ASEE AMERICAN SOCIETY FOR ENGINEERING EDUCATION

Paper ID #47818

Investigating Instructors' Experiences in a Neurodiversity-Focused AI Training Program

Prof. Andrew Begel, Carnegie Mellon University

Dr. Andrew Begel, PhD is an Associate Professor in the Software and Societal Systems Department at Carnegie Mellon University. Prior to this, he spent over 16 years as a Principal Researcher at Microsoft Research. Andrew's goal is to create inclusive workplaces where all people, especially those with disabilities and the neurodivergent, can be successful, without discrimination. His recent work has helped people on the autism spectrum gain employment and facilitate social interaction, helped blind software developers collaborate with their sighted colleagues, and used affective computing and biometrics to better understand how software developers do their work.

Dr. D. Matthew Boyer, Clemson University

Dr. Boyer is a Research Associate Professor in the Department of Engineering and Science Education and an Educational Proposal Writer in the College of Engineering, Computing and Applied Sciences.

Rick Kubina, Pennsylvania State University
Somayeh Asadi, University of Virginia
Taniya Mishra
Ren Butler, Carnegie Mellon University

Ren Butler is a Ph.D. student in Human-Computer Interaction at Carnegie Mellon University. Ren researches psychological safety in neurodiverse AI engineering teams. Ren aims to discover design principles for software development tools that support psychological safety among engineers with social and emotional differences. This will be useful for fostering team learning, well-being, and productivity.

JiWoong Jang, Carnegie Mellon University

Joon is a Ph.D. student at CMU's School of Computer Science, where he focus on understanding, designing, and building AI-equipped assistive technology (AT) and how such tools affect and alter existing social dynamics in intro- and extra-spective ways – tackling stigma, user-assimilation, and the AT adoption/abandonment problem through his research.

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Introduction

Artificial Intelligence (AI) has become a cornerstone of technological advancement, shaping industries from healthcare to manufacturing. As the global reliance on AI grows, so does the need for a workforce capable of navigating its complexities. Central to this workforce is the imperative to include diverse perspectives, which drive innovation and ensure the equitable application of AI technologies. Fostering such diversity requires addressing existing educational access and inclusivity disparities, particularly for neurodivergent learners who remain underrepresented in STEM fields, including AI education.

Despite the increasing focus on equity and inclusion within engineering and computer science education, neurodivergent learners often encounter systemic barriers that limit their engagement and success. Traditional pedagogical models frequently overlook the varied learning preferences and social dynamics associated with neurodiversity. For example, instructional approaches prioritizing uniformity in cognitive or social engagement may inadvertently disadvantage students whose strengths lie outside conventional frameworks. To build a genuinely inclusive AI education ecosystem, educators must recognize these challenges and adapt their teaching strategies to meet the unique needs of neurodivergent learners.

This study investigates instructors' experiences in a neurodiversity-focused AI training program to bridge critical gaps in understanding how educators navigate these complexities. Specifically, the research explores the challenges instructors face when teaching AI concepts, including balancing diverse learning styles, managing classroom dynamics, and implementing effective assessment strategies. These insights can guide the development of educational practices that are both inclusive and effective, enabling more students to contribute meaningfully to the AI workforce.

Research Questions

The following research questions drive this study:

1. What challenges do instructors face when teaching AI concepts to neurodivergent learners?
2. How do instructors adapt pedagogical approaches to accommodate diverse learning styles and preferences in a neurodiversity-focused AI training program?
3. What strategies do instructors employ to manage inclusive classrooms' social and emotional dynamics in such programs?
4. What assessment methods do instructors find effective for gauging student learning in neurodiversity-focused educational settings?

Literature Review

The following review synthesizes existing literature on neurodiversity in STEM education, the current state of AI education, and inclusive pedagogical strategies, focusing on social-emotional learning and assessment methods. These areas provide the foundation for understanding the challenges and opportunities in creating effective and inclusive AI education programs for neurodivergent learners.

Neurodiversity in STEM Education

Neurodiversity encompasses a range of cognitive variations, including autism, ADHD, and dyslexia, that influence how individuals learn and process information. In STEM education, neurodivergent learners often face significant barriers, including rigid instructional methods and environments that fail to accommodate diverse learning needs. Studies have shown that these challenges can lower persistence rates among neurodivergent students in STEM despite their demonstrated aptitude in pattern recognition and problem-solving [1]. However, research also highlights the potential of tailored interventions and support systems in fostering success for neurodivergent students. Such findings underscore the importance of inclusive teaching practices that align with these learners' unique strengths and needs.

AI Education

AI education presents unique challenges due to the field's highly technical and interdisciplinary nature. Current instructional practices often emphasize programming and mathematical modeling, which can be inaccessible to learners with diverse cognitive profiles. For neurodivergent students, AI-focused coursework's abstract and fast-paced nature can exacerbate learning difficulties [2]. Many Computer Science courses rely heavily on standardized assessment methods, such as exams and projects, which may not effectively capture the learning outcomes of all students. Recent studies advocate a shift toward more flexible and student-centered approaches in AI education, including integrating scaffolded learning activities and real-world problem-solving tasks [3].

Inclusive Pedagogy

Inclusive pedagogy aims to create educational environments where all students can thrive, regardless of their cognitive or social differences. Evidence-based strategies such as Universal Design for Learning (UDL) and differentiated instruction offer valuable frameworks for accommodating diverse learning needs. UDL emphasizes using multiple means of engagement, representation, and expression, enabling educators to design curricula accessible to a broad range of learners [4]. Differentiated instruction, on the other hand, involves tailoring content, processes, and assessments to meet individual student needs. Both approaches have been shown to improve learning outcomes for neurodivergent students, particularly in STEM disciplines, by promoting flexibility and personalization in teaching [5].

Social and Emotional Learning in Inclusive Classrooms

The social and emotional dimensions of learning play a critical role in the success of neurodivergent students. Inclusive classrooms that foster a supportive and empathetic environment can mitigate challenges such as social anxiety and communication difficulties, often pronounced among neurodivergent learners [6]. Research suggests that strategies such as peer mentoring, cooperative learning, and explicit instruction in social skills can enhance the classroom experience for all students [7]. These approaches not only benefit neurodivergent learners but also promote a culture of inclusivity and collaboration, which is essential for effective teamwork in fields like AI.

Assessment in Neurodiversity-Focused Settings

Traditional assessment methods, such as standardized tests and time-limited exams, often fail to account for the diverse ways neurodivergent students demonstrate understanding. Alternative approaches, including portfolio assessments, project-based evaluations, and self-reflection exercises, have been identified as more effective for gauging the learning of neurodivergent students [8]. These methods align with inclusive pedagogical principles by allowing students to showcase their strengths and creativity. Gaps remain, however, in understanding how to best implement such assessments in technical disciplines like AI, where mastery of conceptual and technical skills is required [3, 9].

Gaps in the Literature

While there is growing recognition of the need for inclusivity in STEM education, research on neurodiversity in AI education remains limited. Few studies have examined how instructors can effectively teach AI concepts to neurodivergent learners or how to adapt existing pedagogical and assessment frameworks to this context. We need empirical evidence on the long-term outcomes of neurodiversity-focused educational interventions in AI. Addressing these gaps is essential for developing comprehensive strategies that empower educators and students to create inclusive learning environments.

Methodology

This study employs qualitative research to investigate instructors' experiences in a neurodiversity-focused AI summer training program. It is part of an ongoing design-based research and development project funded by the National Science Foundation ExLENT program.

Research Context

The study is situated within the "Preparing Autistic Students for the AI Workforce" (PAS4AI) program, which aims to address the underrepresentation of autistic individuals in AI careers by providing specialized training, mentorship, and experiential learning opportunities. The program's objectives include equipping students with technical AI skills, fostering teamwork and communication abilities, and preparing participants for professional roles in the AI industry. Participants in the program included autistic community college students and instructors with diverse teaching backgrounds. The program curriculum combined conceptual and technical instruction in AI, emphasizing experiential learning through project-based activities and real-world applications. Spanning 4.5 weeks, the program utilized a structured schedule of lectures, workshops, and team-based projects, culminating in a capstone presentation.

Research Design

This study is an iteration of formative assessment in a more extensive design-based research and development project. In this iteration, we explore instructors' experiences within this unique educational context during the first year of implementation. This design suits the research questions, allowing in-depth exploration of complex, real-world phenomena in a bounded system. The interventionist approach provides a detailed understanding of how instructors navigate pedagogical, social, and emotional challenges while delivering neurodiversity-focused AI education.

Participant Selection

Instructors involved in the PAS4AI program were selected for the study based on their active engagement in the program's implementation. Inclusion criteria required participants to have direct teaching responsibilities and involvement in curriculum delivery. Exclusion criteria included instructors who only contributed to curriculum design without classroom interaction. The sample size was determined by the principle of data saturation, ensuring that the data collected was sufficient to capture the breadth and depth of instructors' experiences.

Data Collection

Data collection relied primarily on semi-structured interviews with instructors, supplemented by program documentation and participant surveys. The semi-structured interview protocol was designed to elicit detailed accounts of instructors' teaching experiences, challenges encountered, and strategies employed to address the diverse needs of neurodivergent learners. Additional data sources, such as classroom observations and analyses of instructional materials, were used to triangulate findings and provide a comprehensive understanding of the research context.

Data Analysis

Qualitative data analysis was conducted using thematic analysis, a method well-suited for identifying, analyzing, and reporting patterns within qualitative data. The analysis followed an iterative process, beginning with open coding to generate initial themes, followed by axial coding to explore relationships between themes. Emergent themes were continuously refined to ensure alignment with the research questions and the theoretical framework of inclusive pedagogy.

Findings

Analysis of the interview data revealed several key themes regarding the challenges instructors encountered while teaching in this neurodiversity-focused AI summer training program.

Adapting to Diverse Learning Styles and Preferences

Instructors noted the wide range of learning styles and preferences among the neurodivergent students. Some students excelled in code-focused learning environments, while others thrived with more conceptual and abstract instruction. One instructor noted the challenge of individualizing instruction given that, for privacy and research-related reasons, they were designing materials for students with whom they would not interact directly: "I'm so used to knowing the individual from my work that it was a challenge for me to do that without sort of a clear …" understanding of the learners. Bridging this gap and providing individualized support proved to be an ongoing challenge for instructors. Another instructor reflected on how the dense program with a compressed timeframe contributed to this difficulty: "So it was like too much work for them. We didn't expect that we are going to have to invest this amount of time in this project…"

Balancing Conceptual and Technical Instruction

The curriculum's demand for both conceptual understanding and technical proficiency posed a significant challenge. Instructors differed in their approaches, with some focusing on code while others emphasized abstract, high-level understanding. One instructor described how the

pre-existing materials influenced their approach: "So it was more of kind of nitpicking the material we were given, and we didn't feel like we were in a position to make super high level changes." This discrepancy in teaching styles created confusion among students, who found it difficult to reconcile the varying levels of abstraction. Another instructor commented on the lack of clarity around student background knowledge, which further complicated this challenge: "One of the things that we could have improved on was, we didn't really know exactly what the academic background of the student to be before they came in. And because of that we didn't filter the content in the notebooks well enough."

Managing Social and Emotional Dynamics

Instructors reported experiencing difficulties in managing the social and emotional aspects of the learning environment. Addressing social anxiety, common among autistic individuals, facilitating effective communication within teams, and handling interpersonal conflicts presented significant obstacles. One instructor noted that the default communication style of many students was challenging: "Their default was basically to clam up, turn off the camera, turn off their audio and type in text only when spoken to." The program's compressed timeframe and demanding content compounded these challenges, limiting the time to focus on social-emotional learning. Another instructor described the difficulties these issues created for team projects: "They were having issues with their team, and it was they needed somebody else to kind of like moderate."

Developing Robust Assessment Strategies

Given the need to provide individualized support, instructors found that traditional assessments were often inadequate for accurately gauging student learning in the compressed timeframe of the program. Developing and implementing more effective assessment methods that cater to the unique needs of neurodivergent learners emerged as a critical area for improvement. One instructor reflected on the limitations of relying on informal observations: "That's something we need to fix. [...] This isn't school. I mean, it's not camp either. But we definitely need something more than what we were doing, which was just like exposing them to work and asking them to try." Another instructor provided an example: "That's when we wanted to know who was good at the particular topic, and that turned out to be more about how much the instructors had personally interacted with the student than about any assessment vehicles we have had in the course."

Discussion

The findings of this study illuminate the multifaceted challenges and strategies associated with teaching in a neurodiversity-focused AI training program. By centering instructors' experiences, the study provides critical insights into the pedagogical, social, and institutional factors that shape the effectiveness of inclusive AI education. Instructors in the PAS4AI program encountered significant challenges, including adapting to diverse learning styles, balancing conceptual and technical instruction, managing social and emotional classroom dynamics, and developing robust assessment strategies. Despite these challenges, their experiences underscore neurodiversity-focused programs' potential to foster inclusivity and innovation in AI education.

The variability in learning preferences among neurodivergent students necessitated highly adaptive teaching strategies. Instructors found that traditional, one-size-fits-all pedagogical approaches were insufficient, emphasizing the need for frameworks like UDL and differentiated

instruction. These findings reinforce the importance of providing professional development opportunities to equip educators with the skills to meet diverse learner needs.

The tension between conceptual and technical instruction highlights the complexity of teaching AI concepts in a way that balances accessibility and rigor. This challenge underscores the importance of curriculum design that scaffolds technical skills while focusing on high-level understanding. Collaborative curriculum development involving instructors, neurodivergent learners, and content experts could address these gaps more effectively.

Social and emotional challenges in the classroom further complicate the delivery of inclusive AI education. The difficulties instructors faced in managing social anxiety, communication barriers, and interpersonal conflicts within teams underscore the need for explicit training in social-emotional learning strategies. Incorporating peer mentoring and structured team-building activities may mitigate these issues, creating a more supportive learning environment.

The inadequacy of traditional assessment methods in this context points to a broader need for alternative approaches that better capture the learning outcomes of neurodivergent students. Portfolio assessments, project-based evaluations, and formative feedback mechanisms are promising alternatives that align with inclusive pedagogical principles.

Broader Implications

These findings contribute to the broader discourse on neurodiversity in STEM education by highlighting the intersection of inclusive pedagogy and technical instruction in high-demand fields like AI. They underscore the potential for neurodiversity-focused programs to enhance educational outcomes for marginalized learners and foster innovation by bringing diverse perspectives to AI development.

Limitations

Several limitations of this study warrant consideration. The small sample size and the specific context of the PAS4AI program may limit the generalizability of the findings. Additionally, potential researcher bias and reliance on self-reported data from instructors could influence the interpretation of results. Future research should address these limitations by incorporating larger, more diverse samples and triangulating findings with observational data and student feedback.

Future Research

Building on these findings, future research should explore the experiences of neurodivergent learners within similar programs to provide a more comprehensive understanding of their educational journeys. Longitudinal studies examining such programs' impact on instructors and students would offer valuable insights into their long-term efficacy. Additionally, investigating the transferability of these findings to other AI education settings could further inform the development of inclusive practices across diverse educational contexts.

Theoretical and Practical Implications

Theoretically, this study advances the understanding of inclusive pedagogy in STEM education by integrating insights from neurodiversity and AI instruction. Practically, it provides actionable recommendations for program developers, educators, and policymakers seeking to create more

inclusive AI education environments. These include emphasizing professional development for instructors, integrating social-emotional learning into curricula, and adopting alternative assessment strategies that reflect diverse learner needs.

Recommendations
The study's findings yield actionable recommendations for stakeholders:

For Instructors
Prioritize professional development in inclusive teaching practices, focusing on UDL, differentiated instruction, and social-emotional learning. Utilize alternative assessment strategies, such as portfolios and project-based evaluations, to better capture diverse learning outcomes.

For Program Developers
Engage neurodivergent learners and instructors in collaborative curriculum development to ensure alignment with learner needs and program objectives. Provide structured opportunities for teamwork and mentorship to foster interpersonal skills and professional readiness.

For Policymakers
Invest in funding and resources to support the development of inclusive AI education programs. Expand access to professional development for educators and promote research into the long-term impacts of neurodiversity-focused interventions.

Conclusion
This study investigates instructors' experiences in a neurodiversity-focused AI training program, highlighting the unique challenges and opportunities in teaching AI concepts to neurodivergent learners. The findings reveal critical insights into adapting pedagogical strategies, managing diverse social-emotional dynamics, and employing effective assessment methods in inclusive educational settings. These insights advance our understanding of inclusive STEM education and emphasize the importance of designing programs that empower all learners to contribute to the evolving field of artificial intelligence.

The findings underscore the importance of flexibility and intentionality in curriculum design and instruction. Adapting teaching strategies to diverse learning styles, balancing conceptual and technical instruction, and incorporating social-emotional learning are essential for fostering an inclusive learning environment. Additionally, the inadequacy of traditional assessment methods highlights the need for alternative evaluation frameworks that better reflect the strengths and progress of neurodivergent students.

This research contributes to the broader discourse on equity in STEM education, demonstrating the potential for neurodiversity-focused programs to address systemic barriers and diversify the AI workforce. By equipping neurodivergent learners with the technical skills and collaborative competencies needed for success in AI, such programs promote inclusivity and enhance the field's capacity for innovation.

While this study provides valuable insights, further research is necessary to explore the experiences of neurodivergent learners and to evaluate the long-term outcomes of such programs.

Expanding this work to include diverse educational contexts and disciplines will enhance its applicability and impact. Longitudinal studies could provide a deeper understanding of how inclusive AI education programs influence participants' academic and career trajectories.

Positionality

Inclusive AI education is not only a matter of equity but also a necessity for fostering a workforce capable of meeting the complex challenges of the future. By addressing systemic barriers and embracing the strengths of neurodivergent learners, we can build educational environments that empower all students to excel. The findings of this study contribute to the developing roadmap for creating such environments, demonstrating the transformative potential of inclusive pedagogy to drive innovation and equity in STEM fields. As we refine these approaches, we take an essential step toward realizing the vision of a diverse and equitable AI workforce. We invite interested colleagues to contact us for collaboration and feedback.

Acknowledgment

National Science Foundation Award #2322554 supports this work. Any opinions, findings, conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

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