AI Integration in STEM Teacher Preparation

Assessment of Current Use and Attitudes Across UTeach Programs

The University of Texas at Austin
National Center
for STEM Education

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AI INTEGRATION IN STEM TEACHER PREPARATION

EXECUTIVE SUMMARY

In the fall of 2025, the National Center for STEM Education (formerly the UTeach Institute) surveyed faculty, administrators, and staff at UTeach secondary STEM education preparation programs across 54 colleges and universities to establish a baseline for attitudes about and use of AI in secondary STEM teacher preparation. Fifty-seven respondents representing 31 programs completed the survey, providing insights into the impact that AI is currently having and may have on the future of STEM teacher preparation and classroom instruction.

KEY FINDINGS

The network of UTeach secondary STEM educator preparation programs is characterized by cautious optimism about AI, with 77% of respondents agreeing that it has the potential to positively impact their work. The majority of respondents (61%) characterize themselves as proactive adopters of AI integration. While the majority utilize AI in some manner and are optimistic about the potential use of AI in teacher preparation, 63% remain concerned about challenges—primarily academic integrity (42%), ethical biases (21%), and the potential for AI to degrade deep pedagogical thinking. Seventy percent of respondents identified needs for further training and support.

Currently, 79% of instructors report addressing AI in their courses. Of those who are integrating AI tools, 40% of instructors are building awareness about AI, developing AI use policies, or using AI primarily as a productivity or idea-generation tool. Another 51% are using AI for pedagogical design, supporting lesson planning and design, refining ideas for project-based learning units, and assisting with developing assessments, rubrics, differentiation, and classroom-facing teaching tasks. A few (9%) instructors reported the highest level of AI use for data-rich STEM inquiry such as AI-supported data analytics, research methods coding, simulated/fake data for analysis, or use of intelligent tutoring platforms tied to STEM learning.

RECOMMENDATIONS

The survey results indicate that while the UTeach network recognizes the transformative potential of AI, implementation must be guided by a deliberate focus on pedagogical integrity and ethical safeguards. Specific recommendations include:

- **Cultivating AI for high-impact STEM learning.** A strong consensus from respondents on AI's benefit to lesson planning and individualized instruction suggests an opportunity

to use AI as a thought partner. The network should prioritize exploration of uses of AI that close learning gaps, personalize STEM interests, and enable the application of complex principles through real-world problem solving and data analysis.

- **Mitigating risks to integrity and equity.** Fear of eroding critical thinking and reinforcing biases remains the primary deterrent to adoption. There is an urgent need for vetted resources and evidence showing that AI can enhance outcomes without compromising equity or rigor.
- **Leveraging a community of practice.** The majority of respondents want more support, and their preference is overwhelmingly in favor of peer-to-peer learning. The National Center for STEM Education should facilitate a community of practice focused on developing STEM-specific AI literacy frameworks to guide STEM educator preparation, providing high-quality technical training on AI education tools, developing and testing STEM-specific AI education application modules, and creating a repository of resources that align with research-based STEM instructional practices.

UTeach faculty are not starting from zero; they are already experimenting with AI. However, the network lacks a shared, research-based framework for moving from ad hoc AI use toward higher-order AI literacy, ethical evaluation, and STEM-specific pedagogical design. Ultimately, a coordinated, network-based approach to research and testing will ensure that AI embedded into STEM teacher preparation protects the "human element," enables high-impact STEM learning, and upholds high standards for teacher development.

» AI INTEGRATION IN STEM TEACHER PREPARATION

FULL REPORT

In the fall of 2025, the National Center for STEM Education (formerly the UTeach Institute) administered a survey of faculty, administrators, and staff affiliated with UTeach secondary STEM teacher preparation programs at 54 colleges and universities in 23 states and the District of Columbia to collect information about current use of and attitudes about the integration of AI into STEM teacher preparation. The objectives of this study include:

- establishing a baseline understanding of knowledge and use of AI tools across this network of educator preparation programs, and
- identifying beliefs about and the degree of interest in further exploring the impacts of AI on STEM classroom learning and integration of AI into STEM teacher preparation programming.

These insights will inform the work of an initiative led by the National Center for STEM Education to assemble a working group to further explore opportunities for developing and implementing high-quality uses of AI in STEM teacher preparation.

The national network of UTeach programs represents a diverse group of higher education institutions currently preparing approximately 600 new middle and high school STEM teachers annually. It includes well-established programs that have operated for more than 15 years as well as new programs that launched within the past five years and are just now beginning to produce their first graduates. The UTeach program, pioneered at The University of Texas at Austin in 1997, is distinguished by its unique approach to recruiting and preparing future teachers, an approach characterized by significant cross-campus and school district collaboration; targeted recruitment and retention of undergraduate STEM majors; removal of barriers to access and participation; implementation of a rigorous, clinically intensive instructional program customized for STEM teaching and learning with an emphasis on inquiry and research-based instructional practices; and elevation of the profile of STEM teaching as a career choice across STEM disciplinary departments at the university.

Given its focus on secondary STEM teaching, this network of faculty, program leaders, and staff provides an opportunity to develop key insights into the impact that AI is currently having and may have on the future of STEM teacher preparation and classroom instruction.

METHODS

Sample

This survey was administered to faculty, administrators, and staff affiliated with UTeach secondary STEM teacher preparation programs at 54 U.S. institutions of higher education and yielded 57 respondents. Respondents were primarily course instructors (89%), including research and clinical faculty. Thirty-nine percent of respondents serve in a program director or coordinator role and 18% in administrative support staff or advisor/recruiter roles. Respondents selected multiple roles.

Most respondents have had long careers in education and have transitioned into teacher preparation more recently. Eighty-six percent have more than 15 total years of experience in education as a whole. The number of years explicitly in educator preparation varies:

- 23% report more than 15 years of experience in educator preparation,
- 28% report 11–15 years,
- 25% report 6–10 years, and
- 25% report five or fewer years.

The survey respondents are from 31 institutions of higher education and represent a broad and diverse group of colleges and universities, with a strong presence of large public institutions. Most institutions are public universities, including flagship campuses, multi-campus system institutions, and regional universities, alongside one private urban research university.

Geographically, the institutions span all regions of the United States, with particularly strong representation from Western and Southern states, including Texas and Florida. Many campuses are located in urban or suburban settings and enroll substantial numbers of commuter, transfer, and first-generation students, while others serve as regional or rural anchors for their states. This mix highlights the varied educational contexts in which survey respondents work.

The survey of 15 items assessed respondents' current use of and attitudes about AI, perceived benefits and challenges, and needed support related to integrating AI into professional responsibilities, teacher preparation curricula, and candidate support.

FINDINGS

Survey findings are reported across four categories: adoption profiles and current use, perceived benefits, concerns and challenges, and support needs.

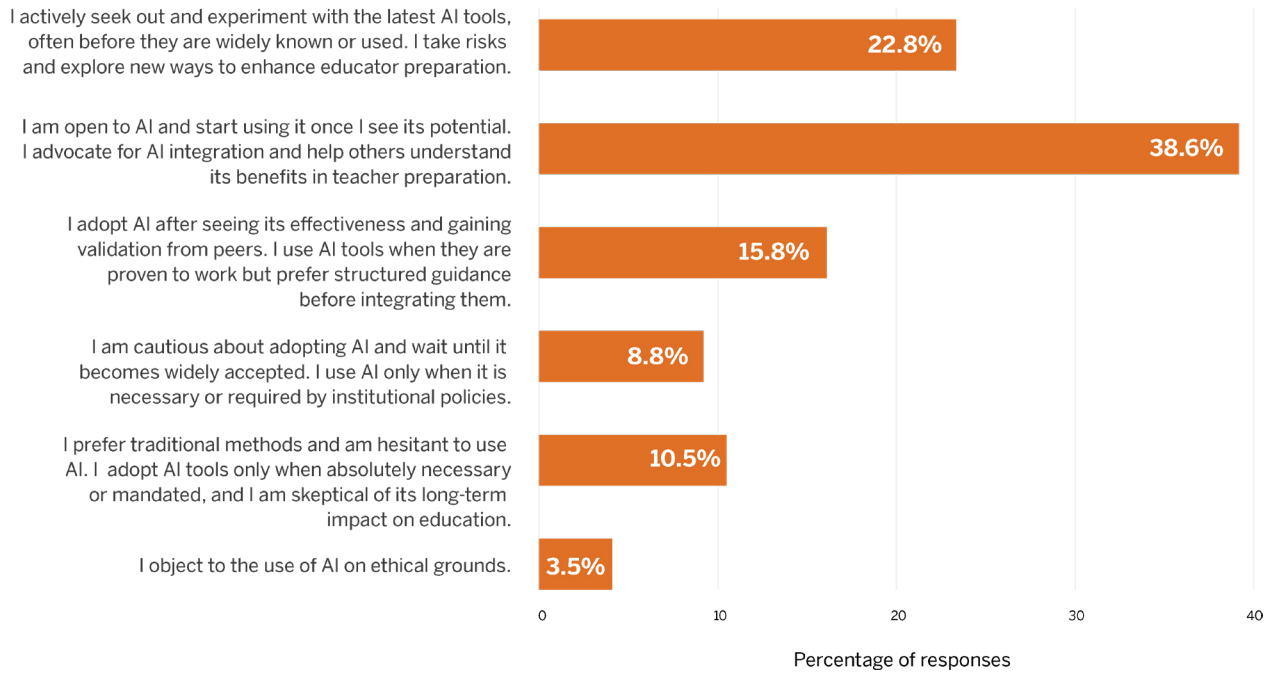
1. AI Adoption and Use

Adoption of AI tools

A majority of respondents (61%) characterize themselves as proactive adopters of AI integration. Overall, respondents' attitudes toward AI fell into four categories:

- 23% percent are "innovators" who actively seek out and experiment with the latest tools.
- 39% are "early adopters" who use AI once they see its potential and advocate for its integration.
- 16% wait for peer validation before adopting AI.
- 24% remain cautious, hesitant, or object to the technology entirely on ethical grounds.

AI Adoption Attitudes



Current Use of AI

Ninety-seven percent of all respondents (instructors and non-instructors) report using AI in some capacity with an emphasis on content generation and research. The ways respondents interact with AI vary:

- 65% generate instructional content.
- 44% use AI for their own educational or scientific research.
- 28% automate administrative tasks.
- 19% generate feedback on lessons.
- 18% analyze student data for decision-making.

Levels of Instructor AI Use in Courses

LEVEL	DESCRIPTION	COUNT	EXAMPLES OF USE
0	No/minimal use	12	Not addressing AI
1	Awareness/policy	6	Requiring citations, syllabus policies around use
2	Tool use/productivity	12	Prompt writing, specific tool use (i.e., MagicSchool, Copilot)
3	Critical evaluation	6	Critiquing AI output, ethics scenarios
4	Pedagogical design	17	5E lesson planning and design, refining project-based learning unit design, developing assessment rubrics
5	Inquiry/data-rich STEM use	4	Data analysis, visualization, inquiry, modeling

Most instructors (79%) report addressing AI in some capacity in the courses they teach. The various uses of AI by instructors in courses can be organized across five levels of use ranging from no/minimal use to use of AI tools for data-rich STEM inquiry. Of those who are integrating AI tools, 40% of instructors are building awareness about AI, developing AI use

policies, or using AI primarily as a productivity or idea-generation tool. Another 51% are using AI for pedagogical design, supporting lesson planning and design, refining ideas for project-based learning units, and assisting with developing assessments, rubrics, differentiation, and classroom-facing teaching tasks. A few (9%) instructors reported the highest level of AI use for data-rich STEM inquiry such as AI-supported data analytics, research methods coding, simulated/fake data for analysis, or use of intelligent tutoring platforms tied to STEM learning.

Barriers to AI Use

For the 12% of instructors not currently using AI, the primary deterrent is concern about effectiveness and reliability (52%), followed by a lack of knowledge about AI tools (41%). Institutional restrictions were notably not a factor for any respondent.

Barriers include:

- Efficiency: Some find that fixing AI mistakes takes longer than doing the work manually.
- Ethical and environmental concerns: Respondents cited the high energy consumption of AI and the potential for exploiting vulnerable communities or reinforcing biases.
- Impact on learning: There is a fear that AI may degrade deep thinking and critical learning, particularly in math education.

2. Attitudes, Perceived Benefits, and Challenges

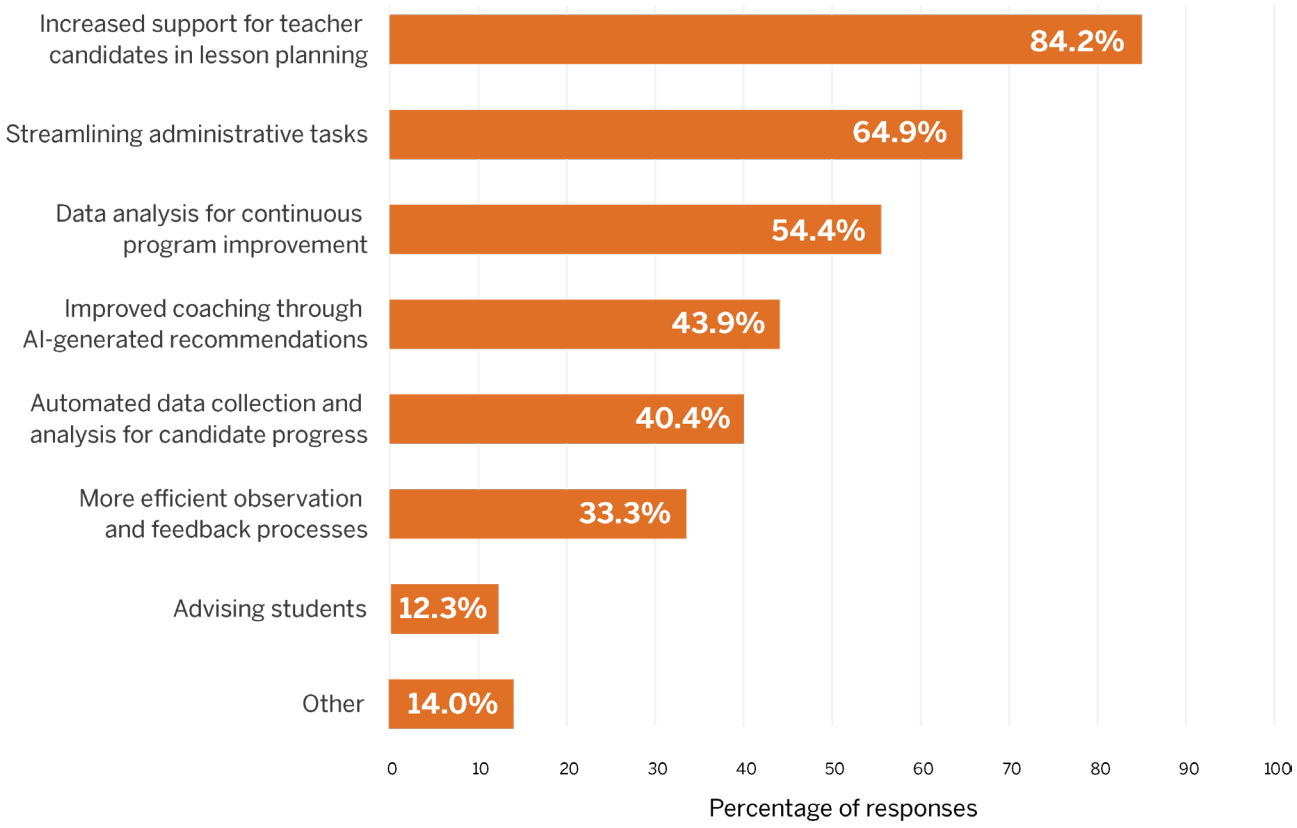
Several survey items reveal a generally optimistic but diverse outlook on AI adoption and its potential benefits within educator preparation and STEM teaching.

Perceived Positive Impact

There is a strong consensus that AI has the potential to benefit educator preparation, with 77% of respondents agreeing that AI will have a positive impact in their work to prepare teachers.

Respondents identified supporting teacher candidates in lesson planning as the most significant benefit (84%). Other top benefits include streamlining administrative tasks (65%), analyzing data for continuous program improvement (54%), and improving coaching through AI-generated recommendations (44%).

Perceived Benefits of AI in Educator Preparation

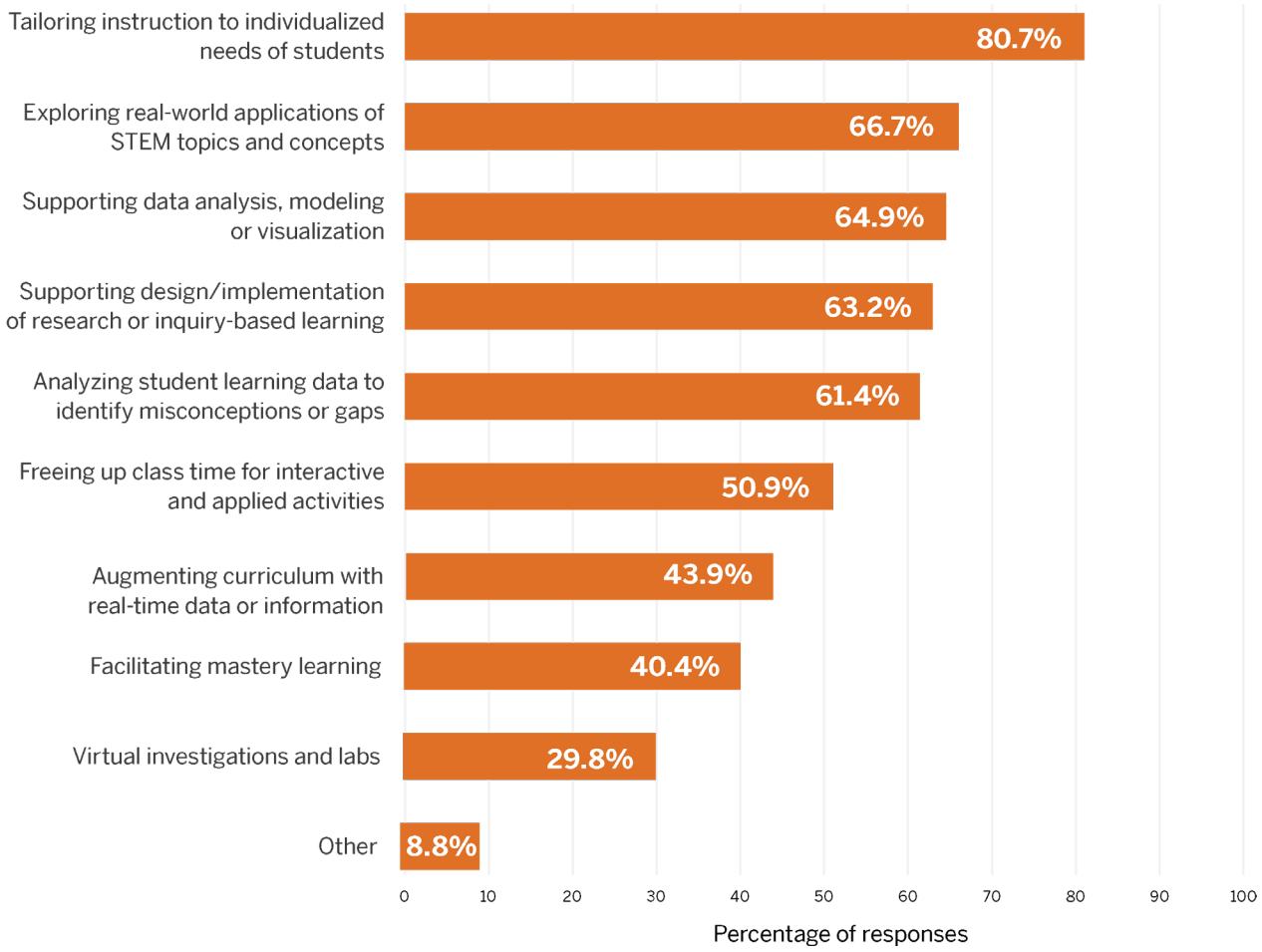


Benefits for Secondary STEM Teaching

Regarding the impact on middle and high school STEM classrooms, respondents see the highest potential in tailoring instruction to individual student needs (81%). There was strong consensus that AI can have value in STEM-specific applications, including:

- Real-world STEM applications (67%)
- Data analysis and visualization (65%)
- Research/inquiry-based learning (63%)
- Identifying learning gaps (61%)

Perceived Benefits of AI in Secondary STEM Teaching and Learning



3. Concerns and Challenges

Despite reports of current use and overall optimism about the potential for AI to support the preparation of new teachers, the survey results revealed a high level of concern among respondents regarding the expansion of AI in educator preparation, with a focus on ethical, pedagogical, and institutional risks.

A majority of the respondents expressed apprehension about the challenges associated with AI: 63% were either "moderately concerned" (30%) or "very concerned" (33%) about potential challenges of using AI in teacher preparation. Primary areas of concern included academic integrity and ethical questions. Respondents identified concerns across five key areas:

- **Academic integrity and degraded learning (42%).** Respondents consistently expressed concern that students will use AI to avoid deep thinking, such as using it to summarize articles instead of reading them or generating lesson plans without understanding the underlying pedagogy. Respondents also expressed concern that AI-generated content is often a "statistically calculated guess" that can lead to plagiarism or the rehashing of subpar materials rather than producing novel, research-backed content.
- **Ethics, bias, and environmental impact (21%).** Some respondents are deeply worried about inherent racial biases in AI and the potential for the technology to exploit vulnerable communities. They also point to the environmental cost and high energy resources required to power AI models.
- **Reliability and accuracy (14%).** Respondents frequently mentioned AI hallucinations and the tendency for tools to provide incorrect or vague feedback that lacks professional depth.
- **Erosion of the human element (11%).** Respondents mentioned fears about the replacement of valuable human-to-human contact and the "human element" essential to educator preparation. There is a worry that over-reliance on AI will de-professionalize teaching, suggesting that the technology can replace the nuanced judgment of a trained educator.
- **Data privacy and institutional compliance (9%).** Concerns were raised regarding FERPA compliance and the ethics of feeding student work into Large Language Models

4. Support Needs

Seventy percent of all respondents expressed a desire for more resources and support around AI use. There was a strong desire for peer-to-peer learning, practical tool demonstrations, and clearer policy guidelines. Support needs can be categorized into four main areas:

1. **Peer collaboration and knowledge sharing.** Respondents prioritized learning from their colleagues over formal training.
    - *Interactive forums.* Respondents are interested in an interactive forum or community of practice where UTeach educators can discuss "shared wins and challenges" and specific implementation strategies.
    - *Conferences and webinars.* Respondents suggested dedicated sessions at professional conferences, webinars, and mini-classes to keep up with the field.
2. **Practical and tool-specific training.** A recurring theme was the need for hands-on time with specific AI technologies.
    - *Technical demonstrations.* Respondents want overviews of available tools, demonstrations of how they wo*rk, and guidance on which tools are best for specific tasks.*

- *Customization.* They are specifically interested in learning how to create custom applications tailored to the 5E lesson plan framework or other unique program needs.
- *Vetted resources.* Respondents want application modules and tools that have been professionally vetted for use with preservice teachers.

3. **Pedagogical guidance.** Respondents are looking for help on how to integrate AI into their teaching and how to guide their students in doing the same.
   - *AI as a thought partner.* Respondents desire training on how to help teacher candidates use AI for complex thinking and professional development rather than just automating simple tasks.
   - *Curriculum integration.* Respondents want to know how to instruct students on appropriate versus inappropriate AI use and how to spot AI-generated work.
4. **Policy, ethics, and reliability.** Confidence remains tied to resolving institutional and ethical uncertainties.
   - *Compliance and security.* There are requests for clarity regarding FERPA and data privacy, as well as institutional policies that move beyond leaving decisions "up to the instructor."
   - *Evidence of efficacy.* Some respondents noted that they would feel more confident if they saw "data showing AI produces better outcomes" or a thorough "cost-benefit analysis."

A small segment of respondents indicated that no amount of training would increase their confidence, either because they already possess deep technical knowledge of AI or because they have fundamental objections to the technology's impact on society.

DISCUSSION AND IMPLICATIONS

The survey results reflect a network of educator preparation program faculty, leaders, and staff characterized by cautious optimism and a strong demand for structured, peer-led guidance on AI integration into STEM teacher preparation. The majority of respondents agree that AI can positively impact their work, but a significant percentage remain concerned about the associated challenges. While the UTeach network recognizes the transformative potential of AI, implementation must be guided by a deliberate focus on ethics and pedagogical integrity. The following recommendations should inform the next steps to further explore opportunities for developing and implementing high-quality uses of AI in STEM teacher preparation.

1. **Cultivating AI uses for personalized and high-impact STEM learning.** The strongest consensus on AI's benefit is its ability to support teacher candidates in lesson planning and to tailor middle and high school classroom instruction to individualized student needs. There is also a clear opportunity to leverage AI to enhance the UTeach model's emphasis on inquiry-based learning and to amplify STEM learning through real-world applications, problem solving, and data analysis. Rather than viewing AI as a tool for automation, the network would benefit most from exploring uses of AI that close learning gaps, personalize STEM learning interests, and enable the application of complex STEM principles and development of foundational STEM practices.

2. **Mitigating risks to academic integrity and equity.** The primary deterrent for AI adoption is the fear of eroding critical thinking and reinforcing biases. Educators are rightly concerned that students may use AI to bypass essential cognitive work. Furthermore, the ethical and environmental costs of AI are significant barriers for a quarter of the network. Programs will benefit from clearer institutional policies and network-level consensus building and guidance. There is a pressing need for vetted resources and evidence showing that AI can improve educational outcomes without compromising equity or academic rigor.

3. **Leveraging a community of practice.** The preference for support is overwhelmingly for peer-to-peer learning over formal training. The network values hands-on demonstrations and the sharing of successes and challenges from colleagues who understand the unique context of STEM educator development. The National Center for STEM Education should facilitate a community of practice focused on developing STEM-specific AI literacy frameworks to guide STEM educator preparation, providing high-quality technical training on AI education tools, developing and testing STEM-specific AI education application modules, and creating a repository of resources that align with research-based STEM instructional practices.

The UTeach network is prepared to engage with AI, but effective integration will depend on a collaborative framework that prioritizes ethical use, preserves the "human element" of teaching, and provides practical guidance and tools for high-impact STEM instruction.

UTeach faculty are not starting from zero; they are already experimenting with AI. However, the network lacks a shared, research-based framework for moving from ad hoc AI use toward higher-order AI literacy, ethical evaluation, and STEM-specific pedagogical design. A coordinated, network-based approach to research, development, and testing will support consensus building and the widespread adoption of vetted and high-quality approaches, resources, and tools for embedding AI into STEM teacher preparation.