AI4CAREER: Workshop on Responsible AI for Career Development at Scale in K-16 Education

Sugana Chawla, Si Chen, Julia Qian, Gina Svarovsky, Alison Cheng, Rick Johnson, Nitesh V. Chawla, and Ronald Metoyer

University of Notre Dame, Notre Dame, IN, USA

Abstract. 8 page include references!!!Rapid advances in artificial intelligence (AI) are reshaping how students imagine, explore, and prepare for future careers, particularly in STEM fields. At the same time, schools across K–16 face growing uncertainty about how AI tools may support—or inadvertently hinder—students' career ideation, interest development, and decision-making. This half-day event brings together researchers, educators, practitioners, and policymakers to examine how students' career thinking evolves in the context of rapid AI change, and how AI-supported career exploration tools can be designed and implemented responsibly across educational stages. The event will feature short research talks, practitioner reflections, and structured discussions focused on three themes: (1) how students across K–16 conceptualize STEM careers amid shifting AI-driven labor markets; (2) the opportunities and risks of AI tools for career exploration, including issues of bias, over-personalization, and developmental appropriateness; and (3) strategies for designing coherent, teacher-guided AI supports that align career exploration across grade levels and educational transitions. Through cross-sector dialogue, the workshop aims to surface shared challenges, identify design principles and research gaps, and foster collaboration toward responsible, developmentally grounded AI use in STEM career learning.

Keywords: STEM Identity · Education Journey · Child-AI Interaction.

1 Introduction

Supporting students in developing meaningful career identities and future-oriented exploration is a central challenge in K–12 education, particularly in STEM. Students' early experiences in science, mathematics, and engineering shape their interest development, sense of belonging, and decisions about whether to pursue further STEM learning [7, 5]. Middle school represents a critical period in this process, as students encounter increasingly differentiated STEM coursework while beginning to form beliefs about what kinds of learners they are and what futures are possible. Teachers and schools are therefore expected to support not only academic progress, but also motivation, engagement, confidence, and emerging STEM-related interests [3].

Recent advances in large language models and data-driven artificial intelligence have intensified interest in AI supported K–12 teaching and learning, including tutoring, automated feedback, and personalized instruction. Prior work suggests that AI tools can help scale individualized support and enable adaptive interaction, positioning AI as a potentially powerful resource for personalized STEM learning [2, 10].

At the same time, the use of AI in K–12 raises important concerns. Many AI-driven educational tools emphasize automation and performance optimization, relying heavily on quantifiable indicators such as test scores or proficiency levels [1]. Such approaches risk misalignment with pedagogical goals, obscuring both students and teachers reasoning processes, and weakening teacher agency [9, 8]. From a learning sciences perspective, effective AIED systems should instead support *co-regulation* between humans and AI, in which AI surfaces information and possibilities while educators interpret and contextualize them [6]. These tensions are especially visible in student advising and STEM career exploration. In many middle school settings, career guidance is limited, episodic, or disconnected from classroom learning, often relying on generic interest inventories or static assessments [7]. This raises a need to understand how AI might support STEM-related career learning without premature labeling or constrained trajectories [4].

In this paper, we present the first phase of a design-based research program exploring how middle school teachers conceptualize the role of AI in supporting personalized teaching and learning, with a focus on STEM career exploration. We conducted focus groups with middle school teachers using design probes to elicit envisioned student-facing and/or teacher-facing AI interactions, desired system capabilities, and concerns about potential harms. We ask: **RQ:** How do middle school teachers conceptualize the role of AI in supporting students' educational journeys, with particular attention to STEM career exploration? This work contributes an empirical characterization of STEM career exploration as an underexplored learning need in middle school, identifies it as a promising target for AIED systems, and offers design implications for such systems.

2 Organizers

The organizing team brings together complementary expertise in responsible AI, STEM education, educational assessment, advising, data science, and community-engaged learning. Collectively, we work across K–16 education, higher education, informal STEM learning, and applied AI systems, with experience spanning human-centered AI design, psychometrics, career pathway development, industry partnerships, and institutional leadership. Our shared goal is to advance principled, evidence-based approaches to AI-supported STEM learning and career exploration that connect research, practice, and policy. We acknowledge that the current team is largely U.S.-based. To foster broader global representation, we will proactively engage international scholars and practitioners through established AI-in-education and STEM networks and widely disseminate the call through global professional societies and regional education communities.

Sugana Chawla is an Associate Professor of the Practice at the Lucy Family Institute for Data & Society at the University of Notre Dame and serves as the Data Science Education Program Director for the iTREDS program. With a background in Environmental Science and Education, she works at the intersection of STEM education, data science, and community engagement. Her work focuses on preparing students and educators to meaningfully engage with data and emerging technologies, while fostering pathways into STEM fields.

Si Chen is a Postdoctoral Research Fellow at the University of Notre Dame, jointly affiliated with Notre Dame Learning and the Lucy Family Institute for Data & Society. Her research focuses on human-centered and responsible AI for education, particularly in STEM and K–16 contexts. With a background in Human–Computer Interaction and working with students with disabilties, she uses mixed-methods and design-based research to develop AI systems that support exploration and sensemaking while maintaining educator oversight and ethical safeguards.

Julia Qian is Associate Advising Professor and Director of Advising Strategy, Assessment, and Policy in the College of Engineering at the University of Notre Dame. Her work focuses on holistic student development, belonging, and student engagement through evidence-based advising practices. She is interested in technology integration in higher education, personalized skill coaching, and assessment-driven policy implementation to support student success.

Gina Svarovsky is Senior Executive Director for Research Engagement and Professor of the Practice at the University of Notre Dame's Institute for Educational Initiatives. Her research focuses on how youth develop interest, skills, and engineering ways of thinking across formal and informal STEM learning environments. She studies how authentic, practice-based experiences support pathways into engineering, particularly for youth and families historically underrepresented in STEM.

Ying (Alison) Cheng is the Sweeney Sweeney Family Collegiate Professor of Quantitative Psychology and Education in the Department of Psychology and Fellow of Institute for Educational Initiatives at University of Notre Dame. An expert in educational assessment and psychometrics, she integrates statistical modeling, data mining, and artificial intelligence to design fair, interpretable, and efficient measurement systems. Her work advances statistics and data science education and develops assessment frameworks that align with evolving demands in quantitative literacy and AI-enabled learning environments.

Rick Johnson is Associate Professor of the Practice and Managing Director of the Applied Analytics and Emerging Technology Lab at the Lucy Family Institute for Data & Society at the University of Notre Dame. He leads applied data science and AI initiatives connecting industry and community partners, including K–12 mobile game development projects designed to inspire STEM and health care career pathways. He also directs a data and AI–focused summer internship program.

Nitesh Chawla is the Frank M. Freimann Professor and the Lucy Family Director of Data & AI Academic Strategy at the University of Notre Dame. His

primary research interests are in artificial intelligence and data science, and is motivated by the question of how we can build interdisciplinary bridges to chart the path from innovation to translational research — advancing common good. He is a Fellow of AAAI, ACM, AAAS, and IEEE. He is a founder of multiple companies, including Aunalytics, which is a data and AI company.

Ronald Metoyer is Vice President and Associate Provost for Teaching and Learning and Professor of Computer Science and Engineering at the University of Notre Dame. His research in human–computer interaction examines how data and emerging technologies can be designed to expand opportunity and support learners and educators, particularly those historically underserved. His leadership bridges research and institutional practice, advancing responsible integration of AI and data-driven tools in teaching and learning.

3 Intended Audience

We aim to host approximately 25–35 participants (excluding organizers), primarily selected from co-authors of accepted workshop submissions. This size is intentionally designed to balance diversity of perspectives with depth of interaction. A group of this scale allows for sustained small-group dialogue, structured synthesis, and meaningful exchange across roles and research communities.

Participants will be selected to ensure representation across developmental stages (middle school, high school, undergraduate) and stakeholder perspectives (students, families, educators/advisors, institutions/industry). We will also aim to include attendees from multiple disciplinary backgrounds, including Learning@Scale, Educational Data Mining, AI in Education, Human-Computer Interactions, learning sciences, STEM education, and educational policy. Including both researchers and practitioners is a priority, as the workshop seeks to bridge system-level research with real-world advising and implementation contexts.

During registration, participants will indicate their primary area of expertise and preferred discussion focus. Final group composition will be adjusted onsite to ensure balanced discussion and interdisciplinary exchange.

4 Themes

This workshop focuses on career learning and career ideation in the age of rapidly evolving AI, examining how AI tools may support or hinder students' exploration of interests, identities, and pathways across K–16 education, with a focus on STEM.

Place holder below [Themes for Position Papers. We invite position papers that engage with the following four themes, with a particular focus on STEM education and career pathways.

1. Redefining STEM Career Readiness in the Age of AI. How should "career readiness" be defined in STEM fields increasingly shaped by automation, generative AI, and data-driven decision systems? What competencies—technical,

analytical, ethical, or adaptive—are becoming more central? How should STEM readiness be measured beyond traditional academic metrics? We welcome conceptual, empirical, and methodological work that reexamines how STEM preparation is assessed across K–16 contexts.

2. Developmental Pathways and Decision Authority in STEM Trajectories. How do STEM career decisions differ across middle school, high school, and undergraduate stages? How should AI-supported exploration tools function differently for younger versus older learners? Who holds decision authority at each stage—students, families, educators, institutions—and how do incentives align or conflict? We seek work that analyzes developmental differences, advising structures, and governance challenges specific to STEM pathways.

3. Design and Evaluation of AI-Supported STEM Guidance Systems. How are AI tools currently deployed to support STEM exploration, advising, or pathway planning? What evaluation frameworks are appropriate for large-scale implementation? What unintended consequences emerge in real educational settings? We welcome studies addressing system design, longitudinal impacts, fairness, and measurement challenges in STEM-focused contexts.

4. Equity, Access, and Inclusion in STEM Career Development. How do AI-supported systems shape access to STEM opportunities for underrepresented learners? What barriers arise related to disability, language, institutional resources, or digital infrastructure? What design principles can ensure inclusive participation in STEM pathways?]

Place holder till here

5 Expected Outcomes and Contributions

First, the organizing team will prepare a post-workshop manuscript that synthesizes insights generated across presentations and structured activities. The manuscript will distill key tensions in career guidance systems, highlight measurement and evaluation gaps, and outline priority questions for future work in large-scale educational settings. The goal is to provide a focused contribution to ongoing conversations in Learning@Scale, AI in Education, and Educational Data Mining.

Second, the workshop will generate publicly available materials. Accepted position papers will be hosted on the workshop website (with author consent), along with synthesized summaries and a structured design matrix developed during group activities. These artifacts will serve as practical reference points for researchers and practitioners examining career pathways and advising systems.

Third, we will support sustained collaboration through lightweight community infrastructure. A dedicated Slack channel will enable continued discussion and follow-up exchanges, while the workshop website will function as a stable repository for materials and updates. Together, these mechanisms will facilitate ongoing collaboration beyond the conference.

6 Schedule

This 3.5-hour interactive workshop is organized around two complementary lenses: (1) understanding AI-enabled STEM career development across developmental stages and (2) proposing stakeholder-centered design solutions. During registration, participants will indicate their preferred developmental focus (middle school, high school, undergraduate) and stakeholder lens (students, families, educators/advisors, institutions/industry). Group assignments for Activity 1 will be assigned and adjusted by organizers to balance expertise and ensure interdisciplinary exchange where activity 2 will be based selected by attendees. All lightning presentations are pre-submitted and grouped by the organizing team.

0:00–0:50 (50 min) — Opening Lightning Presentations: Framing the Problem Space. Ten 4-minute presentations introduce key tensions in AI-supported career readiness, including shifting definitions of readiness, developmental differences, equity and access disparities, institutional constraints, and ethical boundaries.

0:50–1:30 (40 min) — Activity 1: Developmental Lens. Participants break into age-based groups (middle school, high school, undergraduate). Each group analyzes stage-specific career decisions, appropriate roles for AI support, developmental guardrails, and risks of over-automation. Groups produce three opportunity areas, three risks, and three design principles, and shared with the other groups.

1:30–1:40 (10 min) — Break.

1:40–2:20 (40 min) — Activity 2: Stakeholder Lens. Participants reorganize into stakeholder-centered groups (students, families, educators/advisors, institutions/industry). Groups examine incentive structures, authority boundaries, AI literacy requirements, and power asymmetries. Each group generates five design recommendations, one red flag to avoid, and one urgent research question, and shared with the other groups.

2:20–3:00 (40 min) — Final Lightning Presentations: Design Solutions. Ten 4-minute presentations focus on AI-supported design approaches, governance strategies, and implementation models. These talks build directly on the workshop's analytical discussions and highlight concrete pathways forward.

3:00–3:20 (20 min) — Synthesis and Closing.

7 Plans for Proceedings and Advertising

Accepted submissions will be non-archival. All accepted position papers will be published on the workshop website prior to the conference to support early engagement among participants. With authors' permission, papers will remain publicly accessible as a resource for the broader community. Authors will be encouraged to upload their work to arXiv or similar repositories and may revise and submit their work to future peer-reviewed venues.

Organizers will promote the workshop through social media, institutional channels, and professional networks of the organizing team. The Call for Papers

will be shared via platforms such as Twitter/X and LinkedIn, where organizers and collaborators will circulate the announcement within their academic and professional communities. The workshop will also be advertised through institutional websites, newsletters, and department mailing lists affiliated with the organizing team and their partner institutions.

References

1. Bahalkar, P., Peddi, P., Jain, S.: Ai-driven career guidance system: A predictive model for student subject recommendations based on academic performance and aspirations. Frontiers in Health Informatics **13**(3), 8216–8230 (2024)
2. Chiu, T.K.: A holistic approach to the design of artificial intelligence (ai) education for k-12 schools. TechTrends **65**(5), 796–807 (2021)
3. Dickman, A., Schwabe, A., Schmidt, J., Henken, R.: Preparing the future workforce: Science, technology, engineering and math (stem) policy in k-12 education. In: Public Policy Forum. ERIC (2009)
4. Duan, J., Wu, S., et al.: Beyond traditional pathways: Leveraging generative ai for dynamic career planning in vocational education. International Journal of New Developments in Education **6**(2), 24–31 (2024)
5. Gandhi, S.J., Nandikolla, V.K., Youssef, G., Bishay, P.L.: Using career pathways to assimilate high school students into the engineering profession. In: 2016 ASEE Annual Conference & Exposition (2016)
6. Gillani, N., Eynon, R., Chiabaut, C., Finkel, K.: Unpacking the "black box" of ai in education. Educational Technology & Society **26**(1), 99–111 (2023)
7. López, P., Simó, P., Marco, J.: Understanding stem career choices: A systematic mapping. Heliyon **9**(6) (2023)
8. Luckin, R., Holmes, W.: Intelligence unleashed: An argument for ai in education (2016)
9. Mintz, J., Holmes, W., Liu, L., Perez-Ortiz, M.: Artificial intelligence and k-12 education: Possibilities, pedagogies and risks (2023)
10. Murphy, R.F.: Artificial intelligence applications to support k-12 teachers and teaching. Rand Corporation **10**(1), 1–20 (2019)