Artificial Intelligence and Education
An Overview for State Departments of Education

"Thinking about the risks associated with emerging AI technology is hard work, engineering potential solutions and safeguards is harder work, and collaborating globally on implementation and monitoring of initiatives is the hardest work of all. But considering all that's at stake, I would place all my bets on the table and argue that the effort is worth the risk many times over."[i]

The potential of artificial intelligence (AI) is not yet known, but is expected to impact most aspects of our lives and work in the next 20 years.[ii] AI will be able to help solve complex problems, help with investment and business development, support medical and health care, and substantially impact the field of education. State education agencies (SEAs) are initiating work to provide guidance on the use of AI in schools, but there is still much to be done.[iii] SEAs that move more quickly to provide guidance on how to adopt and implement AI effectively may be better positioned to improve efficiencies and innovate. They may also positively impact students' academic outcomes and better prepare students for a future certain to contain and be impacted by this technology.[iv]

This overview of considerations for SEAs in facilitating adoption and policy development for AI is the first of a three-component series. This first component will provide an overview for SEAs to understand and disseminate knowledge and information related to AI, provide a brief introduction to AI in education, and offer examples of current AI-related educational policy. The second and third components will provide concreate action steps to guide policy development.

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Facilitating Innovation Adoption

Building knowledge is the first step towards adoption. Before an innovation or new technology is adopted, knowledge and understanding of the technology is diffused through many channels. Gaining knowledge does not guarantee adoption, but lack of sufficient knowledge is often a contributing factor in failed adoptions. In other words, someone can be fully informed and choose not to adopt, but no one will adopt an innovation they don't know about.[v] The rate of adoption of an innovation is driven by adopters' perceptions of five characteristics:

1. **Relative advantage.** The degree to which an innovation is perceived to be better than what exists
2. **Compatibility.** The degree to which an innovation is perceived to be consistent with adopters' existing values, past experiences, and needs
3. **Complexity.** The degree to which an innovation is perceived to be difficult to understand and use
4. **Trialability.** The degree to which an innovation may be experimented with on a limited scale
5. **Observability.** The degree to which the results of an innovation are observable to others[vi]

As SEAs develop policy on and support implementation of AI, it's essential that they understand and explicitly plan communications to educate stakeholders about the specific attributes of AI that will support adoption. Gaining a thorough understanding of AI's uses and capabilities will enable adopters to recognize how its implementation can benefit their work.

An Overview of AI

AI represents a broad range of technologies that are synthesized as machines capable of imitating functionalities of human intelligence, including perception, learning, reasoning, problem-solving, language interaction, and creative work.[vii]

What AI Currently Can and Cannot Do

AI functions by inducing patterns through statistics. The patterns, at their core, are mathematical incarnations and not intelligent entities. As a result, AI is not very good in situations where it has incomplete information or requires abstract inference. AI is making rapid progress in the areas that center on perception, such as medical diagnosis from scans, speech to text, and the processing of new and existing images. AI capabilities that center on automating judgements are also progressing but are still far from perfect. For example, much improvement is required in areas such as spam protection and artificial creativity. A recent study showing the decreasing accuracy of popular AI tool ChatGPT in solving math problems over time demonstrates the refinement still required by the technology.[viii]

Perhaps the most promising area for AI is in augmenting human intelligence. For example, AI can easily beat humans in chess. However, when AI and humans collaborate, even amateur chess players have been able to beat both computers and grand masters.

Current AI Technology

We currently experience AI in our daily lives. AI helps us track our exercise; answers customer service questions; recommends products, books, and music we may be interested in; and scans our email and phone calls for spam. Specific types of AI technology are presented in Figure 1.

Figure 1. Types of AI Technology

Natural language processing (NLP)

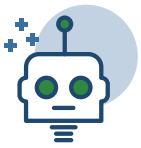
Using AI to interpret texts, including semantic analysis (e.g., translation) and to generate texts (e.g., otter.ai).

Speech recognition

The application of NLP to spoken words (e.g., conversational bots in customer service and smartphone assistants).

Image recognition and processing

Facial recognition, handwriting recognition, image manipulation/creating fake images, and autonomous vehicles.



Autonomous agents

AI computer game avatars, smart robots, and autonomous warfare.

Affect detection

Using AI to analyze sentiment in text, behavior, and faces.

Data mining for prediction

AI for medical diagnosis, weather forecasting, business projections, and fraud detection.

Generative AI

Most prominent in recent years is **Generative AI,** which differs from traditional AI in that it can produce new content rather than just detecting patterns. While some would trace versions of generative AI back 100 years,[xii] current Generative AI models combine various AI algorithms to represent and process content. The recent rise of Generative AI in the form of Dall-E and ChatGPT has demonstrated its advancement and thrust it into the spotlight. Open AI launched ChatGPT in November 2022, and within two months it attracted over 100 million users—the fastest ever consumer adoption of a service.

AI in Education

Leveraging AI in Education

AI has existed in education for over 40 years (e.g., intelligent tutoring systems that track student progress, difficulties and errors), but recent advancements have led its use and prevalence to grow quickly.[ix] The need to integrate technology into education during the COVID-19 pandemic school closures also contributed to increased use of AI, and many companies focused on AI in education reported increases in registered users during this time.[x] However, evidence related to AI's impact on student learning remains scarce.[xi] Despite the lack of evidence, we recommend proactive planning by SEAs for the pending influx of AI to the field of education in the areas of:

a. **Education management and delivery**
b. **Learning and assessment**
c. **Empowering teachers and enhancing teaching**

EDUCATION MANAGEMENT AND DELIVERY

Using AI in this area would focus on scheduling, attendance, student data and task tracking, and accreditation. This may entail more advanced examples of existing practices within early intervention indicator systems or personalized learning. For example, a teacher may be able to engage with a chatbot within a data system to ask it a question such as "which students are demonstrating data indicating they are not on a learning path toward proficiency?" The chatbot would engage with a learning analytics system to quickly give the teacher a response. Additionally, the teacher may be able to ask for specific areas where students are demonstrating need and tailor instruction to match.

LEARNING AND ASSESSMENT

AI has many potential applications in learning and assessment. AI could provide every learner, no matter where they are in the world, with access to high-quality, personalized learning opportunities (e.g., AI learning environments, AI tutors/teachers). AI-facilitated continuous assessment may lead to individualized instruction and content.

EMPOWERING TEACHERS AND ENHANCING TEACHING

AI's purpose in education may be best served when it augments, rather than attempting to replace, the teacher. Teachers' roles will change as AI becomes more advanced and prevalent, but exactly how remains unclear. Examples of how AI may manifest in education include:

- AI-driven discussion forum monitoring
- An AI and human dual-teaching model where the two share responsibilities including, but not limited to, providing instruction, differentiation, and progress monitoring
- AI-powered teaching assistants to handle the more mundane tasks of teaching such as taking attendance, grading, or answering general questions

Challenges in Leveraging AI in Education

AI has great potential to support education in better serving all students. However, educators must discuss and plan for the many challenges in effectively and efficiently using the technology.

Data analysis without context

AI is based on algorithms trained on data. These data contain human bias and as a result the algorithms will also contain bias. Therefore, we cannot assume any output of an AI-driven system is impartial. Also, an AI-generated analysis of a student's data will not incorporate the context known to an educator who is connected to the student. The AI analysis will tell a true story, but one limited to the information it has been provided. We will still need human educators to complete that story to ensure the student is well supported. For example, an AI analysis program may identify that a student is not reading at grade-level, specifically in terms of phonemic awareness. Given the student's age, number of days present at school, and lack of progress, the program may prescribe an evaluation for a learning disability. However, an educator who is working with the child may know the student hasn't received daily phonemic awareness instruction because of disruptions in the child's life. These discrepancies in understanding will have to be carefully mitigated.

Impact of AI on teachers and students

The human interaction between teachers and learners is a core element of education. A huge challenge moving forward will be to ensure AI supports teachers but is not viewed or shaped as a replacement for them. Concurrently, teacher preparation institutions and providers of professional are responsible for learning to ensure teachers are appropriately prepared to work effectively in a setting using AI.

The integration of AI-driven instruction has the dangerous potential to greatly limit a learner's agency and development. An overreliance on AI, with learning decisions made by machines that focus on knowledge transfer and content delivery while ignoring contextual and social factors, could result in less time for learners to interact with each other and reduce learner self-efficacy, regulation, metacognition, crucial thinking, and other skills that are essential in developing a learner as a whole person.

We don't know what we don't know

The greatest challenge in integrating AI into education is the simple fact that we don't yet know much about the technology's current impact or potential in education. We must not move forward assuming AI is the answer to all problems in the field. It will most likely be able to play an invaluable role in education in the future, but we simply do not know enough to determine exactly what that will look like. This is an essential reason why planning for AI integration and continued development should begin in this moment of infancy.

AI Policy in Education

Existing policy responses

The current landscape of AI in education policies is inconsistent across the globe and virtually non-existent within U.S. SEAs. Worldwide, there are four common areas of focus in AI policy:

1. **Governance of data and privacy**
2. **Equal access and opportunities for all and transparency in all actions**
3. **Curriculum innovation to address AI's potential and implications**
4. **Financial support for effective implementation**

In May 2023, the U.S. Department of Education released ***Artificial Intelligence and the Future of Learning*****.** This report, built upon a series of listening sessions held by the department in 2022, notes that it is imperative to address AI in educational policy **now** to prepare for unintended consequences. Further, the report discusses the implications of opportunities and risks, trust and trustworthiness, and the quality of AI models when developing policies in the four areas above.

This guidance will be useful, given that there are currently no stand-alone, AI-specific policies within any SEA. Apart from the state of **Hawaii** convening a working group to recommend uses of AI, no other state has been found to have an existing AI-specific policy or implementation plan for 2023–24. Some states, however, have made efforts to integrate AI into existing policy. For example, in 2021 Georgia updated its **career, technical, and agricultural standards** to include an AI pathway. **Florida, South Carolina,** and **Arkansas** have followed suit in developing and posting curriculum standards or courses incorporating AI topics and skills. Many individual **districts are exploring ways to use AI,** but most districts, like states, have yet to develop **an overarching policy.** However, neither the U.S. as a whole nor any individual state has gone as far as the country of Malta, which released "Towards an AI Strategy" focusing on how its education system will need to evolve and adapt to AI-driven changes in the educational landscape. Meanwhile, China has developed an "Innovative Action Plan for Artificial Intelligence in Higher Education Institutions" focusing on optimizing AI in colleges and universities and the development of university-based AI training systems.

Given the pending imperative to develop AI policy in education, and the dearth of development in the U.S. to date, support will be required. The next two components of this series are designed to contribute to this process. Component two will provide considerations for SEAs to use as they develop a framework for AI-specific policies and guidance. The third component will serve as a guide for beginning development of AI policies. The guide will lead SEAs to define a system-wide vision of AI in education, assess the system's readiness of the system to achieve the vision, and identify strategic objectives to move forward.

Endnotes

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