RESEARCH REVIEW

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STUDY EXAMINES HOW TO INTEGRATE AI IN STEM CURRICULUM

This study pays special attention to how an AI curriculum for students can be integrated into existing STEM curriculum to address teacher and student access inequities.

For teachers to make the best use of technology, they need professional learning not only about applicable tools, but also about their potential uses and limitations as well as the integration of those tools into instruction and planning. A recent study by the Education Development Center provides a glimpse into ways well-designed and thoughtfully implemented professional learning can support educators' knowledge, skills, and effective use of artificial intelligence. This study pays special attention to how an AI curriculum for students can be integrated into an existing STEM curriculum to address teacher and student access inequities.

The researchers frame this study in response to teachers' and students' experiences in encountering barriers to the understanding and effective use of AI-enhanced learning. Because AI is an emerging field, classes that teach students how AI works are often supplemental to public K-12 education, and therefore cost money, which means many students cannot participate. Furthermore, AI has been predominantly taught in higher education mathematical and computational courses, meaning few teachers have deep knowledge of AI methods that they can use to teach students.

▶ THE STUDY

Lee, I. & Perret, B. (2022). Preparing high school teachers to integrate AI methods into STEM classrooms. *Proceedings of the AAAI Conference on Artificial Intelligence, 36*(11), 12783-12791.

▶ METHODOLOGY

This study documents integration of the curriculum AI Methods in Data Science into existing STEM high school classrooms in Massachusetts in an effort to shed light on how AI methods can be applied in STEM fields. The Education Development Center designed the curriculum and provided professional learning along with other partners. The curriculum is made up of five units: Data Analytics, Logic Systems, Machine Learning, Supervised Learning, and Transfer Learning. In each unit, five lessons progress through playful experiential learning, connecting to real-world issues and careers, an articulation of key concepts, hands-on interactive activities, and collaborative activities focused on generating and using AI models.

Nineteen middle and high school STEM teachers representing a variety of STEM disciplines participated in one-week pilot summer professional learning sessions about the curriculum — 10 in the first cohort and nine in the second. The professional learning took place over five days, lasting five hours each day. The sessions were designed to put teachers in the students' place so that teachers could experience and reflect on learning experiences and curriculum the way students do — developing their knowledge and experience with AI, experimenting with models, engaging in hands-on activities, accessing new knowledge individually, and sharing with peers. They also

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engaged in discussions of ethical issues related to AI, reflected on their learning and pedagogical strategies modeled in professional learning, discussed how the units could integrate into their STEM curricula, and developed formative assessments of student learning.

Part of the approach for implementing and integrating the curriculum was to change the way teachers and students think about AI. For instance, the purpose of allowing learners to inspect and modify code was to help learners understand that AI develops and adapts — it is not simply coding. Based on what the designers learned from experiences with related curricula, the curriculum also addresses issues of potential bias in AI. As a way of addressing the fact that students often can't articulate why they chose a particular AI method in their work, a goal of the curriculum was to support learners in their ability to discern and explain when to use different models and techniques.

▶ FINDINGS

To measure program impacts, researchers gathered data in several ways: Participating teachers turned in exit tickets after each learning day, completed an assessment before and after the professional learning to measure their AI content knowledge, and took a survey before and after that examined their attitudes, interest, and excitement regarding AI.

Daily exit ticket data showed more than 90% of teachers strongly agreed that the professional learning's goals were clear, the pacing was appropriate, and the sessions were worthwhile. Teachers felt their voices were heard and their questions were answered.

In addition, participants gained knowledge and skills, as demonstrated on pre- and post-assessments of AI content knowledge. To assess the ability of teachers to discern which AI methods or techniques to use and when, the pre- and post-assessment included six scenario-based questions. Each of these provided a data set and a question to be answered, requiring the respondent to pick the AI method that would be most appropriate for answering the question.

Small studies like this one contribute to the evidence base about effective professional learning because they can articulate the teacher-level experiences and outcomes in detail.

Teachers' baseline interest and excitement about the topic were high and rose moderately over the sessions. Although moderate, the greatest gain reflected teachers' interest in talking with other educators about what they learned, their perceptions of the relevance of AI, and response to the survey item, "I am excited to teach kids about Data Science and Machine Learning." After completing professional learning, the researchers noted, "teachers were less nervous and less worried about the impact of AI at exit than at baseline, but they were also less certain that AI would make the world a better place."

Finally, teachers expressed a desire for more examples of how to integrate the units into existing curriculum and support for using collaborative tools.

▶ IMPLICATIONS

Small studies like this one contribute to the evidence base about effective professional learning because they can articulate the teacher-level experiences and outcomes in detail. In particular, they can home in on learning designs.

The Standards for Professional Learning (Learning Forward, 2022) state that learning designs should have an evidence base and be aligned to the initiative's theory of action. In addition, the **Learning Designs** standard describes the importance of adapting "as learners' contexts or needs evolve" (Learning Forward, 2022), an element built into the professional learning program in this study. In addition to collecting data about teachers' experiences and ability to discern AI approaches, the researchers asked for specific feedback about the content and activities of each day and their relevance and usefulness. The authors describe this feedback as suggested improvements for the next time the session is held.

It is important to highlight the **Evidence** standard here as well. That standard states, "Professional learning results in equitable and excellent outcomes for all students when educators create expectations and build capacity for use of evidence, leverage evidence, data, and research from multiple sources to plan educator learning, and measure and report the impact of professional learning" (Learning Forward, 2022). This study contributes to the evidence base about AI-related professional learning, using research and prior professional learning experiences to design and implement educator learning, and collects and shares data about the results.

Based on teachers' input, the authors have identified potential improvements and adjustments to the professional learning course design. For one, participants said it would be helpful to have more examples of the AI units of study integrated into science classes. Educators also requested a broader framing of the material to situate the concepts in real-world contexts and applications.

Overall, the AI integration approach was well-received by the STEM teachers, who largely felt comfortable going forward to teach the units to high school students themselves. The study authors plan to respond to the feedback, build requested supporting activities, and follow up with participating teachers to see which lessons they implemented and to what effect.

REFERENCE

Learning Forward. (2022). *Standards for Professional Learning*. Author. ■