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AI and the Future of Teaching and Learning: Product Roadmaps and the Path to Safe Artificial Intelligence



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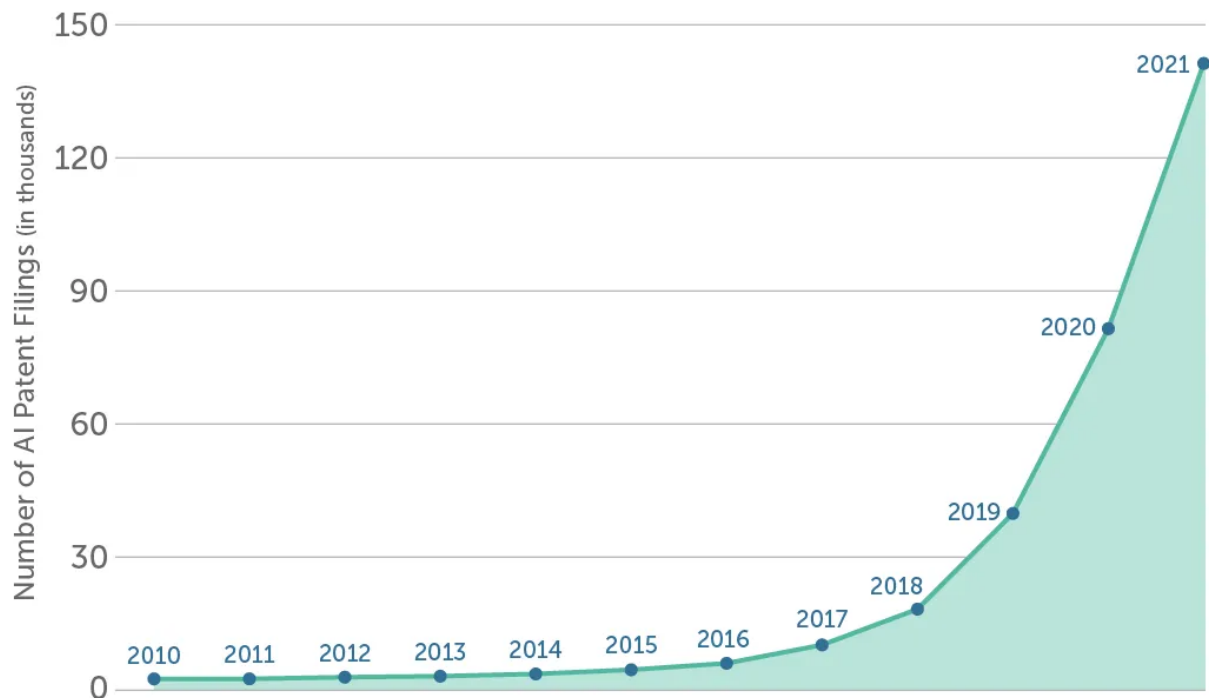


Key Points:

- *Discussions with the educational technology sector reveal most companies have plans to use artificial intelligence in their products.*
- *Educational applications of many types will be artificial intelligence-enabled, including teaching and learning, guiding and advising, and administration and resource planning applications.*
- *Use of artificial intelligence systems in school technology is presently light, allowing time for policy to have an impact on safety, equity, and effectiveness.*

The pace of artificial intelligence (AI) research and development is intensifying. Recently, Stanford's Human-Centered Artificial Intelligence project released the [AI Index 2022 Annual Report](#). This report is a compendium of measures on the level of activity of AI worldwide across all sectors. With respect to AI activity, they found an enormous uptick in the number of patents (see Figure 1), university degrees granted, and level of business investment — and this is occurring globally, with Asia, the United States, and Europe competing to produce the most powerful new advances. In education specifically, the 2021 AI Index Report found that investment in AI systems for educational technology increased from \$1 billion in 2019 to over \$4 billion in 2020.

Figure 1: The pace of innovation in AI is accelerating dramatically, as indicated here by the growing number of patents each year



SOURCE: The AI Index 2022 Annual Report

This substantial increase in investment for educational technology merits attention to consider how policy can play a role in ensuring safe and effective products. To learn more, the Office of Educational Technology, Digital Promise, and Getting Smart met with a range of product developers to learn about their current use and plans for AI. We found broad interest in adopting AI into many forms of educational technology products. Product developers talked about AI entering the lives of educators and students in four distinct ways:

1. A foundation for innovations in learning, leading to new types of applications and personalized experiences for students;
2. A support for educators, to assist in instruction and lessen the burden of routine tasks;

3. A resource for equity, including by adapting learning opportunities to students' strengths;
4. A general-purpose tool that can be used in education everyday;

These AI-enabled educational applications have potential to reshape learning and the learning experiences of students and teachers.

Learning applications

Some uses of AI in learning applications, software that engages users in learning processes, have existed for 20 years or more, such as “Intelligent Tutoring Systems” that provide adaptive feedback to students during mathematical problem solving. Developers discussed how AI could increase the trend towards personalization by giving students more agency in choosing how they learn, while also checking what learners choose fits instructional objectives and has worked for other learners in similar situations. They discussed how including natural language processing (the ability of a computer to listen and respond to student or teacher speech) is likely to be popular among students and educators to request help, share explanations, and provide an alternative to typing. Developers also saw AI as helpful to achieving important but currently unrealized formative assessment goals, for example, helping a high school track its efforts to improve student writing across the curriculum.

Student services and advising applications

Additional uses of AI fall in the realm of helping students plan their trajectories within school systems and into future opportunities. The traditional guidance counselor role may be supported with systems that generate recommendations for students using patterns beyond those which

human counselors are normally aware of. In one research-based example[1], a major state university noticed that traditional gateway courses are often over-subscribed, leading to delays in students' completion of their four-year degree. However, using AI techniques, researchers were able to find patterns in the course-taking behavior of students that had been previously unnoticed. Many students found creative pathways through less popular alternative courses that nonetheless led to degree completion. Like a car navigation system, the AI-based system was able to increase awareness of alternative course taking pathways that both maneuvered around roadblocks and connected better with students' interests.

Administrative and resource planning applications

Developers indicated that AI is likely to appear in resource allocation and planning applications, for example, designing more efficient bus routes or suggesting alternative healthy menus when supply chain issues block a school's normal food procurement options. AI techniques can be helpful in constructing schedules and resource allocations that are fairer — or, potentially, less fair. AI may also assist in routing information to parents in a greater variety of formats and media and in helping parents to complete required forms on time.

Policy implications

Developers described the adoption of AI in their products as still in early stages, but with a likely acceleration in the next 3–5 years. Developers are well-aware that the public and educators will only sustain an ecosystem if they trust the ethics and safety of the products. They also understand that trust is dependent on how risks are mitigated when AI systems are incorporated into educational products. Because AI is not already a major element of most products, now is an opportune time for policy discussions

that shape its future uses. Conversations around safe AI in educational technology are already underway. For example, the EdSAFE AI Alliance is a consortium that brings together networks and organizations across the educational technology sector to connect and discuss the development of safer, more equitable education ecosystems of AI. Developers have also applied for and received product certifications from Digital Promise that disclose how their product development processes are addressing bias. Developers are attentive to conversations about AI occurring in policy forums led by UNESCO, the European Union, and other international organizations. They welcome policy discussions that can shape a safe market ecosystem for future products that provide better solutions to educational challenges than the products we have today.

To move forward, we must consider how policy can ensure safe and effective AI innovations — a path paved with transparency, collaboration, and continuous learning.

[1] Pardos, Z.A., Chau, H., & Zhao, H. 2019. Data-assistive course-to-course articulation using machine translation. In Proceedings of the Sixth (2019) ACM Conference on Learning @ Scale (L@S '19). Association for Computing Machinery, New York, Article 22, 1–10.

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