

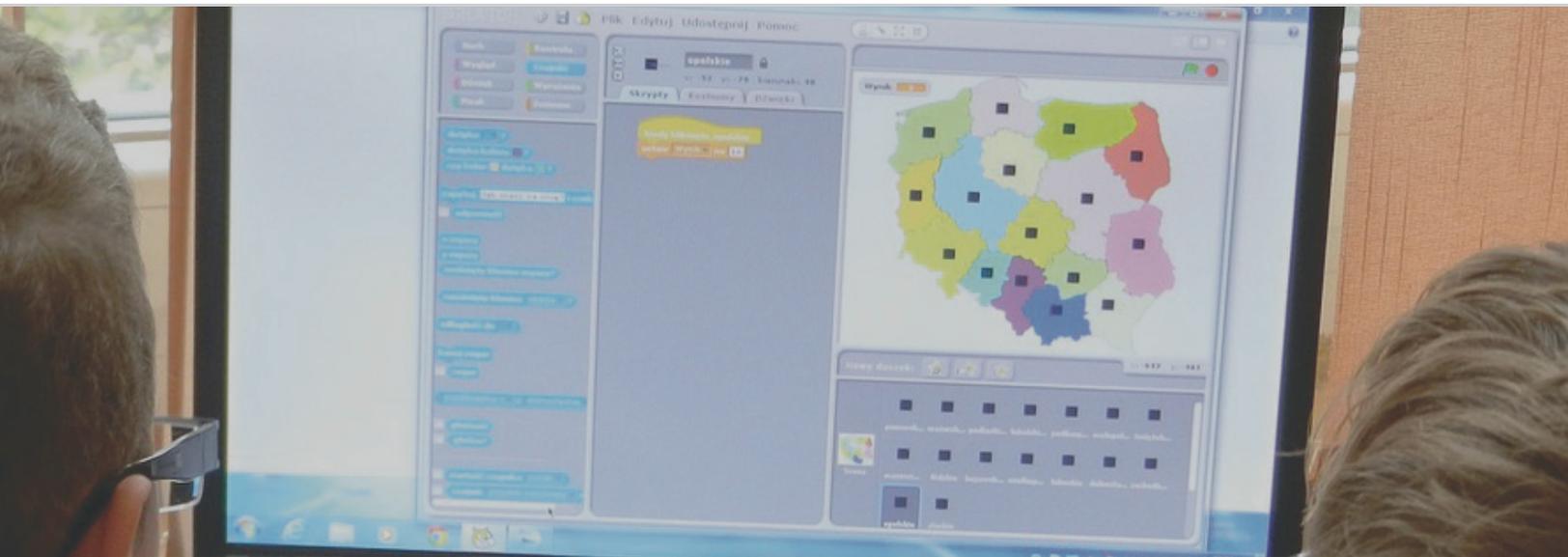


DIGITAL TECHNOLOGIES IN SUPPORT OF PERSONALIZED LEARNING

JANET S. TWYMAN

This topic brief is one in a series on personalized learning prepared for Conversations with Innovators, 2018.



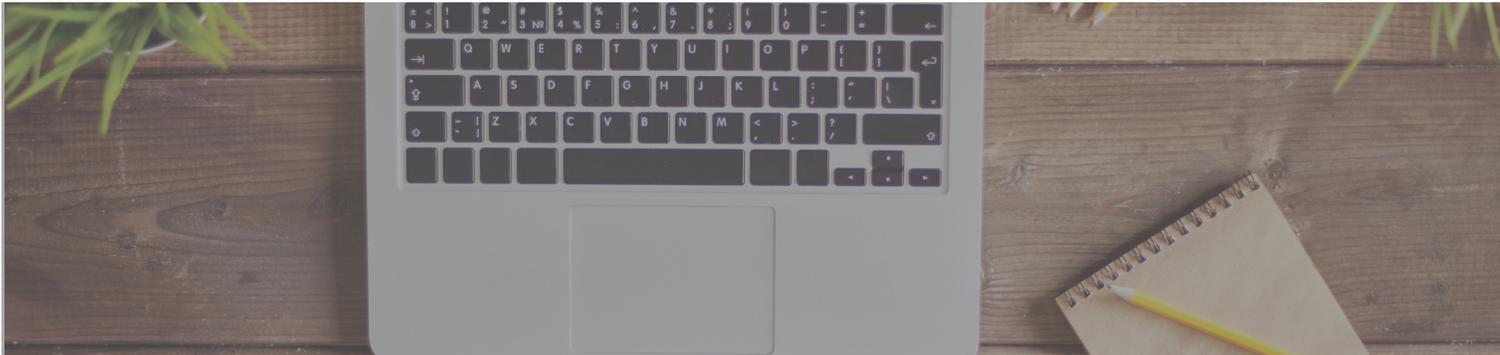


Today's students are generally quite tech savvy. Most learners own a smartphone or other digital device and spend several hours a day using media or on the Internet. Teachers are becoming more tech savvy as well. Seven in ten teachers report that educational technologies allow them to do "more than ever before" for their students (American Psychological Association, 2016), likely a good thing given that educational technology is an inevitable part of modern schooling. The U.S. Department of education encourages a culture of learning powered by technology (U.S. Department of Education, Office of Educational Technology, 2010), calling for the use of advanced technologies to improve student learning, accelerate and scale up the adoption of effective practices, and use data and information for continuous improvement (p. v.).

Advanced educational technologies are often digital and often mobile (i.e., portable and personal). Digital technologies are electronic tools, systems, devices, software, and resources that generate, store, or process data in the form of numeric code. Digital devices include computers, laptops, cellphones, virtual reality goggles, electronic personal assistants (e.g., Siri, Alexa) and "smart" watches, cars, refrigerators, eyeglasses, light bulbs, vacuum cleaners, and hundreds of other common items. Sometimes we use digital technologies regardless of the device, such as when we access websites and web tools, programming tools, and software applications. We use digital resources to communicate, be social, or be productive; to discover and analyze information; and to create new things. Yet as noted by Layng and Twyman (2013), technology is not solely digital tools and their accompanying software (the technology of tools); there is also a technology surrounding the practices used in teaching and learning (the technology of process). Both are critical to improving teaching and learning. Much of the technology of the process is covered in the section on instructional design¹; this section focuses on the technology of tools, specifically digital technologies.

Imagine an educational system in which all students have access to a rich “library” of information and a multitude of experts to guide their learning. Imagine students mastering essential knowledge and skills at their own optimal pace, in a personalized and collaborative manner, with multiple opportunities to creatively showcase that learning in real-world applications. Imagine a teacher’s ability to know in real-time exactly where each student is in his or her learning . . . exactly what each student’s strengths, needs, interests, motivations, and aspirations are, both moment to moment and over time. Imagine a school “day” that is not a 6-hour day but rather a 24-hour, 7-day-a-week opportunity for students to be excited and engaged and access the instruction they need to become lifelong learners.

How can digital technologies shift these imaginings to reality? How can these technologies support, enhance, and transform current teaching practice? What tools can be used to support those efforts? The Center on Innovations in Learning curates an EdShelf collection of recommended software applications at <https://edshelf.com/profile/n0gkqt5/>. Below are ideas on how technology can improve instruction and a number of tools that support that effort.



Increase student engagement.



Technology tools can embolden teachers to break away from a passive instructional model and make their lessons more interactive. Research clearly indicates that active student respondingⁱⁱ increases student engagement, increases learning outcomes, and decreases disruptive behavior. Hardware tools such as classroom response systems (“clickers”) and even students’ own digital devices, coupled with software applications, allow all students to respond individually and simultaneously, often with immediate individualized feedback and data on each learner for the teacher. CIL’s edshelf collectionⁱⁱⁱ “Quiz and Poll Creators—Active Responding” features more than 20 tools that can be used to increase student active response engagement.

Individualize instruction.



We know education is most effective when we challenge and support each child at his or her own level. The past few decades have seen an explosion in the number of digital-technology tools designed to do just that. Individualization and variation to address each learner's needs may come from using different forms of media to learn information (e.g., text, audio, video, images, virtual field trips) as well as providing students options in demonstrating what they've learned (e.g., student presentations, a music video, a 3D printed model). Digital instructional software can automate skills-based independent practice for students who need it when they need it, as well as provide immediate individualized feedback with opportunities to practice and try again. Individual student interests, goals, and aspirations can be supported by increased access to different digital content, and full individualization is made possible by supporting variation across instructional time, place, path, pace, practice, and trace.^{iv}

Gather information.



The Internet enables students to find and analyze resources and materials in ways not thought possible before. In addition to effectively accessing scholarly databases, research studies, and reliable news sources, using accurate search terms and critically sifting through the results (for authenticity and reliability) is a skill that all students need to master. Perhaps even more important, learners need to find out how to do research using scholarly databases, research studies, and reliable news sources. For instance, when searching for information on Personalized Learning, CIL's Resource Database (<http://www.centeril.org/search/search.aspx>) has more than 2000 reliable, vetted entries related to the topic.

Organize information.

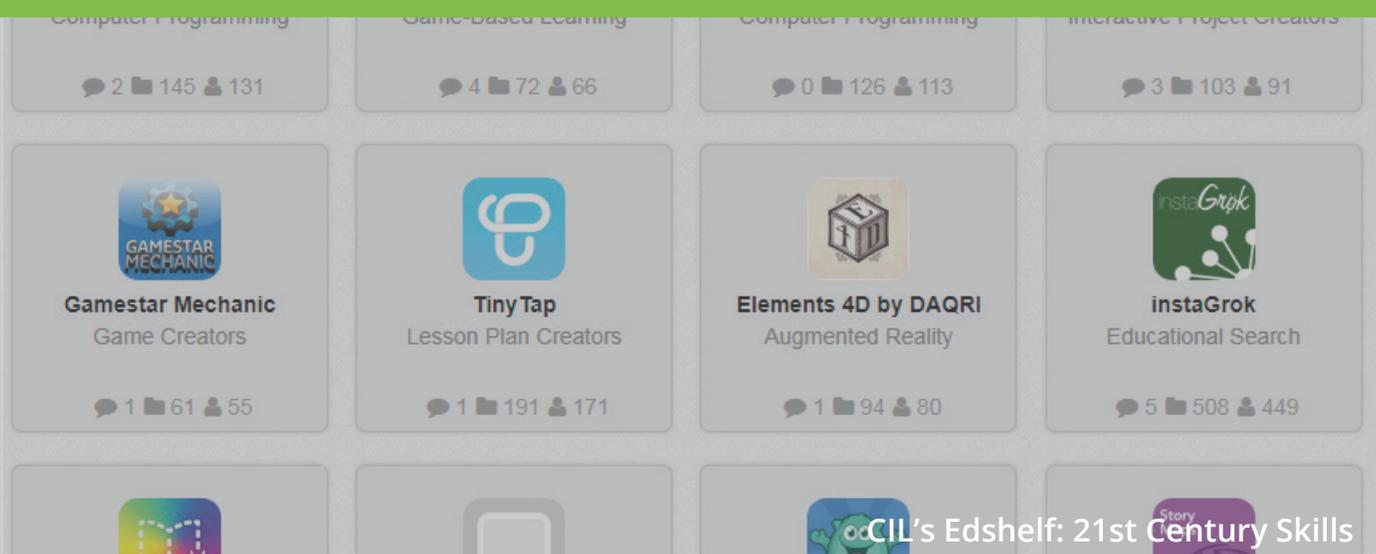


Many students (and teachers) struggle with organization, whether for a single project or a body of work. Note-taking apps can help students systematize their work; many provide prompts, reminders, and strategies that help build organizational skills while using the app. Saving notes and projects digitally can enable students to update or submit (or even find) their work as needed. Other tools help showcase student work, such as the digital portfolios and other resources found on CIL's EdShelf: "Portfolios/Collection/Curation"

Organize thinking via coding and programming.



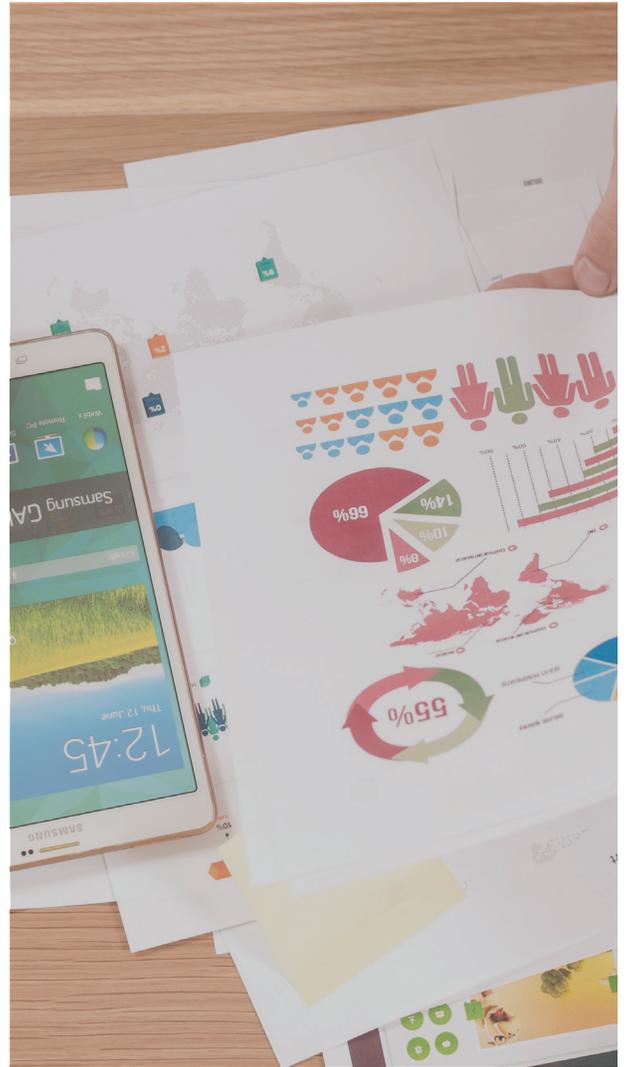
When learning to program, build, and test their own apps, games, robots, or algorithms, students are learning skills in critical thinking, logic, and communication. In programming, students learn how to break down a problem into individual steps, a skill needed in other subjects as well. It supports creativity as ideas are brought to life. Fun, easy, programs introducing coding can be found on CIL's EdShelf "21st Century Skills."





Communicate.

Most students come to class already knowing how to use digital technologies to communicate (often in ways that the adults around them don't quite support or understand). Students have learned how to use digital technologies for frequent and sometimes rich connections; teachers can leverage those skills for classroom communications (both tapping into an existing skill as well as using the opportunity to teach about types of and effective and respectful communication). Additionally, teachers can now more easily connect with parents (and students), via virtual office hours, online grade books (with required privacy protections), individual and group emails, or class webpages with helpful information (class expectations, upcoming assignments, success stories, and so on).



Collaborate.

Digital tools can support student collaboration both face to face and over the miles and provide interactive experiences among peers. Effective, active collaboration is a critical skill in and beyond the classroom. Collaborative tools support real-time simultaneous creating, editing, and commenting, such as those listed on CIL's EdShelf on "Project Collaboration Tools" and "Group Interactive Commenting and Feedback."

Stimulate student creativity.



Creativity is said to be the “premier skill” necessary in the 21st century (Fogerty, n.d.). When students create their own content to demonstrate their learning, they are more likely to take ownership of their learning.^v Students can create and edit text, infographics, images, animations, music, videos and more to showcase their thoughts, opinions, perspectives, and learning. Digital technologies provide a plethora of ways for students at all ages and across all content areas to be innovative, inspired, and expressive, across all content areas. Following are a few possibilities; the opportunities for creation are endless:



Mind mapping and brainstorming. Mind mapping and brainstorming are two great ways to activate a students’ prior knowledge as well as stimulate thinking about topics to be introduced. Activities should encourage original or inventive thinking; digital technologies can make these activities more interactive or collaborative. Web whiteboards support thinking “on the fly” even when students are in different rooms or different countries. Using digital tools, students can craft mind maps and other visuals to organize, show, and share their thinking. A number of tools can be found on CIL’s EdShelf “Mind Maps and Web Whiteboards.”



Blogs for creative writing and thinking. Blogs help hone writing skills and critical thinking as students create entries or comment on other posts, without the formal structure required in most writing assignments. Free, highly regarded blogging platforms for teachers and students include Edublogs (www.edublogs.org), WordPress (www.wordpress.org), and Youth Voices (www.youthvoices.live).



Student-created presentations. Presenting has become an integral part of being a student (and often as an adult as well). Preparing and presenting involves organization, communication, time management, and audience awareness and provides an opportunity to increase specific skills such vocabulary, grammar, thinking public, speaking, and writing. The visual component of presentation is important as well, and CIL’s EdShelf “Presentation Creators” offers a number of different tools.

***Storyboards, animation, and video for creative writing and expression.***

We know that storytelling is a powerful way to express oneself and connect with others. Storytelling can help students explore meaning and understand experience. Students can create their own digital stories with some of the tools listed on CIL's EdShelf "Animation and Storybook Creators" and create videos and other visual formats with tools from "Video Creating and Editing" and "Screen Capture and Recording (Screencasting)."



Maker spaces for creative thinking and invention. The Maker Movement stems from the seemingly inherent human desire to create and fully supports the notion that we learn best by doing. "Maker" refers to hands-on activities (e.g., physically building something, programming a computer, creating a video short) that also have an academic purpose. Generally, the Maker Movement represents three ideals: "making" as a specific activity, "maker spaces" as communities of shared practice, and "makers" as individuals who learn and grow by making (Halverson & Sheridan, 2014). Maker spaces are zones (in and out of schools) that facilitate students' abilities to experiment, design, build, and try out new things. Whereas some maker spaces focus on using new or digital technologies (e.g., 3D printing, video capture, digital photography), others emphasize more "low-tech," backyard-style creation. Many blend the best of both; all involve collaboration, iteration, playfulness, support, and the idea that the process is more important than the result.

Broaden student horizons.



Learning is not limited to the classroom. And although a high-quality teacher is critical, students can now also learn from experts and peers from around the world via email, social media, video calls or chat, and other platforms. Augmented (overlay of digital onto the real world) and virtual (entirely digital experience) realities bring experiences from afar directly to the student. Students can take 3D interactive tours of far away (or even no-longer-existing) places, see inside the human body, or virtually dissect creatures. With the rich experiences digital technologies make accessible to any student, anywhere, anytime, it is even more important for teachers to use their relational suasion^{vi} to enhance these journeys and develop new interests based on acquired relevance.

Adapt instruction in the moment.

Early digital technologies attempted to automatically support instruction by adapting content based on student progression through electronic material (e.g., PLATO; Smith & Sherwood, 1976). For instance, a string of correct responses resulted in an increase in the difficulty of the material or advancement to new content, conversely a pattern of incorrect responding resulted in repeating previous material or a receiving a tutorial on a specific topic. Current technologies (thought of as intelligent adaptive learning) strive to identify and analyze learning difficulties, such as why a student is not progressing or why they are doing what they are doing (Kurshan & Woolley-Wilson, 2016). Such programs attempt to assess what students already know and provide only what is needed to achieve mastery while also analyzing engagement to offer insight into motivation and learner abilities (see Baker, 2016). Every student response, hesitation, or lack thereof, as well as response choices, latency and fluency of responding, and response patterns (across corrects and errors) are analyzed and responded to by the system to provide students and teachers what is needed to develop competency and fluency in important concepts and skills and promote deeper understanding. The goal of these technologies is to learn about the learner while the learner is learning—in other words—to personalize digital learning for each student.



Provide real-time, formative data.



Digital technologies are just beginning to meaningfully change the way educators (and students) use learner data. Historically, student performance was viewed through a “rear-view mirror,” such as summative test data that provided information about the outcomes of prior teaching (Kurshan & Woolley-Wilson, 2016). Teaching requires relevant, meaningful, real-time information during lessons that enable teachers to adapt the lesson to the needs of the learners. Intelligent adaptive learning platforms make it possible to collect evidence of student thinking and learning in ways not previously thought possible. Effective instructional software provides feedback to students and information to teachers at virtually every step of the learning process; information used to gauge individual student real-time progress toward his or her learning goal. By arming educators with rich, timely information about student growth and performance, future developments in intelligent adaptive learning platforms will likely encourage educators to reimagine their instructional practices, resulting in increased classroom innovation and improved student outcomes.

With the great opportunities that digital technologies provide comes great responsibility for ethical and respectful use. Students (and teachers) should learn their rights and responsibilities as citizens of the digital world, including those related to accuracy, ownership, privacy, and respect as well the shared obligation that we all make the Internet a more safe, positive, and productive place.

SUMMARY

Digital technologies alone will not reshape education. However, educators can use digital technologies to better know, engage, and teach students. These tools can help teachers address the diversity found across all students, providing previously unimaginable ways to tailor instruction to not only each individual learner’s strengths and weaknesses but also each individual’s interests, preferences, motivations—a marker of true personalized learning.

REFERENCES

- American Psychological Association. (2013, February 3). *PBS survey finds teachers are embracing digital resources to propel student learning* [Press release]. Retrieved from <http://www.pbs.org/about/blogs/news/pbs-survey-finds-teachers-are-embracing-digital-resources-to-propel-student-learning/>
- Baker, R. (2016). Using learning analytics in personalized learning. In M. Murphy, S. Redding, & J. Twyman (Eds.), *Handbook on personalized learning for states, districts, and schools* (pp. 165–174). Philadelphia, PA: Temple University, Center on Innovations in Learning. Retrieved from http://www.centeril.org/2016Handbook/resources/Cover_Baker_web.pdf
- Fogerty, R. (n.d.). Creativity: The premier skill of the 21st century. Retrieved from <http://www.p21.org/news-events/p21blog/>
- Halverson, E. R., & Sheridan, K. (2014). The maker movement in education. *Harvard Educational Review*, 84(4), 495–504.
- Kurshan, B., & Woolley-Wilson, J. (2016, July 26). Technology and classroom data. *Forbes*. Retrieved from <https://www.forbes.com/sites/barbarakurshan/2016/07/26/technology-and-classroom-data/#2eafbc232039>
- Layng, T. V. J., & Twyman, J. S. (2013). Education + technology + innovation = learning? In M. Murphy, S. Redding, & J. Twyman (Eds.), *Handbook on innovations in learning* (pp. 133-148). Philadelphia, PA: Temple University, Center on Innovations in Learning. Retrieved from http://www.centeril.org/handbook/resources/fullchapter/Education_Technology_Innovation_Learning_SA.pdf
- Shute, V., & Zapata-Rivera, D. (2012). Adaptive Educational Systems. In P. Durlach & A. Lesgold (Eds.), *Adaptive Technologies for Training and Education* (pp. 7-27). Cambridge: Cambridge University Press. doi:10.1017/CBO9781139049580.004
- Smith, S. G., & Sherwood, B. A. (1976). Educational uses of the PLATO computer system. *Science*, 192(4237), 344–52. Retrieved from <http://science.sciencemag.org/content/192/4237/344>
- U.S. Department of Education, Office of Educational Technology (2010). *Transforming American Education: Learning powered by technology*, Washington, D.C. Retrieved from <https://www.ed.gov/sites/default/files/netp2010.pdf>

ⁱ For more information, see the brief on Instructional Design.

ⁱⁱ For more information, see the brief on “Enhancing Motivation Through Active Student Response.”

ⁱⁱⁱ The Center on Innovation in Learning’s edshelf collection is found at: <https://edshelf.com/profile/n0gkqt5/>

^{iv} For more information, see the brief on “Variation: Ways and Means to Personalize Learning.”

^v For more information, see the brief on Voice in Student-Driven Personalization.

^{vi} For more information, see the brief on Relational Suasion.



For more information about Personalized Learning
please visit:

www.centeril.org

The contents of this publication were developed under a grant from the Department of Education. However, those contents do not necessarily represent the policy of the Department of Education, and you should not assume endorsement by the Federal Government.