non-dominant perspectives and reinforce prevailing views and structures. For instance, automated essay scoring systems face a range of challenges in fairly assessing learners with different genders, ethnic backgrounds, socio-economic statuses, and English language proficiencies (Shermis & Burstein, 2013); more recently, AI detectors have exhibited bias against non-native English writers (Liang et al., 2023). Meanwhile, educational technologies are grounded in value systems that favor certain educational goals. For instance, many technologies prioritize disciplines like STEM while marginalizing arts, humanities, and areas not directly tied to national competitiveness or

workforce demands. The personalized learning narrative, combined with the push for massive scale that mirrors other sectors, reinforces individual performance metrics (Roberts-Mahoney et al., 2016), downplaying structural inequities and presenting personalization as a simplistic solution to complex structural issues. Pedagogically, traditional educational technologies have adopted cognitive-centric frameworks that emphasize cognitive outcomes and prioritize information delivery over critical thinking. Many proposed educational solutions operate within this limited framing of pedagogy and learning. As a result, technology often prioritizes efficiency over pedagogical diversity, favoring tools that automate rote tasks rather than foster creativity or deviation from dominant norms of education.

In this paper, we focus on pedagogical biases that can be implicitly embedded in AI-powered educational technologies. While we acknowledge that not all AI technologies in education are used for teaching and learning, we believe it is essential to critically examine pedagogical biases in technologies designed for learning and teaching. On the one hand, these biases may represent outdated views on education, making it crucial to avoid potential harms. On the other hand, there are opportunities to purposefully design AI tools with a "bias" toward contemporary and forward-looking educational visions.

In this paper, we investigate two specific pedagogical biases—agency and dialogue—and examine their manifestation in lesson plan generators, one of the most prevalent AI applications in education. We pose two central questions: *Do lesson plan generators exhibit pedagogical biases in student agency and dialogue? What practical strategies can be developed to enhance student agency and dialogue in AI-generated lesson plans?* This paper proceeds as follows: We begin with an overview of the current landscape of AI-powered lesson plan generation. We then examine the pedagogical biases related to student agency and dialogue, presenting our evaluation of existing tools alongside practical strategies we have developed and tested. We conclude by urging all stakeholders—particularly educators and tool developers—to adopt intentional AI design approaches that both mitigate harmful pedagogical biases and actively promote beneficial ones aligned with contemporary educational values.

What Are AI-powered Lesson Plan Generation Tools?

AI-powered lesson plan generation tools are educational technologies that leverage large language models, such as ChatGPT, to assist teachers in creating lesson plans. These generators allow educators to efficiently produce lesson plans tailored to specific subject areas, grade levels, and curriculum standards based on their input parameters.

With ChatGPT, educators can generate structured lesson plans by providing prompts such as "Create a 45-minute lesson plan for 8th grade science on photosynthesis." The model then outputs a lesson plan with learning objectives, activities, and assessment strategies, which teachers can refine by requesting modifications like "Add more hands-on activities" or "Include differentiation strategies for English language learners." ChatGPT can also produce supplementary materials, including discussion questions, quizzes, and homework assignments aligned with the lesson objectives. Special-purpose lesson plan generators, such as MagicSchool, Diffit, and School AI, further streamline the process by directly offering customization controls on their interfaces. These tools allow teachers to input parameters like grade level, subject area, learning objectives, and preferred teaching standards (e.g., Common Core) to generate tailored lesson plans.

AI-powered lesson plan generators have gained significant popularity among educators in recent years for several reasons. They save time by automating much of the lesson planning process (Dornburg & Davin, 2024; Moundridou et al., 2024), provide a rich source of design ideas adaptable to specific classroom needs, and demonstrate versatility in accommodating different teaching methods and pedagogical approaches (Fan et al., 2024; Moundridou et al., 2024). However, research has identified important limitations that beg careful consideration. The quality of generated lesson plans can be highly variable, with some outputs requiring significant revision or refinement (Dornburg & Davin, 2024). Perhaps most critically, these AI systems may exhibit biases toward outdated pedagogical practices, potentially reinforcing teaching methods that no longer align with contemporary educational research and best practices (Cameron & Mesiti, 2024; Dornburg & Davin, 2024). These limitations highlight the need for critical adoption and further refinement of these tools to better serve educational needs.

Student Agency

Student agency refers to students' capacity to set goals, reflect on their learning, and take purposeful action toward their growth and development (Bandura, 1989; Scardamalia & Bereiter, 2008). With high levels of agency, learners become active contributors to knowledge construction, challenging, adapting, and innovating within their learning environments. This involves elevated metacognition and self-regulation (Järvelä et al., 2018), enabling students to move toward independence from teachers and other authority figures in education. Hence, student agency is generally valued in education.

To evaluate student agency in lesson plans, we drew upon Vaughn's (2020) multidimensional framework, which comprises dispositional, motivational, and positional dimensions. The dispositional dimension focuses on students' self-perception and intentionality as active learners capable of setting goals and taking purposeful action (Vaughn, 2020). Key constructs include engaging with authentic problems and encouraging goal-directed behavior (Bandura, 1989; Moses et al., 2020). The motivational dimension encompasses beliefs and values that drive students to engage and pursue their goals, inspiring persistence, intentional decision-making, and consistent action (Vaughn, 2020). Key constructs include making value-aligned choices, demonstrating resilience, and self-efficacy (Bandura, 1989). The positional dimension highlights how students experience agency within social contexts (Vaughn, 2020; Vygotsky, 1978), emphasizing peer relationships, classroom culture, and social interaction in fostering collaboration, negotiation, and agency expression. It can be nurtured through social learning opportunities and an environment where students' voices matter.

To investigate the extent of student agency in AI-generated lesson plans, we conducted a technological study comparing three conditions: the "vanilla" GPT-4 model without educational customization, and two widely used educational platforms, MagicSchool[2] and School AI,[3] each with over a million users. Focusing on Grade 8 math, science, and history, we selected two topics from each subject based on the Common Core State Standards (CCSS), Next Generation Science Standards (NGSS), and New York State K-8 Social Studies Framework. For each topic, we generated five lesson plans under each AI condition using consistent prompts.[1] A total of 90 lesson plans were generated, which were then analyzed and scored based on the student agency framework described above.

The results revealed that AI-generated lesson plans scored poorly, with some variations across subjects. They predominantly promote teacher-centered classrooms, where educators maintain control over most teaching and learning activities, leaving limited opportunities for student agency. In MagicSchool, for instance, many lesson plans include directives such as "Assign the worksheet or a set of problems and ask students to work quietly." Likewise, vanilla GPT-4 lesson plans frequently instruct that "Students will be divided into small groups," "Each group will be given a set of hypothetical data," and "Students will be assessed based on their participation." Furthermore, lesson plans across MagicSchool, School AI, and vanilla GPT-4 tend to emphasize certain aspects of student agency while neglecting others. The most frequently represented constructs include interaction, opportunities to share ideas, and problem-solving, whereas constructs such as goal-directed behavior, initiative, and shared authority are largely absent.

To investigate strategies for enhancing student agency in AI-generated lesson plans, we developed a custom lesson plan generator that incorporates the definition and dimensions of student agency through prompt engineering. This lesson plan generator is programmed in Python and incorporates OpenAI's GPT-4 API. Using the same user input, we generated lesson plans for the same subjects and evaluated them against the student agency framework. Our custom AI generator scores significantly higher across different dimensions of student agency compared to MagicSchool, SchoolAI, and GPT-4, and across all three subject areas. The lesson plans generated using our custom AI promote self and peer assessment, rely less on teacher-led quizzes, and enable students to take on diverse roles. They also offer more resources and choices, allowing students to select presentation formats and research topics, thereby fostering exploration and initiative.

Classroom Dialogue

Dialogue in education refers to the structured use of classroom talk and interaction to promote student learning, engagement, and knowledge construction (Edwards-Groves, 2023). In contrast to traditional monologic teaching, dialogic pedagogies emphasize interactive and collaborative meaning-making. Through dialogue, students engage in academically productive discourse that allows them to articulate thoughts, challenge ideas, and build shared understanding. Dialogue plays a crucial role in promoting students' higher-order thinking skills, knowledge construction, and ability to engage in meaningful academic discussions. Through dialogue, students learn to articulate their ideas, consider alternative perspectives, and collaboratively build a deeper understanding of the subject matter. However, despite these benefits, restrictive, teacher-centric discourse structures persist in classrooms, creating inertia against more dialogic pedagogies. Large language models, trained on existing text data, are expected to carry biases that hinder the nurturing of dialogue in the classroom.

Similar to our efforts in student agency, we analyzed the content of 90 AI-generated lesson plans from these three conditions: vanilla GPT-4, MagicSchool, and School AI. This analysis was guided by a framework by Alexander (2008) that delineates different types of talks in a lesson: *Rote* (teacher-class)—drilling through repetition; *Recitation* (teacher-class or teacher-group)—questioning to test recall; *Instruction/exposition* (teacher-class, teacher-group, or teacher-individual)—telling students what to do; *Discussion* (teacher-class, teacher-group, or pupil-pupil)—exchanging ideas or information; *Dialogue* (teacher-class, teacher-group, teacher-individual, or pupil-pupil)—achieving common understanding.

Results showed that the most prevalent type of talk in these AI-generated lesson plans is rote, characterized by structured repetition of key facts and concepts. These lesson plans typically follow a predictable sequence: an introduction presenting a real-world scenario, followed by direct instruction where teachers define concepts, provide examples, and demonstrate problem-solving methods, concluding with a summary reinforcing key ideas. Instruction/exposition and discussion emerge as the next most prevalent types. In the instruction/exposition phase, educators maintain a directive role, conveying knowledge and providing explanations to the class, groups, or individuals. MagicSchool, for instance, features teachers addressing common misconceptions such as attributing the Great Depression solely to the stock market crash. Similarly, School AI lesson plans depict teachers using diagrams to illustrate concepts like natural selection. In contrast, examples of discussion are limited in scope, primarily involving students working in pairs or small groups to answer teacher-led questions or solve problems, with minimal opportunities for student-generated inquiries or extended dialogue. School AI lesson plans often initiate discussions to capture students' interest and activate engagement at the beginning of the lesson. However, these discussions are rarely sustained throughout the class, resulting in a lack of continuous interaction and reduced opportunities for deeper understanding and critical thinking as the lesson progresses. Notably, the dialogue phase, crucial for deepening understanding and fostering reflection, is largely absent. Lesson plans generated by vanilla GPT-4 tends to halt group discussions without providing scaffolding or guiding questions, restricting students' ability to clarify concepts and engage in meaningful discourse.

To explore strategies for enhancing classroom dialogue in AI-generated lesson plans, we developed another custom lesson plan generator that integrates a dialogue phase to promote student learning, engagement, and collaboration. Sample lesson plans from our custom generator revealed notable differences. In these lesson plans, teachers begin by posing diverse questions and examples to activate prior knowledge, encourage peer idea-sharing, and stimulate discussions on real-world applications. During discussions, students articulate their thoughts while peers ask clarifying questions and provide feedback, fostering a dynamic exchange that deepens understanding. Teachers prompt critical thinking beyond textbook answers, cultivating an interactive and intellectually stimulating environment. Our custom generator prioritizes knowledge building through collaboration and dialogue, ensuring students actively engage with and build upon ideas (Alexander, 2008).

Discussion

While AI has the potential to streamline lesson planning and reduce educator workload (Fan et al., 2024; Karpouzis et al., 2024; Zheng et al., 2024), this study reveals significant limitations of AI-generated lesson plans in fostering student agency and dialogue. These lesson plans often follow repetitive, teacher-centered patterns that restrict opportunities for students to make choices and take meaningful actions in their learning. Furthermore, the lesson plans demonstrate a lack of emphasis on fostering productive classroom dialogue. Our findings demonstrate that incorporating appropriate prompts can steer AI to generate lesson plans that attend to multiple constructs of student agency and dialogue.

Of course, there are many other values and biases that call for deeper investigation. By surfacing gaps in existing AI-powered tools, we argue that educators need to engage with AI tools mindfully, and AI tool developers must collaborate with educators and learning scientists to embed core educational values in these tools. Educators should be supported in discerning

pedagogical biases against important values in education. To support this process, we need to make a concerted effort to create teacher learning opportunities, open-access prompt repositories, and collaborative communities. Even more crucially, we need to empower educators to take an active role in shaping AI tools so that they reflect pedagogical ideals and help pave the way for the future of education.

Data Availability

The data and prompts underlying this article are available on the project's Open Science Framework website at https://osf.io/djmqn/.

Endnotes

[1]All prompts can be found on https://osf.io/djmqn/.

[2]https://www.magicschool.ai/

[3]https://schoolai.com/

References

Alexander, R. J. (2008). *Towards dialogic teaching: Rethinking classroom talk* (4th ed.). Dialogos.

Bandura, A. (1989). Human agency in social cognitive theory. *American Psychologist*, *44*(9), 1175–1184. https://doi.org/10.1037/0003-066X.44.9.1175

Cameron, S., & Mesiti, C. (2024). *What Kind of Mathematics Teacher Is ChatGPT? Identifying the Pedagogical Practices Preferenced by Generative AI Tools When Preparing Lesson Plans*. Mathematics Education Research Group of Australasia.

Dornburg, A., & Davin, K. J. (2024). ChatGPT in foreign language lesson plan creation: Trends, variability, and historical biases. *ReCALL*, 1–16. https://doi.org/10.1017/S0958344024000272

Edwards-Groves, C. (2023). Dialogic Pedagogies. In *Oxford Research Encyclopedia of Education*. https://doi.org/10.1093/acrefore/9780190264093.013.1836

Fan, H., Chen, G., Wang, X., & Peng, Z. (2024). *LessonPlanner: Assisting Novice Teachers to Prepare Pedagogy-Driven Lesson Plans with Large Language Models*. https://doi.org/10.1145/3654777.3676390

Järvelä, S., Hadwin, A., Malmberg, J., & Miller, M. (2018). Contemporary Perspectives of Regulated Learning in Collaboration. In *International Handbook of the Learning Sciences*. Routledge.

Karpouzis, K., Pantazatos, D., Taouki, J., & Meli, K. (2024). *Tailoring Education with GenAI: A New Horizon in Lesson Planning* (No. arXiv:2403.12071). arXiv. http://arxiv.org/abs/2403.12071

Liang, W., Yuksekgonul, M., Mao, Y., Wu, E., & Zou, J. (2023). GPT detectors are biased against non-native English writers. *Patterns*, *4*(7), 100779. https://doi.org/10.1016/j.patter.2023.100779

Moundridou, M., Matzakos, N., & Doukakis, S. (2024). Generative AI tools as educators' assistants: Designing and implementing inquiry-based lesson plans. *Computers and Education: Artificial Intelligence*, *7*, 100277.

Roberts-Mahoney, H., Means, A. J., & Garrison, M. J. (2016). Netflixing human capital development: Personalized learning technology and the corporatization of K-12 education. *Journal of Education Policy*, *31*(4), 405–420. https://doi.org/10.1080/02680939.2015.1132774

Scardamalia, M., & Bereiter, C. (2008). Pedagogical biases in educational technologies. *Educational Technology*, *45*(3), 3–11.

Shermis, M. D., & Burstein, J. (Eds.). (2013). *Handbook of Automated Essay Evaluation: Current Applications and New Directions*. Routledge. https://doi.org/10.4324/9780203122761

Vaughn, M. (2020). What is student agency and why is it needed now more than ever? *Theory Into Practice, 59*(2), 109–118. https://doi.org/10.1080/00405841.2019.1702393

Vygotsky, L. S. (1978). *Mind in Society: Development of Higher Psychological Processes* (M. Cole, V. Jolm-Steiner, S. Scribner, & E. Souberman, Eds.). Harvard University Press. https://doi.org/10.2307/j.ctvjf9vz4

Zheng, Y., Li, X., Huang, Y., Liang, Q., Guo, T., Hou, M., Gao, B., Tian, M., Liu, Z., & Luo, W. (2024). Automatic Lesson Plan Generation via Large Language Models with Self-critique Prompting. In A. M. Olney, I.-A. Chounta, Z. Liu, O. C. Santos, & I. I. Bittencourt (Eds.), *Artificial Intelligence in Education. Posters and Late Breaking Results, Workshops and Tutorials, Industry and Innovation Tracks, Practitioners, Doctoral Consortium and Blue Sky (Vol. 2150, pp. 163–178)*. Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-64315-6_13