Risks from Personalized Learning Technologies

CENTER FOR DEMOCRACY & TECHNOLOGY

January 2023

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Risks from Personalized Learning Technologies

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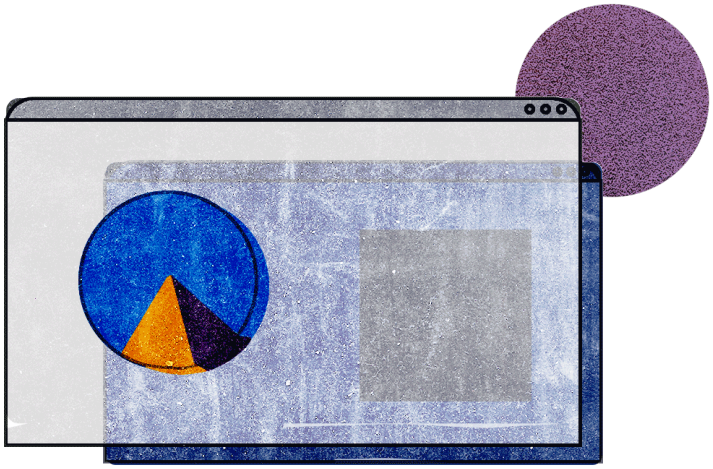

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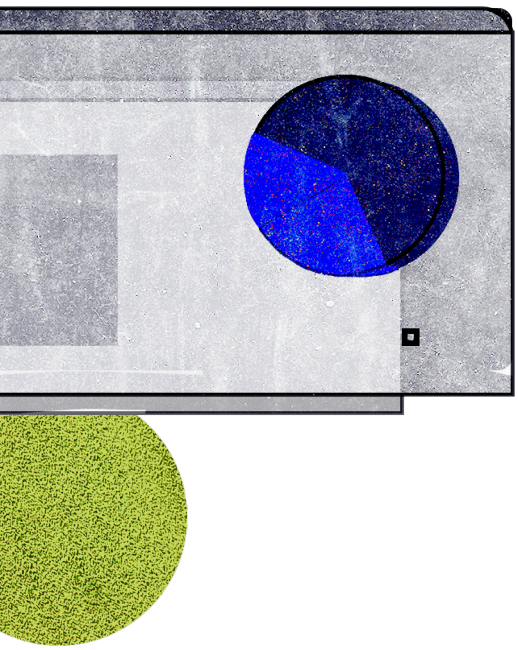


Personalized learning is a popular trend in K12 education. There are 17 states that incorporated personalized learning into their plans for the 2015 Every Student Succeeds Act, a federal law that lets school districts spend up to 3% of federal funding on personalized learning. Yet "personalized learning" as a pedagogical practice has come to have many different meanings, and there are ongoing questions about how technology should be incorporated into personalized learning classrooms.

The multiple meanings of "personalized learning" can pose a challenge to teachers, technology administrators, and education policymakers. This guidance will make sense of the different meanings of "personalized learning," provide an overview of different technologies that could be used in a personalized learning classroom, and recommend practices that enable responsible and privacy-forward uses of data and technology for personalized learning.

What is personalized learning?

The U.S. Department of Education defines personalized learning as "instruction in which the pace of learning and the instructional approach are optimized for the needs of each learner." In practice, personalized learning has come to take on a wide variety of meanings, since any educational practice that caters to "the needs of each learner" could be considered personalized. The lack of clarity around personalized learning makes procuring technology for it more difficult, since educators must carefully consider the specific meaning of the phrase used by each vendor or practitioner.

However, some common practices have been popularized by the "personalized learning" trend. This guidance will expand upon the use of technology for each of these practices:

- **Self-paced learning**: Classrooms eschew having the entire class of students work on the same material simultaneously. Instead, teachers divide students into smaller groups or even individually, each of whom works on different activities, which may be facilitated by technology like digital educational materials. This allows classrooms to meet the differing needs of different students.

- **Tailored goals**: Students adopt different learning goals depending on their needs. This practice allows students to advance at their own pace and achieve mastery on a given subject before moving onto the next. Student goals might also draw from academic standards, college and workforce readiness, or soft skills. Technology helps facilitate personalized goals through software, called learner profiling & management systems, that collect, aggregate, and display data.

- **Project-based learning**: Students work individually or in small groups to create deliverables in response to an open-ended question. As with differentiated activities, sometimes students and teachers will work together to define individualized project criteria, including project- and student-specific assessments. Learning management systems can help manage the complexity of project-based learning by giving teachers a way of tracking multiple projects and assessments across multiple students and learning goals.

- **Digital content**: Classrooms use educational content that connects more readily with the individual student. Digital educational materials might help with this by allowing students to customize their on-screen avatar, which is then used as an insert for the student in educational content.

- **Teacher-focused personalization**: Teachers customize and improve their instructional capabilities. Broadly conceived, the above mentioned are about personalizing education for students. In contrast, teacher-focused personalization tools cater towards differing needs between teachers. These tools help make it easier for teachers to manipulate classroom environments according to their preference (e.g., classroom voice assistants).

How might technology be used for personalized learning, and what are the potential risks?

Technology is not wholly necessary to implement personalized learning, but it can be helpful. The latter half of this report discusses the ways technology might aid in personalized learning.

These tools for personalized learning raise three categories of privacy and ethical risks that educational policymakers should be aware of:

- **Unproven benefits**: There's still a lack of scholarly consensus about the benefits of personalized learning and best practices, including any technology deployed for personalized learning. The reality may not live up to the stated capabilities of personalized learning technology.

- **Bias**: Some of the technologies in use to personalize learning for students may fail to work well for, and even discriminate against, some groups of students. Because the field is new, there has not yet been the time to research, recognize, and remedy any such bias.

- **Privacy**: Any third-party software that records and keeps data about students, such as demographics and academic performance, poses potential privacy risks, and technology for personalized learning is no different. The data collected by classroom technologies could be used for secondary purposes like targeted advertising or be left vulnerable to attacks from bad actors.

How much does personalized learning technology cost?

The cost of personalized learning has varied substantially from one school to the next. In one study of six Chicago public & charter schools in 2018, upfront costs ranged from $233 to $1,135 per student. These costs account for not just technology, but also the cost of supporting the technology and training teachers in personalized learning. On average, 41% of the personalized learning budget was spent on technology, while the next highest expenditures were professional development (21%) and extra staff support (20%). Five years after implementation, personalized learning accounted for 2% of the total school budget.

A different study of 16 brand new schools found a wider spread in the cost of implementing personalized learning: $5,300 to $24,000 per student. Moreover, these new schools spent dramatically less on technology: around $205 per student on average. Translated as a percentage, these schools spent 0.08% to 3% of the personalized learning budget on technology – dramatically less than the 41% spent by the six Chicago schools.

Finally, though digital textbooks might be cheaper than physical textbooks per unit, there are additional costs that might outweigh those savings, such as: the upfront investment of buying devices; upgrading school wireless internet; device management and maintenance costs; and replacing devices.

In-Depth Review of Technologies Used for Personalized Learning

Digital educational materials and games

Digital educational materials refers to educational materials like textbooks, articles, and quizzes that are accessed via computers or other devices, rather than physical copies. Digital educational materials are the most common technology used for personalized learning. In a 2017 survey of 261 teachers across 32 schools implementing personalized learning, teachers reported using technology most often for content consumption like consuming "structured curriculum materials" or e-textbooks (61%), reading in general (57%), watching videos (57%), and reading online reference materials (53%).

Digital educational materials help with personalized learning in two ways. For one thing, they make it easier for classrooms to adopt individual activities and learning plans for students. There might also be a wider variety of content available to students digitally as compared to physical educational materials. Digital educational materials might also have the ability to promote student engagement by allowing students to create avatars that reflect themselves.

A specific type of digital content is educational games, which require students to demonstrate their knowledge or understanding in order to make progress in a video game setting. This means that each student may move through the game at a different pace as their grasp of the material progresses at different rates. Moreover, games often have built-in difficulty settings that can be tuned, manually or automatically, to fit the competency level of any given student.

Educational games have two main downsides. First, games may not actually accomplish their stated goals of helping students learn and retain content. It's possible that students find ways to succeed at the game without understanding the underlying concepts or that the game itself does not do a good job at assessing knowledge. Second, games may not be equally accessible to all groups of students. Some students may not have grown up playing video games and be less familiar with the mechanics of game playing, and students with disabilities might have a hard time engaging with games that are not designed with accessibility options.

Learner profiling and management software

Learner profiling and management software tracks data across multiple sources to help teachers understand how each student is performing on specific concepts. Sources of this data include standardized assessments and other educational content offered by the same vendor. Learner profiling is a key part of personalized learning, since assessing a student's current strengths and weaknesses is the first step to creating a customized education plan. Based on a student's learner profile, a teacher may move a student ahead to the next topic, assign quizzes and review material to help improve weaknesses, or have additional instructional time with the student. Learner profiles can also help teachers group their class into subgroups of similarly capable students and assign the subgroup the same material.

Learner management software can also help with project-based learning, another instructional practice associated with personalized learning. In project-based learning, students work for an extended period of time to address a relatively complex, open-ended problem. Project-based learning involves a great deal of flexibility across a number of dimensions, including which problems students choose, what deliverables they create, and how teachers will assess the project. Some kinds of learner management software can assist with managing these kinds of flexibility if they are designed specifically with project-based learning in mind.

Although learner profiling and management software can be a great asset to teachers in a personalized learning setting, they also raise important risks. First, learner profiling systems, by their nature, centralize data across multiple sources, resulting in heightened privacy risks for that data. If a bad actor sought to misuse student data, they would only have to gain access to one system rather than multiple sources of data in different technical systems.

The benefits of learner profiling and management software can also only be realized if teachers use these tools effectively. Though a learner profiling system can tell a teacher about a student's strengths and weaknesses, it is still up to the teacher to determine what actions to take next (the next kind of technology, adaptive learning, does purport to recommend actions automatically). Because learner profiling can only report metrics based on the information it has available, it typically can only say that a student does

not understand a topic, but not why the student fails to understand it. Consequently, teachers should receive training on how to effectively use learner profiling systems.

Finally, learner profiling systems may make mistakes in their assessments because of biased input data. There may be additional facts about a student's background that a learner profiling system omits, like a student's social or language development. The sources of assessment for the learner profiling software may reflect test-taking ability rather than understanding, especially on timed tests. Misassessment of student understanding is especially important in the context of software since unrecognized bias can lead to feedback loops that reinforce gaps in learning and achievement, rather than close them.

Adaptive learning systems

A more sophisticated kind of technology is adaptive learning. The goal of adaptive learning is to identify when a student has mastered a piece of content and automatically recommend another concept to work on. The level of "adaptivity" in adaptive learning runs the gamut from systems that do little more than offer pre-made quizzes to systems that attempt to tutor students on their own, like "intelligent tutoring systems." In an intelligent tutoring system, a student has to show their work. Then, the system tries to notice when a student is off track and suggest how they should approach the problem differently.

There's conflicting scholarly evidence for their effectiveness over traditional methods of instructions. Some studies find that adaptive learning systems present little to no benefit while others find that adaptive learning provides advantages comparable to one-on-one instruction, the gold standard for pedagogy. The upshot for education policymakers is that adaptive learning is not a panacea.

Like with learner profiling, adaptive learning also poses the risk of misassessment due to biased data (see above). These risks are exacerbated for adaptive learning because of the potential for less teacher oversight. While a learner profiling system requires teacher input, adaptive learning systems make teacher input optional. Moreover, even if adaptive learning systems perform as intended, they may still widen the achievement gap. The risk is that adaptive learning creates a feedback loop where strong students progress even more rapidly while weaker students are left behind.

Classroom voice assistants

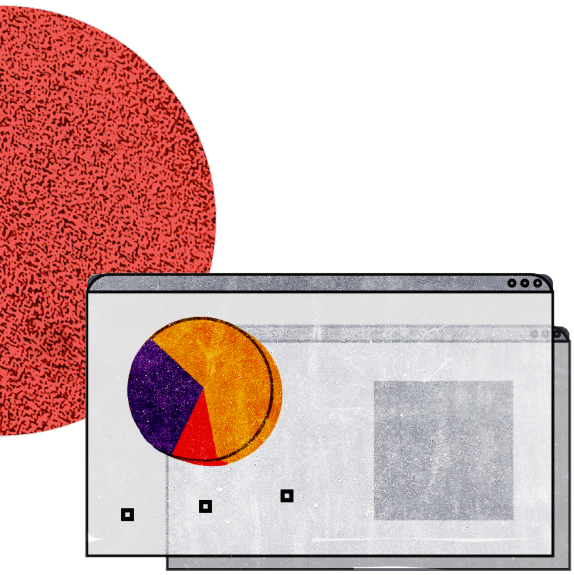
Voice assistants (e.g., Amazon's Alexa, Google Home) enable the teacher to perform small tasks like starting a timer, opening a particular presentation, or searching the web with their voice. Such systems can either be purpose made for classrooms or piggy-back off of existing consumer voice assistants through software integrations.

Although voice assistants do not directly help teachers customize learning material for each student, they fit into a secondary usage of "personalized learning" that focuses on teachers and their capabilities.

However, using voice assistants for personalized learning presents some risks. First, classroom voice assistants may not perform as expected. Consumer voice assistants are often meant for adult voices, not children's. Also, consumer voice assistants have demonstrated racial biases in recognizing voices. Voice assistants that are custom-made for classrooms might fare better on recognizing children, but developing voice assistants is a resource-intensive task that might be challenging for newer companies.

Voice assistants also pose privacy risks because consumer voice assistants may not be sensitive to the privacy protections legally required in the classroom. As a primer, voice assistants are not intended to retain and process audio recordings via the internet until a "hotword" or "activation phrase" is heard. Though voice assistants are always listening for the hotword, the processing for recognizing the hotword is also supposed to take place completely locally on the device itself. However, there have been cases in which ambient audio recordings, taken prior to the activation phrase, were still sent to third parties for analysis. Moreover, an ambient recording of classroom audio could be considered protected under existing educational privacy rules. Thus, schools should work to ensure that voice assistant providers meet existing student privacy protections.

Recommendations



As schools consider whether and how to adopt technologies for personalized learning, the following recommendations can help them deploy technologies effectively and responsibly:

- **Define clear goals for the intended purpose of each technology with regard to personalized learning.** Before investing significant resources into any kind of technology, schools should consider how a technological proposal helps achieve personalized learning for each student. This guidance has surveyed some of the ways in which technology may be helping with personalized learning, but there is no one-size-fits-all recommendation.

- **Engage community early and continuously on the implementation of personalized learning technologies.** Schools should engage the community on defining goals (see previous recommendation). They should also vet the technology with stakeholders like parents, teachers, and students to ensure that it will accomplish (or enable teachers to accomplish) the stated goals.

- **Train teachers:** Schools should incorporate teacher training about how to use tools effectively, recognize shortcoming of tools, and combine their own expertise with tools' insights. Keeping teachers in the loop is crucial to preventing feedback loops. Notably, teachers cannot be kept in the loop if systems are not transparent and understandable about where their data comes from and how they make decisions. Schools should select systems that allow teachers to access the data they need to understand the system's recommendations.

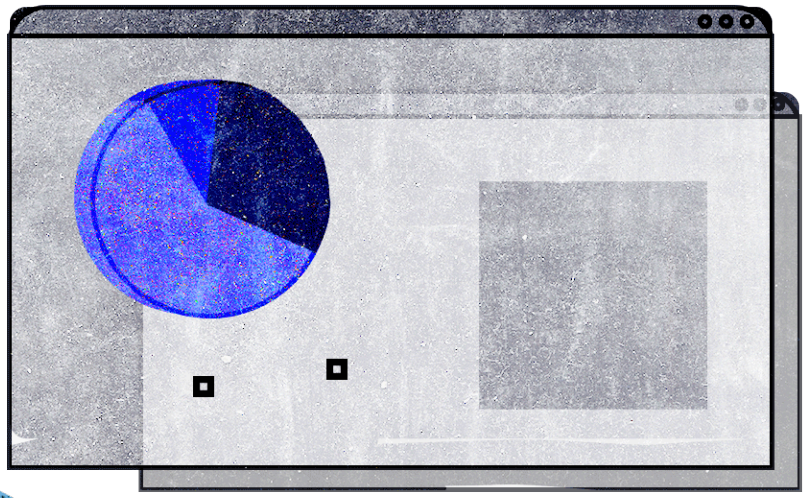
- **Vet and continue to audit tools for efficacy, bias, privacy, and security.**
  - *Efficacy*: Schools should ask for research and documentation that supports vendor claims about the effectiveness of the technology in question.
  - *Bias*: Schools should ask vendors about how they ensure their product performs equitably and audit the tool, process, and educational outcomes to ensure that it behaves equitably once deployed by the school.
  - *Privacy and security*: Schools should choose education technology vendors that have been vetted for privacy standards established by the school district, especially those that have designed products for a consumer audience.

- **Enact privacy-forward governance** of data generated from personalized learning. Schools should ensure that any data produced by or used by the system is incorporated into data governance procedures, including access control systems and schedules for both retention and deletion.

Conclusion

Personalized learning tools hold promise for schools that are interested in providing customized educational experiences for students. However, as this report makes clear, there are concerns that teachers and educational policymakers should be aware of. These issues can be mitigated by following the recommendations provided in the report.

Readers may be also interested in the Equity in Civic Technology team's two-page brief on managing bias and equity in algorithmic systems and a longer report on the same topic.



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