



Indicator: All teachers use appropriate technological tools to enhance instruction. (A5)

Explanation: Technological tools make personalized learning practices feasible at scale and have been shown to improve a wide variety of educational outcomes. An ever-increasing array of technological tools are available to teachers, however many teachers are not using these tools in transformative ways that change their classroom roles and encourage increased student ownership of learning. Teachers must reflect on the interplay between the content, their teaching practices, and technology, and use the instructional planning process to guide their selection of technological tools. Teachers need sustained, standards-aligned and content-embedded professional development to use classroom technology effectively and in ways that promote active learning.

Questions: What types of educational technologies are available to teachers and what are best practices for implementation? How can teachers integrate technology to enhance instruction and maximize student learning?

Learner-centered, or personalized learning refers to “tailoring learning for each student’s strengths, needs, and interests—including enabling student voice and choice in what, how, when, and where they learn—to provide flexibility and supports to ensure mastery of the highest standards possible” (Patrick, Kennedy, & Powell, 2013, p. 4). The student is actively involved with the teacher in co-constructing their individualized learning pathway, and the location, time, and pace of learning may vary from student to student (Redding, 2016). Technological tools make personalized learning approaches possible at scale and can assist in all areas of teaching and learning, including student data and assessment, curriculum selection and alignment to standards, and instruction and learning (Wolf, 2010; Redding, 2014). A good deal of research evidence has supported the use of technologies to increase student achievement (e.g., Tamin, Bernard, Borokhovski, Abrami, & Schmid, 2011). Recent preliminary research also suggests that personalized learning practices that incorporate technology, when implemented with fidelity, may result in positive and large student achievement gains, particularly for students behind academically (Pane, Steiner, Baird, & Hamilton, 2015).

What Types of Educational Technologies Are Available to Teachers and What are Best Practices for Implementation?

Grant and Basye (2014) describe digital tools within five main educational areas:

- Literacy resources: e.g., eBooks, audio books, blogs and discussion forums can introduce students to multiple texts on similar topics, and assistive technology devices such as text-to-speech tools can make these texts available to a wide range of students.
- Web tools: e.g., wikis, podcasts, digital games, and multimedia editors allow students to make choices about how to demonstrate their learning and help them explore new technologies and develop critical 21st century skills such as online collaboration. Digital games have been shown through recent research to improve both learning of academic content and intrapersonal outcomes such as motivation, intellectual openness, work ethic, and

positive core self-evaluation (Clark, Tanner-Smith, & Killingworth, 2016).

- Digital information sources: Provide immediate access to encyclopedia sites, podcasts, expert sites, media sites, and blogs, allowing students to interact with relevant content and experts.
- Social networking sites: Can be useful particularly for special needs students who may feel isolated from peers. For example, an autistic student can connect with peers using Edmodo, a social networking site designed to let students within a classroom connect with each other around class content.
- Learning management systems (LMS): Provide a platform for students to access content and allows for documentation of student progress. Teachers use these systems to organize their instruction and communicate with students and parents (e.g., Edmodo, Blackboard).

To maximize the benefits of technology, Project RED (Revolutionizing Education through Technology) identified 9 key implementation factors associated positively with measures of educational success such as standardized achievement tests and graduation rates (Greaves, Hayes, Wilson, Gielniak, & Peterson, 2012). These factors are described below in order of importance to predicting success:

1. Intervention classes: ELL students, Title I, special education and reading intervention programs benefit from daily technology integration.
2. Change management leadership: Principals provide ample time for teachers' professional learning and collaboration.
3. Online collaboration: Students use technology daily (e.g., digital games, simulations, and social media) to collaborate with peers to achieve learning goals.
4. Core subjects: Technology is integrated into core curriculum at least weekly.
5. Online formative assessments: Technology is used at least weekly to monitor student learning outcomes.
6. Student-computer ratio: One-to-one is ideal; lower ratios improve outcomes.
7. Virtual field trips: Contribute to learning if done at least monthly.

8. Search engines: Are used by student on a daily basis.

9. Principal training: In order to ensure teacher buy-in and model effective practices, principals must receive training in order to guide effective implementation.

How Can Teachers Integrate Technology to Enhance Instruction and Maximize Student Learning?

Prior to making a decision to use a digital tool to teach a lesson, teachers must first consider the learning goals, activities, and formative and summative assessments that will make up the lesson; the selection of digital tools should follow naturally from other instructional planning decisions rather than serving as the focus of instruction (Hobgood & Ormsby, 2011; Leimbach, 2015). Teachers must also understand their students' interests, readiness, and learning profiles in order to design learning activities and select digital tools to meet individual needs (Grant & Basye, 2014). Koehler and Mishra (2009) provide a widely used framework of technology integration, TPACK (Technological Pedagogical Content Knowledge) that highlights the complexity of how teachers use technology in their classrooms. The model suggests that effective technology integration occurs when teachers carefully consider the interplay between the content (subject matter), pedagogy (teaching methods) and technology. Reflecting on all three domains together "results in a lesson in which all the component parts are aligned to support the learning goals and outcomes of the instructional plan" (Hobgood & Ormsby, 2011, p. 2).

The U.S. Department of Education's recent National Education Technology Plan (2016) encourages a shift from 'passive' to 'active' technology use by students. Active technology use involves students using technology as a tool to "engage in creative, productive, lifelong learning rather than simply consuming passive content" (p. 18). Examples of active technology use include coding, peer collaboration, media design and production; passive technology use can involve completing digitized worksheets or simply consuming media. Unfortunately, research has also suggested that many teachers have not been adequately prepared to effectively integrate technological tools into instruction in ways that promote active learning, particularly in rural and/or high-poverty districts (Blanchard, LePrevost, Tolin, & Gutierrez, 2016). In fact, recent studies indicate that many teachers in

general are using technology primarily for passive or administrative tasks, and students report infrequent active technology use in classrooms (Moeller & Reitzes, 2011; Mundy, Kupczynski, & Kee, 2012; Herold, 2016). Traditional professional development with technology tools has primarily focused on how to use these tools within current teaching and learning models rather than on helping teachers use technology in transformative ways that change their roles and pedagogical practices and impact the way students are learning within the classroom (Blanchard, et al., 2016). Teacher technology-enhanced professional development should be sustained (longer than one year), embedded in content, matched with stated objectives, and allow for teachers to reflect on and refine their pedagogical approaches (Gerard, Varma, Corliss, & Linn, 2011). Additionally working with multiple teachers from the same school helps provide a supportive structure for technology integration (Gerard, Bowyer, & Linn, 2010).

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