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Artificial Intelligence (AI) and Education

Educational tools enabled by AI have recently attracted attention for their potential to improve education quality and enhance traditional teaching and learning methods. Although there is no single consensus definition, AI generally allows computers to perform tasks that are conventionally thought to require human intelligence. Congress may consider the benefits and risks of AI in classrooms, including the impact of AI on issues such as student data privacy, teacher preparation, and technology development and procurement.

Current Applications of AI in Classrooms

Today, both startups and established companies seek to integrate AI into marketable products. In some cases, AI performs functions independently of teachers, while in others it augments teaching capabilities. Applications of AI-based education technology include the following:

- **Tutoring.** AI programs commonly referred to as Intelligent Tutoring Systems (ITS) or adaptive tutors engage students in dialogue, answer questions, and provide feedback.

- **Personalizing Learning.** ITS and adaptive tutors tailor learning material, pace, sequence, and difficulty to each student's needs. AI can also provide support for special needs students, for instance by teaching autistic children to identify facial expressions.

- **Testing.** Computer adaptive assessments adjust the difficulty of successive questions based on the accuracy of the student's answers, enabling more precise identification of a student's mastery level.

- **Automating Tasks.** AI can perform routine tasks such as taking attendance, grading assignments, and generating test questions.

As well, at least one public school district has partnered with a university to provide a K-12 AI program aimed at teaching students AI concepts and technologies.

Benefits and Drawbacks of AI in Classrooms

Researchers have yet to reach a consensus about the effectiveness of AI-based instruction. Definitions of key terms often vary from study to study, and the academic literature includes both evidence supporting and evidence refuting AI's educational value. Additional research might help resolve the issue.

Some studies have found benefits to using AI-based classroom technologies in certain situations. For example, a 2014 meta-analysis concluded that ITS produced statistically significant improvements in student learning outcomes (e.g., mastery and retention) when compared to traditional classroom teaching, independent textbook use, and non-AI computer-based instruction. However, experts point out that ITS curricula are rather inflexible due to technical challenges in accommodating user feedback, modified core standards, or content changes.

AI technologies may help facilitate "personalized learning" (tailoring instruction to the needs of each student) and "blended learning" (combining technology with face-to-face interaction). Many school officials hope that such approaches will improve academic performance and reduce achievement gaps between groups of students. Some teachers also suggest that personalized learning increases student engagement, motivation, and independence.

AI-based learning faces significant implementation challenges. Greater student independence may disadvantage children who are less self-disciplined or who receive little educational support at home, potentially exacerbating the achievement gap. Moreover, surveys indicate that some teachers struggle to translate the data they receive from personalized learning tools into actionable instruction and spend inordinate amounts of time creating individualized assignments. There is also debate over how well students retain knowledge learned from an AI-based system, and whether spending substantial class time on computers diminishes social learning at school.

The budget implications of using AI in education are unclear, given uncertainties about the cost-effectiveness of the technology. For example, the versatility and scalability of AI might drive some institutions to reduce teaching staff in favor of AI alternatives. In contrast, AI might create demand for education professionals who can design and implement personalized learning programs.

Federal Activity

Federal actions have addressed issues related to AI in schools, such as internet access and student data privacy.

Successful implementation of AI by schools requires significant investment in information technology (IT) as well as reliable broadband internet access. These resources are not uniformly distributed across school districts; for example, close to 80% of schools without fiber connections were located in rural areas as of 2017. Federal efforts to address this disparity include such programs as the Universal Service Program for Schools and Libraries. Commonly known as E-rate, the program provides subsidies of up to 90% to help ensure that qualifying schools and libraries can obtain high-speed internet access and telecommunications at affordable rates.

The National Science Foundation and the Department of Education's (ED's) Institute of Education Sciences have awarded grants to projects researching AI-enabled classroom technologies. In addition, ED's Office of Educational Technology has released several publications on topics relevant to AI in schools, such as learning analytics and educational data mining, teacher preparation, personalized learning, and student privacy.

The Every Student Succeeds Act (P.L. 114-95), which reauthorized the Elementary and Secondary Education Act of 1965, authorized the use of computer adaptive testing in state student academic assessments mandated under the act. This marked the first time Congress explicitly approved an AI testing technique for widespread use in schools.

Congress has taken steps to address public concerns regarding the privacy of students' personal information, including concerns about education technology companies collecting personally identifiable information (PII) from students to maintain user accounts.

- The Family Educational Rights and Privacy Act of 1974 (FERPA), as amended in 2013, limits the power of schools to disclose students' education records but has been criticized for weak enforcement mechanisms against third parties that misuse student data.

- The Protection of Pupil Rights Amendment of 1978 (PPRA), as further amended in 2015, requires schools to notify parents and offer an opt-out choice if a third party surveys students for marketing purposes.

- The Children's Online Privacy Protection Act of 1998 (COPPA) requires parental consent before websites collect information about children aged 13 or under.

Many experts worry that current law, passed largely before AI became a major policy consideration, is insufficient to address today's cybersecurity threats. Bills introduced in the 115th Congress, such as the Protecting Student Privacy Act (S. 877), SAFE KIDS Act (S. 2640), and Protecting Education Privacy Act (H.R. 5224), would affect how third parties can access and use students' PII.

Selected Policy Considerations

Although most education policies are set at the state and local level, Congress may consider oversight and legislative actions on issues such as student privacy, teacher preparation, product selection, and algorithmic accountability.

Student Privacy. Like many digital services, AI-enabled education tools collect and store PII. In response to public concerns about data security and privacy, activists created a voluntary Student Privacy Pledge in 2014. Signatories promise to place limits on the lifespan of stored data, maintain reasonable security measures, and refrain from selling data. Although President Obama and several Members of Congress endorsed the pledge, critics have asserted that the language is vague and the pledge is little more than a publicity move. Meanwhile, 41 states have enacted laws governing student data collection, use,

reporting, and safeguarding since 2013. Several of those laws were modeled after California's Student Online Personal Information Protection Act (SOPIPA). Congress may consider whether such state efforts are sufficient or if a federal law is needed.

Teacher Preparation. If AI technologies are adopted on a broader scale, teachers face the task of not only learning to use specific products but also integrating a range of AI technologies into their lessons. Preparation programs offered by teacher-certifying universities and institutes might provide such training. In FY2018, ED's Teacher Quality Partnership (TQP) competition plans to award approximately $14 million in grants to these programs. If Congress decides to support funding teacher preparation for AI, options could include redirecting funds toward teacher technology training and directing ED to develop best practices for teacher technology competency.

Product Procurement and Support. Choosing products can be a time- and energy-intensive effort involving teachers, administrators, IT staff, and other school officials. While some schools allow teachers to experiment freely, others require IT staff to vet hundreds of privacy policies and security measures. Some school districts have turned to digital content consultants for guidance in selecting products. To help schools gather research on educational tools and strategies, nonprofits and federal agencies have developed resources. For example, the State Educational Technology Directors Association provides a best practices guide for product procurement, and ED's What Works Clearinghouse rigorously reviews the effectiveness of educational products and practices. Despite these resources, surveys indicate that peer recommendation is a more prevalent basis for choosing products than research-based evidence. A centralized platform to exchange information and collaboratively troubleshoot problems might help formalize inter-district communication and allow schools to make wiser and less costly purchases. The Technology for Education Consortium estimates that districts would collectively save $3 billion per year on education technology purchases simply by sharing price information.

Algorithmic Accountability. Parents and school administrators may find it difficult to trust AI technologies used to influence or make decisions about student learning. Mistrust can stem from the refusal of companies to disclose their algorithms, which they argue are trade secrets, or from the "black box problem," which occurs when an algorithm's complexity renders its processes inscrutable even to developers. Options for Congress could include holding hearings, conducting oversight, and considering requirements to enhance transparency and accountability of data use more broadly, as the European Union has sought to do through the General Data Protection Regulation.

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