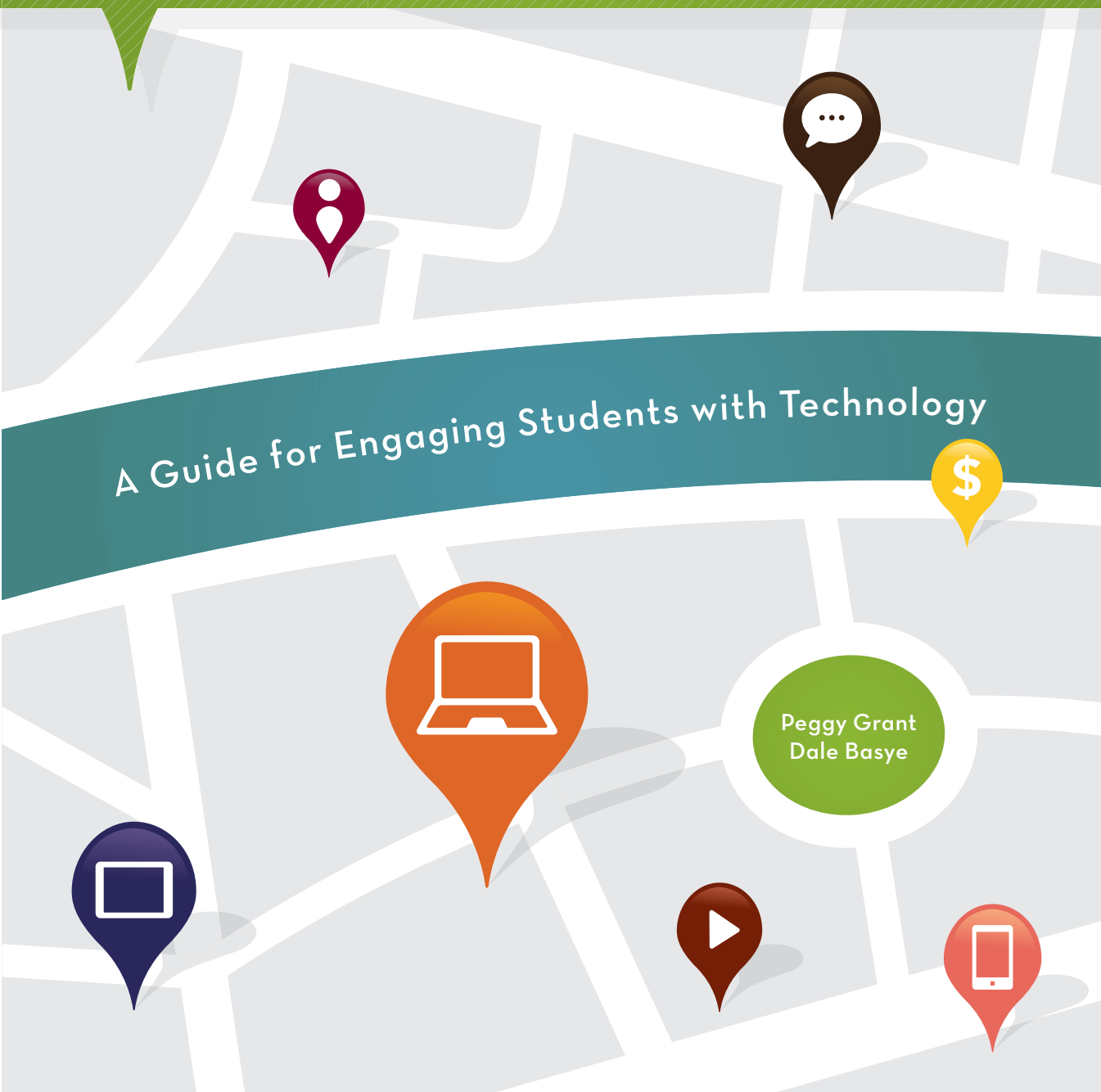
PERSONALIZED LEARNING



A Guide for Engaging Students with Technology

Peggy Grant
Dale Basye

PERSONALIZED LEARNING

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International Society for Technology in Education
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ABOUT ISTE

The International Society for Technology in Education is the premier membership association for educators and education leaders committed to empowering connected learners in a connected world. Home to the ISTE Conference and Expo and the widely adopted ISTE Standards for learning, teaching, and leading in the digital age, the association represents more than 100,000 professionals worldwide.

We support our members with professional development, networking opportunities, advocacy, and ed tech resources to help advance the transformation of education. To find out more about these and other ISTE initiatives, visit iste.org.

As part of our mission, ISTE works with experienced educators to develop and publish practical resources for classroom teachers, teacher educators and technology leaders. Every manuscript we select for publication is carefully peer reviewed and professionally edited.

ABOUT THE AUTHORS

Peggy Grant After 21 years as an award-winning junior high English and reading teacher, Grant left the classroom to pursue a PhD in literacy education. She moved to the Chicago area, where she taught at Purdue University Calumet for seven years and then worked as a literacy consultant with Learning Point Associates. As senior content developer for Clarity Innovations, Grant writes educational content for the web and for online and face-to-face training in project-based-learning and technology integration. In addition to creating written content, she has given numerous state, regional, national, and international presentations and conducted workshops on literacy, assessment, higher-order thinking, and 21st-century skills. She has also developed and facilitated long-term professional development for classroom teachers in urban, rural, and suburban school environments.

Dale Basye is an award-winning writer, author, and creative director with more than 20 years of professional experience in both journalism and advertising. His specialty is creating dynamic, relevant multimedia experiences for children. Basye has worked with Quaker, Nestle, Lucasfilm, the Oregon Department of Health, Lego, Portland Public Schools, Mattel, the Oregon Parks and Recreation Department, and Portland State University to develop and implement a number of programs and campaigns for young people. His work has earned him two Communication Arts Awards of Excellence, a Gold and Bronze medal in the Summit Creative Awards, and two Portland Rosey Awards for Interactive Work. Basye is author of *Heck: Where the Bad Kids Go* and its sequels.

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INTRODUCTION

This book is designed to help today's educators make sense of the shifting landscape in modern education. While changes may pose significant challenges, they also offer countless opportunities to engage students in meaningful ways to improve their learning outcomes.

The key to engaging students can be found by educators who are willing to bridge the gap between what kids are too often still doing in school—working silently alongside one another on activity sheets, staring at teachers as they lecture, and taking the same tests—and what kids do *outside* school: connecting and sharing online, and engaging in virtual communities of their own. Personalized learning is the key to engaging students, as teachers are leading the way toward making learning as relevant, rigorous, and meaningful *inside* school as outside.

Personalized learning is an invitation for educators to create opportunities for learning that takes advantage of the digital skills most students already possess. Personalized learning is specifically tailored to each student's strengths, needs, and interests while ensuring the highest standards possible. This approach is a major paradigm shift from the traditional "one-size-fits-all" approach to education. Personalization encourages educators to be more open and flexible, so that students can become more invested in designing their own personal learning paths. Students engaged in personalized learning at their various paces are given access to tools and feedback that motivate them to capitalize on their unique skills and potential.

Digital tools can fuel student-centered learning by allowing students more control over, a sense of ownership of, and accountability for the learning methodologies that fit their particular learning styles, the processes that best fit these styles, and, to a great extent, the content areas that spark their interests. Digital tools also help students to absorb and effectively demonstrate such 21st-century skills as communication, collaboration, problem solving, critical thinking, and creativity through the creation, consumption, manipula-

tion, and sharing of digital content. These skills are vital for today's students to flourish in tomorrow's job market, as millennial adults will likely perform more than a dozen jobs. And most of these jobs do not exist today, meaning that mastery of 20th-century skills, including rote memorization, performing repetitive tasks, and general knowledge, simply will not suffice.

Students thrive on dynamic learning experiences that are collaborative, relevant, and engaging. As cloud-based learning solutions and mobile education apps continue to become more popular, schools need to find innovative ways of integrating these technologies into teaching, learning, and assessment. When used correctly, these technologies and techniques allow for greater autonomy, engagement, individualization, and differentiation than ever before, while giving students more active, responsible roles in their own learning.

Mobile devices and one-to-one personalized learning techniques are breaking the boundaries of education by delivering anytime/anywhere learning: turning the entire world into a potential classroom!

Personalization empowers students to take true ownership of their education, altering the dynamic between teachers and students. This new model gives teachers the time and information they need to design personalized instruction that builds the critical thinking skills crucial to independent learning. Teachers can also create diverse, highly personalized learning environments that recognize students' different skills, challenges, and talents.

This book provides the essential information needed to implement personalized learning with technology and concludes with a step-by-step guide to planning, funding, and implementing a schoolwide personalized learning program.

Please let us know what you think about the information in this book. We are very interested in your feedback and look forward to helping educators and administrators deliver 21st-century solutions that effectively engage and motivate today's students.

Paige Johnson

Education Strategist, Intel Corporation
ISTE Board of Directors

CHAPTER

Why Consider Personalized Learning?

Educators are finding traditional classroom structures—where the same lessons are presented to a class of students and equal time and resources are allotted to all students for learning the material—nonviable. Students in the same grade have different knowledge base levels and learn at different rates. They are more likely to succeed academically, emotionally, and behaviorally when they are supported as individuals.

In contrast, with personalized learning structures made increasingly available through technology and online opportunities, teachers and students are empowered to take charge of their education experiences. The customized one-to-one (often shortened to 1:1) computing approach transforms learning environments, turning them into dynamic communities of connected learners taking advantage of digital tools. In student-centered classrooms, students meet core standards as they use various methods and work at different paces, based on their educational needs and interests. In this way, students learn how to learn on their own unique terms.

The customization of education represents an important advance because it recognizes that pupils come from different backgrounds and have varied interests and ability levels (Sharples, 2007). Special needs students, for example, can get additional time and attention as technology tools afford them unprecedented access to resources. Gifted pupils can move quickly to accomplish required skills and then be engaged by more

demanding projects. Students master concepts at their own speeds and in their own ways via one-to-one learning.

Collaborative learning represents another virtue of the personalized online world. In addition to one-on-one learning, technology enables students to collaborate with one another and work with a range of interactive, instructional resources. These resources can include teachers, parents, peer tutors, volunteers, and other interested individuals. Students become engaged participants, spurred on by regular feedback and challenging assignments.

One-to-one personalized learning is not simply a "patch" for a broken education system. It is a new way of expanding and enhancing learning for all students, regardless of their individual abilities and circumstances. Personalized learning is not the digitization of traditional learning. It is the individualization of learning through use and mastery of modern digital tools and collaborative strategies among teachers, students, and peers who utilize the unique possibilities of the digital environment. Technology is the tool that makes personalized learning easier and more efficient.

A successful personalized learning initiative has the following characteristics:

- Students' interests and abilities are engaged in authentic, real-world activities to promote the learning of content area standards.
- Teachers take on the roles of facilitators and coaches in the classroom rather than the dispensers of knowledge.
- Students take control over the learning paths they take to achieve established goals, building self-efficacy, critical thinking, and creativity skills.
- Technology enables students' choices related to what they learn, how they learn, and how they demonstrate their learning.
- Formative assessment throughout the learning cycle, supported by digital tools, helps teachers and students address weaknesses and build on strengths.
- Progress through subject area content is measured by the demonstration of proficiency in identified skills and understanding.
- Technology is integrated throughout teachers' and students' experiences to support learning.

Personalized learning is not a replacement for teachers. Rather, it provides the data and strategies educators need to make better pedagogical and interventional decisions to allow students to learn in their own ways, at their own paces.

HIGHLIGHT

ISTE Standards

The International Society for Technology in Education has developed student, teacher, administrator, coach, and computer science educator standards for "learning, teaching, and leading in the digital age." Explore these standards at www.iste.org/standards.

Neither is personalized learning a replacement for the traditional classroom experience. Instead, it is meant to serve as a dynamic enhancement to the classroom, freeing up teachers to spend more time interacting with students. One-to-one learning also allows teachers to mediate learning rather than act as gatekeepers, transforming the classroom into a hub of self-directed learning with teachers enabling and empowering each student's unique learning path.

Personalized learning does, however, require both a radical shift in the design of schooling and a better leveraging of modern technologies, so that in the course of daily teaching and learning activities, teachers may employ formative assessment methods to track learning needs and gains dynamically. These resources and strategies must be appropriate for each student's learning style, abilities, and interests in order for each one to succeed.

Technology tools, especially mobile devices, allow students to assert control over the methods by which they learn, thereby personalizing their educational experiences. Students can learn anywhere anytime when they are connected to subject matter content by these mobile devices. Yet, simply providing technology to learners doesn't necessarily make their learning personalized. To achieve the satisfaction of being connected with content in meaningful ways, the learner must be at the center of the experience.

The formula for personalized learning is an adjustable, individualized pace combined with an adjustable, differentiated learning approach (with and without mobile devices) that allows students to incorporate their interests and choices into the overall experience.

Powerful, adaptive software can help fuel meaningful instruction. Online language laboratories, quizzes, lectures, and lessons can all make what students learn in the classroom more engaging and relevant. These tools help to put students truly in charge of how

they learn, while teachers keep students on track, creating and discovering material to enhance the excitement of learning.

YOUR TURN

Introduction to Personalized Learning with One-to-One Computing

Stop and Reflect: What questions do you have about personalized learning in a one-to-one environment?

_____

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_____

Discuss: What goals does your school have that you think might be addressed with personalized learning?

_____

_____

_____

Apply: What steps have you already taken to implement one-to-one computing in your school? What are your plans and goals?

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_____

How Can Personalized Learning Help Meet School Goals?

Schools today are under more and more pressure to meet rigorous standards for all students. Administrators cannot afford to expend valuable resources on initiatives and programs that do not produce results. Preliminary evidence shows great promise for personalized one-to-one computing programs.

Improved Student Achievement

The U.S. Department of Education's National Educational Technology Plan 2010, *Transforming American Education: Learning Powered by Technology*, sets forward the immediate and ongoing goals of using technology "to provide engaging and powerful learning experiences and content, as well as resources and assessments that measure student achievement in more complete, authentic, and meaningful ways. Technology-based learning and assessment systems will be pivotal in improving student learning and generating data that can be used to continuously improve the education system at all levels" (2010, p. ix).

To achieve this goal—the full utilization of technology to engage, enrich, and empower learners—the education system must create relevant learning experiences that reflect the realities of students' daily lives beyond the classroom while preparing them for the challenges of the future. This involves teaching what students need to learn to fulfill core requirements—paced to individuals' needs, tailored to their learning styles, while allowing them to pursue their specific interests.

In contrast with traditional classroom instruction, the personalized approach puts students at the center of the education process. It supports individual and collaborative collection, analysis, and response to student performance data by allowing all students access to appropriate levels of support and instruction, aligned with their current levels of individual development. All students' daily activities are based on what they need to learn, utilizing the approaches that best fit their individual paces and learning styles to deliver the best results for them. Students can receive instruction one-on-one or in small groups, with instruction speeding up or slowing down, depending on the needs of the particular learner or group of students. In 2010, Project RED (Revolutionizing EDucation)—an organization established by the Greaves Group, the Hayes Connection, and the One-to-One Institute for addressing major issues in U.S. education—conducted a survey of technology programs in 997 U.S. schools. This research shows that, if effectively implemented, technology programs can lead to improved student achievement and

significant return on investment. These results led to "seven major findings of interest to schools embarking on or already administering a technology implementation" (Greaves, Hayes, Wilson, Gielniak, & Peterson, 2010).

Key Finding #1

Finding number one comprises nine key implementation factors that are linked most strongly to education in rank order of predictive strength:

- Intervention classes: Technology is integrated into every intervention class period.
- Change management leadership by the principal: Leaders provide time for teacher professional learning and collaboration at least monthly.
- Online collaboration: Students use technology daily for online collaboration (games/simulations and social media).
- Core subjects: Technology is integrated into core curriculum weekly or more frequently.
- Online formative assessments: Assessments are done at least weekly.
- Student-computer ratio: Lower ratios improve outcomes.
- Virtual field trips: With more frequent use, virtual trips are more powerful. The best schools do these at least monthly.
- Search engines: Students use daily.
- Principal training: Principals are trained in teacher buy-in, best practices, and technology-transformed learning. (Greaves, et al., 2010)

Key Finding #2

Properly implemented technology saves money.

Key Finding #3

One-to-one schools employing key implementation factors outperform all schools, including one-to-one schools that haven't employed these implementation factors.

Key Finding #4

The principal's ability to lead change is critical. Change must be modeled and championed at the principal level.

Key Finding #5

Technology-transformed intervention improves learning.

Key Finding #6

Online collaboration increases learning productivity and student engagement.

Key Finding #7

Daily use of technology delivers the best return on investment (ROI).

From these findings, Project RED recommends:

1. Learning for all students should be personalized through frequent, appropriate use of technology integrated with curriculum and instruction in all classrooms and other learning places.
2. Professional learning and effective use of technology should be high priorities for administrators and teachers. To truly transform learning, educators must be able to confidently integrate technologies into their teaching, learning, and assessments.
3. Technologies such as social media, games, and simulations should be used to engage students and encourage collaboration. Leveraging the extraordinary power of technology connects students and excites them about learning while empowering them to succeed.
4. Online assessments gauge student learning and help tailor instruction for personalized learning experiences. This data is used to determine instruction, remediation, and accelerated learning strategies for each student. (Greaves et al., 2010; Pearson Foundation, 2012)

One-to-one personalized learning makes education more adaptive and timely from the students' standpoint and increases the odds of pupil engagement and mastery of important concepts. It frees teachers from routine tasks and gives them more time to serve as instructional coaches and mentors for students (Moody & Bobic, 2011). Personalized learning also supports collective involvement to include parents, principals, and specialists as needed.

Regarding allocation of time, personalized learning is *flexible* and gives students access to learning around the clock. In conjunction with teachers' guidance, students undertake lessons based on their preferred learning approach. As they master key concepts, they advance to higher skill domains.

HIGHLIGHT

Project RED

Project RED is a coalition of research organizations focused on supporting school leaders in the effective use of technology to improve teaching and learning, specifically through one-to-one computing programs. Read more in Appendix A: Introduction to Project RED.

A Model of Technology Integration for Professional Development

Technology, perhaps counterintuitively, is not the greatest challenge to effective professional development for a personalized learning program. A personalized approach to teaching and learning, that is, to student-centered instruction, requires a shift in perceptions about what it means to teach, and without that shift, technology will merely make teacher-centered instruction more efficient without improving students' learning or engagement. Students' learning can certainly be personalized to some extent without technology, and many teachers have taken that path. For these teachers, the technology available with one-to-one devices can begin to move them more efficiently toward a fully personalized curriculum.

Even the most motivated, enthusiastic teachers can face significant challenges when incorporating instructional strategies that personalize learning. Puentedura's (2010) SAMR (Substitution Augmentation Modification Redefinition) model of technology integration applies to efforts to implement a mobile learning initiative but can also be applied to one-to-one programs with an emphasis on personalization. Depending on their instructional philosophy and technology proficiency, teachers may respond to professional development with the goal of attaining proficiency in technology for personalized learning in one of four ways or stages:

Substitution. Teachers at the *substitution* stage use technology to perform the same tasks they would with traditional tools. For example, students would print a worksheet and then complete it by hand, watch a teacher model a mathematical process on a whiteboard instead of a chalkboard, complete a report using word processing software, and conduct research on the internet.

Augmentation. When technological tools are used to improve or enhance a traditional activity, *augmentation* takes place. Students can take a quiz online and receive immediate results or watch a video at home on a mobile device instead of on a big screen in the classroom. Students may use word-processing features, such as spell-checkers or graphics facilities, to make traditional reports and essays more accurate or visually effective.

Modification. Technology use at the *modification* stage introduces technology as a way to significantly redesign traditional learning experiences. Here, some personalization can occur. In a project-based learning environment, students can choose to use technology applications to complete projects that would normally be completed in other ways, such as making a video of a procedure or performance instead of undertaking a live performance. Small group research activities are conducted with peers from across the country instead of only with students in the classroom, and students use tools, such as email, Skype, or Instant Messaging, to collaborate and communicate.

Redefinition. The final stage of technology integration, *redefinition,* calls for the development of learning experiences that are not feasible without technology. For example, students create virtual tours of a local historic area as podcasts and share them with a partner school in another country. In a learning environment where the role of technology is redefinition, students learn content knowledge and skills by making choices, planning, monitoring their progress, and assessing the quality of their work. At this stage, mobile devices support every aspect of learning, and each student's experience is personalized.

Bridging the Digital Divide with Mobile Learning

In the beginning of the educational technology movement, when schools provided just a few computers, if any, for student use, the "digital divide" between the computer "haves" and "have nots" was frequently discussed. Students with computers at home had access to resources unavailable to their less affluent peers. In contrast, now mobile learning is available to most of the poorest U.S. school districts and to teachers and students worldwide, wherever access to the internet and/or broadband connections exists.

Mobile learning is the ability to provide or receive educational content on personal electronic devices, such as smartphones and tablets. It is often self-paced, untethered, and informal in its presentation. Mobile learning has the power to make learning even more widely available and accessible and can help cash-strapped school districts give

their students the opportunity to extend their learning outside the classroom with their personal mobile devices.

Mobile devices allow students to gather, access, and process information outside the classroom. They can encourage learning in a real-world context and help bridge school, after school, and home environments, resulting in true "anywhere/anytime" learning. The lower cost of the newer devices makes them more affordable for schools wishing to implement one-to-one programs.

Mobile devices can also help overcome many of the challenges associated with larger technologies, as they fit more naturally within various learning environments, while offering educators numerous differentiated instruction possibilities via engaging and robust methods.

A 2013 survey (Harris Interactive, 2013) of students in Grades 4–12, undertaken for Pearson educational services company, found that in spite of the ubiquity of mobile devices, such as smartphones and tablets, many students had no personal access to technology—not to mobile devices or desktop computers.

Even if the school provides students with a mobile device, the lack of a home broadband connection can limit students' access to online resources that are essential for success in mobile learning. Part of a one-to-one program, therefore, must include considerations for providing a broadband connection outside the school.

Individualized, Differentiated, and Personalized Learning

No one would question the premise that students in today's classrooms vary widely in their abilities, interests, and motivations to learn. With the ultimate goal of helping all students achieve their learning potential, educators have often adopted methods to *differentiate* instruction, that is, to design varied types of instruction to meet individual students' learning needs and goals. Informally, a teacher may recommend a resource or topic to a student who has a particular interest or may take the time to provide individual support or extra practice. More formally, however, teachers may take advantage of teaching and learning strategies that theoretically meet students where they are and support them as they develop necessary skills and content understanding.

In the 1960s and 1970s, approaches to differentiation became more formalized with the advent of what was called *individualized instruction*. Although, technically, the approach included any teaching strategies that met individual students' needs, in practice, students usually worked through prepackaged materials at their own rates. These programs were usually built around the development of basic skills in reading and math. Students were placed into lessons based on pretests and moved on to the next steps when post-test scores indicated mastery. These lessons were often completed without the direct supervision of a teacher (Weber, 1977). *Personalized learning* is a 21st-century model of differentiated instruction that addresses Tomlinson's and Allan's (2000) vision of addressing each student's readiness, interest, and learning profile through differentiation of content, process, and product. Personalized learning is often conceived of as an instructional method that incorporates technology and the use of mobile devices to help all students achieve high levels of learning. Table 1.1 compares the two models of differentiation, individualization and personalization.

Many students require multiple options for taking in information and making sense of ideas. Creating high, yet realistic expectations for all students is a fundamental goal of the Common Core State Standards Initiative (www.corestandards.org). Successful personalized learning programs are based on the principle that any software application used within a school must provide the same level of functionality for all students, regardless of their unique abilities.

Differentiated instruction focuses on students' strengths by structuring class assignments so they require higher levels of critical thinking, while permitting a range of responses geared to different learning styles and readiness.

Researched-based Universal Design for Learning (UDL) has provided a structure for meeting the needs of diverse learners, asking teachers to consider multiple means of engagement. According to the National Center on Universal Design for Learning, UDL "is a set of principles for curriculum development that give all individuals equal opportunities to learn" (2013, p. 1). The UDL offers ideal settings for multiple entry points for students to engage in particular lessons and minimizes instructional barriers to learning. The rest of this section provides excerpts and summaries of material from the National Center on UDL's website: www.udlcenter.org/aboutudl/whatisudl.

Most lessons contain a suggested teaching sequence that moves from simple to complex, allowing teachers to locate specific steps that students are struggling with or to stretch out problems for students who desire a challenge. Within a given time frame that allows

Table 1.1 Two Models of Differentiation: Individualization and Personalization

Individualization	Personalization
Standards and Learning Goals	
Students learn a complete list of facts, concepts, and skills	Students learn a core list of critical concepts and skills with options for additional knowledge based on students' interests, abilities, and teachers' recommendations
Demonstration of Learning	
Students complete teacher-prescribed summative assessments, usually with objective questions	Students choose to demonstrate learning in different ways, based on interests, abilities, and teachers' recommendations
Learning Process	
Students move through a prescribed set of lessons and activities, based on assessment results. May repeat lessons or move on at individual rates	Students make choices about how and when to learn, based on interests, abilities, and teachers' recommendations
Assessment of Learning	
Students achieve a predetermined passing score on a summative assessment	Students experience formative assessments through teacher, self- and peer assessments throughout a learning unit and summative assessment of products and processes, based on established criteria, usually described in rubrics
Role of Collaboration	
Working with others is rarely incorporated, usually considered cheating	Group work is a critical component of many learning activities
Role of Self-Direction	
Students move at their own paces and are responsible for completing tasks without immediate supervision or support (Weber, 1977)	Students must make decisions about how they will demonstrate their learning and how to organize and plan projects and activities. They must also learn to assess their own progress and effectively use resources, such as technology, peers, teachers, and mentors (Project Tomorrow, 2012)

for individual differences, all students are expected to do their personal best, working at their maximum potential.

Another vital component of the UDL is the constant flow of data from student work. Daily tracking for each lesson, as well as mid- and end-of-module assessment tasks, are essential for determining students' understandings at benchmark points. Such data flow keeps teaching practice firmly grounded in students learning and makes incremental progress possible. When feedback is provided, students understand that making mistakes is part of the learning process.

Personalization in education ensures that individual students' needs are met. This concept is similar to personalization in marketing to consumers. For example, when a company recommends products based upon customers' previous selections, the company is specifically marketing to individuals. Such personalized industry practices contrast with simply mass marketing one product or service.

Even the best teachers, though, struggle to find the time and resources to offer differentiated instruction effectively. This is where technology excels. It can help educators to deliver meaningful, differentiated instruction, avoiding unnecessary struggles while saving time and building students' learning capacities. Technology can support teachers as they make decisions about lesson planning, student grouping, curriculum advancement, and online learning programs.

Via technology, individual students receive timely responses when learning systems indicate they are falling behind or advancing. Parents and caregivers can become better advocates for their children's learning, as they are notified of their learning performances. School leaders are better able to support teachers with data gained from frequent student learning measures and regularly generated class performance data with graphic illustrations. As students advance from mastering simple to more complex concepts, teachers can (a) break problems down for students struggling with a next step or (b) make problems more complex for those eager for greater challenges.

However, most teachers do not have the experience or training to personalize instruction properly. Teachers who did not learn how to create differentiated or personalized learning programs as part of their university education need support through ongoing, adaptive professional development. This includes a comprehensive set of tools and resources; easy access to data, curriculum, and content resources; and training in the optimal use of technology to create and implement the necessary lessons and resources.

The role of teachers dramatically changes as they employ personalized learning techniques. Personalized learning requires a shift from teachers delivering knowledge to their classrooms of students to teachers as facilitators of learning, often as members of a team of teachers with differentiated roles. While the teacher-directed model has its place, the facilitator model is a significant departure from the ways most teachers have been trained to teach and the ways they learned themselves. Through further differentiation of teachers' roles, student-teacher ratios and instructional relationships can be varied to meet the variety of students' needs (National Center on UDL, 2013).

Personalized Learning in the Classroom

Differentiated learning is instruction tailored to the learning preferences of different learners. Learning goals are the same for all students, but the method or approach of instruction varies according to the learning styles of each student (i.e., visual, auditory, kinesthetic, or a combination of these) or what research has found works best for students like them.

To manage a classroom effectively using differentiated instruction, teachers must carefully select organization and instructional delivery strategies. Initial and ongoing assessments of student readiness and growth are essential. Meaningful initial and ongoing assessments inform teachers so that they can better provide a menu of approaches, choices, and scaffolds for students' varying needs, interests, and abilities. The point is to teach students what they need to learn and not what they already know—to discern when particular children or activities warrant more or less attention (Moore & Hansen, 2012).

Technology tools can offer personalized learning environments in which students collaborate, interact with software, conduct research, create products, and communicate with others outside their schools (Moeller & Reitzes, 2011). In addition, technology provides new and more efficient ways for students to receive and engage with content and varied options for demonstrating what they have learned. The internet offers students an abundance of tools to use according to their needs and interests. Rather than giving students a couple of options, educational websites offer a wide array of choices. Teachers can pair the right tools with the right students, helping to differentiate the learning experience.

For example, blog-publishing platforms offering easy-to-use tools, such as wordpress.com, can create unique opportunities for students within their particular learning styles, utilizing different media types (e.g., video, audio, animations, and text). To differentiate for students who have difficulty taking notes in class, simply recording the instructor's

lecture can make a powerful difference. To differentiate for students who are auditory or visual learners, laptops, tablets, and most mobile devices are equipped to play music, show pictures, and screen video clips. Teachers can create or copy pictures (with permission, of course) and then store them to a device for subsequent viewing during a lecture or to reinforce concepts.

Students can create their own surveys using online tools, such as SurveyMonkey (www.surveymonkey.com). Tools such as TrackStar (http://trackstar.4teachers.org/trackstar/index.jsp) and Web Poster Wizard (http://poster.4teachers.org) allow teachers to create interactive, online lessons easily, while many websites, such as National Public Radio (www.npr.org), provide rich, educational multimedia to engage students. Teachers can embed links to dictionaries and helpful resources with Bartleby (www.bartleby.com) or create concept maps and diagrams to provide visuals during labs and other activities. Students can be encouraged to use their own tools, such as NoteStar (http://notestar.4teachers.org), to collect and organize notes or ThinkTank (http://thinktank.4teachers.org) to help develop their own research organizers.

When students are allowed to use a tool in an educational setting that for many of them is an essential part of their everyday life, it can help enrich the material (for example, by supplying animated illustrations with music, colorful or funny examples, and interesting film clips) and, thus, make the lesson more enjoyable. These tools and options allow students with different learning styles to become engaged and to thrive.

According to Hobgood and Ormsby in their article for LEARN NC, a program of the University of North Carolina's School of Education:

> Many of the obstacles to implementing differentiated instruction can be overcome with the effective use of technology. . . . Technology can equip teachers to address students' needs in an almost limitless number of ways, through content input, learning activities, and opportunities to demonstrate comprehension. And because many students come to the learning environment with a predisposition for using tech seamlessly, technology can become an intermediary that bridges the relationships between teacher and student, allowing the teacher to meet a student in a familiar realm.
>
> Technology also addresses the necessity to cover a wide range of content in a short length of time by minimizing the need to take each step of the curriculum at a slow enough pace to teach the slowest learners in a single, teacher-directed

HIGHLIGHT

Common Core State Standards

Learn more about the specifics of the Common Core State Standards in Appendix B: Common Core State Standards Overview.

> way. Students with special needs may benefit greatly from technologies that assist them. . . . For example, a student with dyslexia who might normally struggle with a reading passage could benefit from reading the text while listening to an audio recording of it through headphones. By providing audio, visual, or concept-mapping supports while introducing new concepts, teachers lessen the need for review and remediation after the initial instruction.
>
> Before making the decision to use a particular technology for a particular lesson, teachers should first make decisions about the learning goals, activities, and assessments that will shape the learning experience. During the process of making these decisions, teachers can more easily envision opportunities to integrate one or more technologies. (Hobgood & Ormsby, 2011)

Teachers who develop a basic understanding of their students' readiness, interests, and learning profiles are ready to use that information to adapt their instruction, based on the four variables of teacher-dependent differentiation: content, process, product, and environment. As instruction continues, teachers can adjust and enhance their understandings of students' needs (Hobgood & Ormsby, 2011).

> Differentiating by content can happen in a variety of ways, but the two primary means include 1) using different content to teach the same subject to students with different needs, and 2) enhancing or augmenting existing content to make it accessible to all students. Technology can facilitate both strategies—finding new content and augmenting existing content.
>
> As with differentiation by content, using technology to differentiate by process requires first attending to the student-dependent dimension of differentiation. Focusing on student readiness, student interests, and learning profile yields effective differentiation centered on learners' needs (Hobgood & Ormsby, 2011).

YOUR TURN

Personalized Instruction in Your School

Stop and Reflect: Have you had any learning experiences that benefited or would have benefited from a more personalized approach? What were these experiences like, or how might they have been improved with personalization?

Discuss: What efforts have you seen in your school to personalize instruction?

Apply: Which teachers and support staff in your school are most open to ideas about personalized learning and one-to-one computing? Why?

Person	Personalization/One-to-One Computing/Both	Reason

CHAPTER

A Vision of Online and Face-to-Face Learning to Meet Student Needs

By seeking a "best fit" between face-to-face and technology-enhanced course options, teachers open the door to personalized learning and to success for every learner, regardless of background and individual differences.

Traditionally, teachers are responsible for finding, organizing, and delivering content and coaching, coaxing, and responding to students in the classroom (Smith, 1997). In the online environment, students choose what is important and must justify their choices through successful learning or initiate more effective personal strategies. Traditionally, experts come to class infrequently. Online, however, all experts are within reach, as long as they are willing to connect. Online learning can open up a universe of learning possibilities.

Technology adds choices as to how, when, and where students access learning opportunities, thus reducing many barriers. Learning becomes a personal experience, combining personal interactions with media supports and online learning and communication activities (Smith, 1997). Students remain connected to peers, experts, information, and experiences through threaded conference discussions, video records, and real-world data simulations in an anywhere, anytime frame of access.

Though devices by themselves will not transform education, they are a necessary and vital component of a strategy to deliver the opportunities afforded by digital learning. These 21st-century tools can produce improvements in attendance, test scores, and student engagement.

When relevantly integrated into a face-to-face classroom curriculum, online learning allows schools to supplement more advanced, make-up, or specialty courses that they wouldn't normally have the faculty on hand to teach, especially in smaller or underfunded school systems.

Expanded internet access can yield the expanded options necessary for immersive personalized learning. Full digital access for every student provides the platform for improved access to effective materials and compelling online courses. Using their schools' purchasing power can also help instructors negotiate lower-cost licenses and contracts for digital content and online courses. Digital access allows frequent, free, and easy-to-administer formative and benchmark assessments. Schools can even extend the learning day and year, allowing students to learn anywhere, anytime. This ability also helps schools to expand access to great teachers and greater learning opportunities.

Technology-enhanced courses allow students to consult peers and subject experts seamlessly and non-disruptively through computer-mediated communications, participating in compelling electronic learning dialogues. They can collaborate through email, social media, and chat sessions and compare their work to simulated and real-world models.

Students can conduct meaningful research by perusing rich electronic libraries, taking advantage of online tutorials, accessing web-based information, and consulting archives of discussions. They can bookmark and organize websites to better trace their research, create web-page summaries of their findings, and even use information organization software to help plan more efficient learning strategies. Online testing can employ role-playing, simulations, and modeling to further deepen and enhance learning.

Real-time guidance with ample face time keeps online learning from becoming impersonal and unfocused. Online tools are not merely a "plug-in" for traditional learning. Meaningful interaction offline translates to better accountability online. Skillful alignment between online and offline instructional strategies is the best way of meeting students' academic needs.

Personalization and Common Core State Standards

Throughout this book, we relate students' and teachers' experiences with personalized learning. The majority of the case studies are compilations of personalized teaching and learning experiences that we have observed in our work with teachers using one-to-one programs and personalized learning or through research.

That said, let's look in on some students who are engaged in learning experiences targeted precisely at their knowledge and skill levels. Four students are taking an advanced course on playwriting and are reading each other's new dialogues via computer sharing, while several others are improving their English language skills as they play a vocabulary game. Three small groups are working on projects they devised to demonstrate costume design, set building, and acting skills. All these students are in the same classroom, and we can see that they're all enjoying their work. The teacher is walking from group to group, asking and answering questions.

In this time of doing more with less, educators are forced to do more with lessons. And, in addition to budget shortfalls and technological change, administrators and educators are also grappling with the implementation of the new Common Core State Standards Initiative.

Personalized learning, in its initial adoption phase, has already proved itself as a dynamic way to produce higher levels of achievement for students and improved working conditions for teachers. But how can it help educators adhere to Common Core standards and—more important—close the gap between where students are and where they need to be?

Personalized learning can use cost-effective, practical strategies to help students achieve Common Core standards within today's financial and time parameters. Project RED, described in Chapter 1, is a national research and advocacy plan that investigates how technology can help educators reengineer the U.S education system. It shows an average cost of moving from a traditional classroom to a one-to-one classroom of $298 per student per year, with potential savings of more than $400 per student per year. Areas with the potential to generate direct savings include moving to digital materials and online assessments, reducing print and copying budgets, and moving professional development online. An example of indirect savings would be reductions in the cost of postsecondary remediation (Greaves et al., 2010).

To be prepared for college, work force training, and life in a technological society, students need the skills to gather, comprehend, evaluate, synthesize, and report on information and ideas; conduct original research to answer questions or solve problems; and analyze an extensive range of texts in old and new media forms. The needs to conduct research and to produce and consume media are embedded in every aspect of today's curricula. Similarly, with personalized learning, research and media skills and understandings are embedded throughout the Common Core standards.

By the end of this decade, most U.S. schools will fully incorporate instructional technology into their structures and schedules, using predominantly digital instructional materials aligned with the Common Core. Learning will be more personalized. The reach of effective teachers will be expanded. Personalized learning presents large-scale opportunities to develop schools that are productive for all students by ensuring that the right resources and interventions reach all students at the right times.

By elegantly blending assessments with daily classroom instruction, technology-based learning platforms can serve as the cornerstones of revolutionary educational change. These platforms have the potential to personalize the learning process, support teachers to enact best teaching strategies, and help students to meet ambitious and rigorous standards (Intel, 2013, pp. 1–3).

With digital technology, testing can be personalized and performances evaluated for all individuals in real time. Online testing can also leverage content-embedded assessments (e.g., learning games, simulations) to deepen engagement as well as to power adaptive instruction (i.e., adaptive assessments linked to units of instruction) and make it easier for teachers to differentiate instruction. Rigorous, competency-based online courses also encourage frequent writing assignments, along with structured feedback; help students move at their own pace; connect parents and siblings to learning opportunities; leverage teachers' talents in diverse ways; and match Common Core testing environments (Bailey, Ellis, Schneider, & Vander Ark, 2013).

School systems that fully incorporate educational technology will need more flexible teacher roles; better financing of classroom technology; and regular self-evaluations, as well as regular teacher and student assessments, so school officials know what works. School officials need to integrate their databases to enable connected information systems—systems specific to data collection, analytics, and reporting—to be powerful enough to fuel truly personalized learning and track real-time students' performances. In order to create dashboards to create meaningful statistics from disparate data and for

website assessments, administrators should view their data as a valuable resource to aid in planning and assessment.

Research suggests that availability of traditional plus virtual learning options will create new environments in which students make choices to customize their learning experiences to suit their personal and changing needs. Thus, this technology-supported, choice-based model can increase access to education and experts. The choice-based model "can also blur distinctions between courses—rendering separate remedial or advanced courses unnecessary (Smith, 1997)"—while providing rigorous learning environments that are:

- Flexible: Many students can set their own timelines and decide when, at what pace, and in what format they wish to learn.
- Competency-based: A student's prior experience is factored into his or her education plan, resulting in courses built around concepts and learning outcomes.
- Mentored: When a student doesn't understand a concept, he or she can access a dedicated faculty "mentor" who can help them to succeed.
- Organic: Course sequencing and assignments are fluid to encourage self-directed learning.

Through choices offered as extensions to traditional, face-to-face classes, high school students can join college students and lifelong learners in workplace environments that offer access to learning modules and courses.

Personalized learning utilizes cognitive learning science to enable customized learning experiences. It's about creating a dynamic environment of active learning, where students make choices and are encouraged to take academic risks while being supported by their teachers and the structure of the curriculum. Assessment information helps students expand their learning and gives teachers instant feedback on students' performance and understanding. Assessment programs also create individualized coursework for students based on their unique learning styles and/or academic abilities.

Evidence-based cognitive learning science demonstrates that students learn better when they focus on content rather than being forced to generate solutions, particularly when their problem-solving skills are still weak. Thus, learning outcomes improve when students are effectively managed through sound, responsive instruction and problem-solving strategies, metacognitive skill development, and test-taking skills.

At-risk, on-level, and advanced students can work at their own paces. Their teacher is alerted (by web-based reports and via email) whenever they require additional support or interventions. Personalized learning systems—where instruction quickly adapts to each student and results are efficiently measured in real-time—enable teachers to be more effective because programs assess students' skill levels accurately and quickly. Teachers can modify the content, instructional modes, timing, and feedback as needed.

Equipped with this data, teachers can structure learning exercises focused on each student's specific needs, rather than disseminating and presenting information to a large group in hopes of getting through to the majority of the class. In its ideal state, personalized learning allows all students to sustain significant progress, whether they are considered at-risk, exceeding grade-level expectations, or at any point along the continuum.

As opposed to being a cumbersome process for teachers, personalized learning can free teachers to set realizable, engaging personal goals for students as they meet academic benchmarks. Teachers can also facilitate student-to-student collaboration and other 21st-century skills to provide the support that students need to grow, flourish, and realize their potential.

Meeting the Needs of All Learners

Technological tools can be divided into five main educational areas: literacy resources, web tools, digital information resources, social networking sites, and learning management systems.

Literacy resources, such as ebooks, blogs, and discussion forums, can help students learn as they use their preferred learning styles and topics, as well as introduce them to multiple texts on similar topics. Text-to-speech tools, as well as other assistive technologies, can make these resources available to a wide range of students.

Consider a middle school language arts classroom where students are learning the following Common Core State Reading Standard for Literature (RL 7.1): "Cite several pieces of textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text" (www.corestandards.org/ELA-Literacy/RL/7/#CCSS.ELA-Literacy.RL.7.1).

Note that the standard does not specify a specific text; therefore, the wide range of available digital texts available allows a teacher to focus on the skill a student is learning rather than on understanding of a specific text. One student may choose to demonstrate proficiency in the standard by responding to a digital short story by a contemporary author, while another, who is more advanced, may read a classic novel available on Project Gutenberg's website (www.gutenberg.org). Nonnative English speakers can use e-texts to continue to develop their critical thinking skills while they are learning English. Teachers may also find ways for students to demonstrate their understandings of the skill through graphic novels or even audiobooks, all available digitally.

Web tools, such as podcasts, wikis, media editors, and aggregators, allow students to demonstrate their learning in multiple ways. Using these tools not only helps students develop important technology skills, but also provides ways for students to share their work and benefit from the motivation of an authentic audience. With learning activities carefully designed to meet content-area standards, students can make choices about how to show what they are learning in ways that help them explore new technologies and build on current skills.

When students in Duane Webb's U.S. history class study the Cold War era, students culminate their learning with a project in a media of their choice. Prior to beginning their work on the project, Webb gives them a rubric that specifies the content and the level of quality he expects of their projects. The rubric also includes descriptions of 21st-century skills, such as collaboration and self-direction, that will be part of students' final grades.

Trang, a Vietnamese immigrant who is still learning English, is creating a video where she interviews family members and American neighbors and friends about their Cold War experiences. This project allows her to do some research in Vietnamese while creating a final project in English.

Bobby, a student with learning disabilities, is very interested in the arms race and chooses to create a wiki that dramatically illustrates weapons and tactics used during the Cold War and explains the political context of their development. Because Bobby often has trouble staying organized and completing tasks, he uses productivity apps, such as to-do lists and calendars, as well as self-direction checklists, to make sure he stays on track and meets the project's requirements. Bobby's interest in the topic, combined with the specific guidelines of the project, ensure that he completes the project with a high quality level and meets the important content standards, 21st-century skills requirements, and technology expectations.

Digital information resources provide students with immediate answers. Instant access to encyclopedia sites, podcasts, expert websites and blogs, as well as to media sites, ensure that students are able to interact effectively with content and experts.

Web research is the most common use of technology in 21st-century classrooms. Although students need considerable instruction in thinking critically about information they find on the web, it is clear that useful and formerly unavailable resources can help students explore practically any content-area topic. The diversity of these resources enhances and strengthens the personalization of learning through students' choices and teachers' recommendations.

Students in Bob Silvers' fourth grade class are studying the following Next Generation Science Standard: "Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways" (www.nextgenscience.org/4ls1-molecules-organisms-structures-processes).

To demonstrate their understanding of this standard, students are asked to use graphics software to create an annotated image that illustrates their understanding of this standard. For this activity, Silvers has selected relevant websites for students to use for their research. He has taught his students important skills for using the web. He wants those students who are capable to have as many choices as possible so they can develop and strengthen their critical thinking skills. To scaffold the learning of some students, he provides a list of sites at different reading levels, so that students with special needs can participate fully in the project.

Katie, a special education student with an Individualized Education Program (IEP) accesses websites at her reading level to complete a science activity. She practices her skills at "reading about science" with text at her reading level and develops her technology skills along with the rest of her class.

Social networking sites, although often overlooked and even rejected, by many educators, make available to students with special needs a network of similar students, as well as educators and experts. With appropriate supervision and monitoring of students using these sites, social networks can alleviate these students' isolation. Networking sites are especially valuable for students who have problems communicating and whose appearances may detract from building constructive relationships with peers and others.

Donald, a high school junior who suffers from autism, uses Edmodo, a social networking site designed specifically for educational uses, to connect with other students. Doing this helps him develop critical socialization skills for the digital world of the 21st century. With guidance, he can learn how to adapt this learning to face-to-face interactions.

Dawn, a middle school student with a severe writing disability, uses the microblogging network that her teacher created for her class on Edmodo to share her thoughts about the novel she is reading in her language arts class. Because her posts must be brief, no more than 140 characters, she can focus on meaning and pay attention to the structure and mechanics of her posts as she practices keyboarding, an essential skill for participating in today's digital world.

Learning management systems (LMSs) that help teachers organize instruction and communicate with students and parents support personalization by providing a platform for accessing content and keeping records of students' progress.

For example, a high school biology teacher uses her LMS as a one-stop shop for students to make choices about their learning and for her to monitor their progress. On her class website, she includes the following resources for a group project on genetics:

- Wikis and collaborative documents for students to use in planning
- Links to video resources and websites at different levels of difficulty and complexity
- Self- and peer assessments that students will complete during the project
- Suggested productivity apps, such as calendars and to-do lists, to keep students on track
- Online discussions for students to respond to required readings
- Due dates and project requirements
- A showcase site for students to share their final projects

This secondary biology teacher also uses the tools within the LMS, such as the wikis and the documents that trace individual students' participation and contributions to the project.

At-Risk Students

For struggling or disengaged students, school can be a frustrating, dispiriting place. At-risk students often begin school academically behind. Many children in the United States enter first grade far below the norm, and they have a hard time catching up—if

they ever do at all. Their failures prevent them from climbing the ladder of academic growth on schedule. It is a given that delinquency is correlated with school failure, particularly the failure to learn to read. For the schools and the communities, failure is costly, requiring special programs, extensive social services, and even detention services.

Faced with the difficulty of educating at-risk students, school systems are turning to one possible solution that links at-risk students' success to their motivation. By using instructional technologies in creative ways, school systems are attempting to increase students' motivation, with the hope that when students are given choices as to how and what they learn, they will feel more invested in their learning and improve their achievement outcomes. As more school systems commit to engaging and, thus, educating *all* students instead of accepting students' failing and dropping out, differentiated instruction and innovative school improvement plans using interactive technologies are becoming increasingly pervasive. The National Research Council's and the Institute of Medicine's report, *Engaging Schools: Fostering High School Students' Motivation to Learn*, argues that motivation is a key factor in the success or failure of education (2003). At the forefront of technological shifts in education is the premise that students prefer to use technology and are motivated to learn because technology is more engaging than conventional approaches.

Technology and the powerful place it holds in our culture, as well as in the global economy, can influence the future success or failure of at-risk children. Using instructional technologies has the potential for raising achievement and increasing success among our most vulnerable student groups (Brown, 2002; Slaughter, 2009). By empowering at-risk youth who have the cognitive abilities to navigate the technology industry, educators can teach them the skills to aid their academic success and better equip them for the future (Young, 2002).

On November 19, 2012, "U.S. Secretary of Education Arne Duncan brought together leading experts from the public and private sectors at a Summit on Education in Correctional Facilities. . . . [The] Summit was designed to tackle the pressing issues around educational access and quality for court-involved adults and youth" (PRNewswire & USNewswire). These youth are among those educators deem "at-risk."

"'All students deserve a high quality education,' said Jim Shelton, the Department of Education's Assistant Deputy Secretary for Innovation and Improvement. 'This economic environment has highlighted the tremendous cost to communities of a system that results in less than 15% of those it serves receiving high school diplomas or equivalents'" (PRNewswire & USNewswire, 2012, p. 1).

Personalized learning addresses both the needs of at-risk students and the community by increasing opportunities for successful outcomes while decreasing the expectations and predictability of low achievement by traditionally underserved students. It creates a second chance for students who have been failed by the traditional education system to realize and be actively engaged in their academic success. Thus, personalized learning increases opportunities for at-risk students to be aware of and actively involved in their own social change.

By honoring the real-world lives of students and integrating the relevance of technology into curriculum, instructional practices, and support, personalized learning works. It creates a blueprint for engaging at-risk youth. The blueprint combines high expectations for every student; a rigorous, competency-based and standards-aligned approach; a small, personalized learning environment; opportunities to make real-world connections; and distinct pathways toward becoming successful adults.

Personalized learning allows the accumulation of a data warehouse for every student, enabling schools to collect, store, and analyze data. The data warehouse can maintain many years of data (a student's entire K–12 records, for example), facilitating ongoing analysis. Superintendents, for example, could evaluate the effectiveness of a district's at-risk reading programs according to other assessments and the students' demographics, as well as look for success factors based on the students' involvement in other, complementary programs, to better identify which children will benefit from specific programs in the future.

This data warehouse acts as a ongoing repository, providing a foundation for educators to layer on analytics, reporting, and other capabilities as part of an education intelligence or decision support system. Ideally, the results can be dynamic curricula that challenge and engage at-risk students while preparing them for academic success. It's a competency-based and standard-aligned approach—it does not tell teachers what to teach but how to engage students on deeper, more meaningful levels.

Personalized learning can be especially effective for at-risk or struggling students. The following is a hypothetical example of how personalized learning might impact at risk students in the classroom:

> Brandon is a fifth grade special education student reading at a third grade level. He spends part of the school day with his regular class and part of the day receiving instruction at his level in reading and math. Because Brandon is a struggling reader,

in the past he was unable to participate in several of the literacy-based activities in his class. With the advent of the one-to-one laptop program, Brandon uses text-to-speech technology to listen to some of the stories that his class is studying. While he is learning more basic reading skills in his special education class, he can practice critical thinking and comprehension skills with the same texts his class is studying. He is also able to contribute to discussions and take part in other experiences such as dramatizations and personal responses along with his classmates.

Teaching students who are performing below grade level involves more than simply spending more time repeating drills on subject matter. Here are some Common Core approaches to accommodating students who are below grade level in the classroom:

- Model problem-solving sets with drawings and graphic organizers, giving many examples and visual displays.
- Guide students as they select and practice using their own graphic organizers and models to solve.
- Use direct instruction for vocabulary with visual or concrete representations.
- Use explicit directions with steps and procedures enumerated.
- Guide students through initial practice, promoting gradual independence.
- Use alternative methods of delivery of instruction, such as recordings and videos that can be accessed independently or repeated if necessary.
- Scaffold complex concepts and provide leveled problems for multiple entry points.
- First use manipulatives or real objects; then transfer examples from concrete to pictorial to abstract.
- Have students restate their learning for the day. Ask for a different representation in the restatement.
- Encourage students to explain their thinking and strategies for the solution.
- Choose tasks that are "just right" for learners but teach the same concepts.
- Clearly model steps, procedures, and questions to ask when analyzing and solving problems.
- Cultivate peer-assisted learning interventions for instruction and practice.
- Have students work together to solve and then check their solutions.
- Teach students to ask themselves questions as they solve: What is being asked? Do I have all of the information I need? What do I do first? In what order do I solve this problem?
- Practice routines to ensure smooth transitions.

- Set goals with the students regarding next steps and what to focus on next (Intel Education and Tech & Learning, 2013).

Students with Disabilities

"Ensuring that children with disabilities enjoy opportunities for learning in an inclusive environment requires changes in attitude, backed by investment in teacher training and learning equipment" (UNESCO, 2010, p. 12).

Worldwide, there are roughly 186 million children with disabilities who have not completed their primary school education, making them the world's most disadvantaged minority in terms of education (World Bank, 2002 [www.opcr.org/english/stats_world.htm], cited in UNESCO, 2009).

The number of children with special education needs has grown in the past 20 years due to a broader definition of disabilities and better diagnostic tools. According to the Organization of Economic Co-operation and Development, as many as 35% of school-age students need some kind of special support or have been diagnosed as having special needs (Microsoft, 2013).

The inclusion of children with disabilities in mainstream schools promotes universal primary completion, is cost-effective, and contributes to the elimination of discrimination. This is especially crucial considering that students with disabilities are less likely to attend, progress through, and complete school than their peers.

Students with disabilities are a diverse group with one common characteristic: the presence of disabling conditions that hinder their abilities to benefit from general education. In order for students with disabilities to meet high academic standards and to fully demonstrate their knowledge and skills, their instruction must incorporate supports and accommodations (www.corestandards.org/assets/CCSSonSWD-AT.pdf, p. 1).

Focusing particularly on vulnerable and marginalized groups, personalized learning seeks to develop the full potential of every individual, ensuring that students are not excluded from the general education system on the basis of their disability (UNESCO, 2011). Personalized learning requires attention to the unique needs of all students of all abilities, acknowledging that each have different learning styles, including students with mild, moderate, or severe disabilities. The use of technology in education plays a particularly vital role by enabling flexible curriculum development and assisting students with

disabilities to participate as equals in the learning experience. It also helps to prepare them for lifelong learning, recreation, and work outside of school.

It is important for teachers to build awareness of specialized, assistive educational solutions and the accessibility features of mainstream technologies to enable meaningful learning, as well as learning how educational materials can be produced and adapted digitally to meet the accessibility requirements of students with disabilities (Massachusetts Department of Elementary and Secondary Education, 2012).

Gathering information about these students' unique needs is only half the battle. To put this knowledge into action, teachers need to solicit expert advice from special educators on how to actually *meet* those unique needs and create individualized education programs (IEPs) that will be prescriptive as to how each student's unique needs are met.

Embracing the benefits of assistive technology to assist students with learning disabilities is vital. For teachers who aren't comfortable with technology, this poses a challenge. Viewing this technology as a pedagogical tool—one that integrates with all differentiated learning objectives—can help technology-reluctant teachers to come around to the benefits of these assistive tools. It's a new outlook: viewing disabilities as an opportunity to reinvigorate learning styles with differentiated experiences (Hobgood & Ormsby, 2011).

Assistive learning tools help bridge the gap between the general curriculum and the needs of students with disabilities. They foster student engagement by allowing students to interact with information in diverse ways. This not only allows flexibility in how subjects are presented, but also in how students can demonstrate their knowledge and skills. Providing the appropriate support tools for these students reduces barriers often present in traditional instruction.

Augmentative and alternate modes of media are relatively simple ways for teachers to reach out to students with disabilities. Mainstream technologies, such as computers, web browsers, and mobile phones, contain built-in accessibility features. There are also assistive technologies—such as hearing aids, screen readers, and adaptive keyboards—and accessible media and formats—such as accessible HTML (hypertext markup language), videos with captioning, and DAISY (Digital Accessible Information System) books (www.daisy.org/education)—that can make learning easier for students with disabilities.

For a list of assistive technology systems, see *Assistive Technology for Kids with Learning Disabilities: An Overview* by Kristin Stanberry and Marshall Raskind (www.readingrockets.org/article/33074).

So teachers faced with the challenges of teaching students with disabilities should first take into account the different learning styles of all students with disabilities then learn about accessible technology and the role it can play in the classroom. Based on this assessment, teachers can create and adapt teaching, learning, and assessment materials (especially text into accessible formats) and explore the range of accessible technology, resources, and peer-to-peer support available.

Apart from the obvious benefits to students and teachers, personalized learning can help combat the risk of social exclusion that students with disabilities often experience by replacing physical access with virtual access to many learning experiences.

Students with disabilities may require braille, large print, audio, or special digital files. For a good explanation of student materials that satisfy the National Instructional Materials Accessibility Standard (NIMAS) format, visit www.p12.nysed.gov/specialed/aim.

Individualized education programs (IEPs) or Section 504 Accommodation Plans should be the first sources of information for designing instruction for students with disabilities. Here are some Common Core approaches when teaching math to students with disabilities with suggestions as to how these platforms may be used:

- Teach from simple to complex, moving from concrete to representation to abstract at the student's pace.
- Clarify, compare, and make connections to math words in discussion, particularly during and after practice.
- Partner key words with visuals and gestures.
- Connect language with concrete and pictorial experiences.
- Couple teacher-talk with "math-they-can-see," such as models. Let students use models and gestures to calculate and explain.
- Teach students how to ask questions to extend "think-pair-share" conversations.
- Couple number sentences with models.
- Enlarge print for visually impaired learners.
- Use student boards to work on one calculation at a time.
- Invest in or make math picture dictionaries or word walls.
- Elaborate on the problem-solving process.
- Read word problems aloud.
- Post a visual display of the problem-solving process.

- Talk through the problem-solving process step-by-step to demonstrate thinking process.
- Before students solve, ask questions for comprehension.
- Focus on students' mathematical reasoning, not their accuracy in language.
- Listen intently in order to uncover the math content in the students' speech.
- Provide learning aids, such as calculators and computers, to help students focus on conceptual understanding (Intel, 2013).

Overall Differentiated Techniques for Students with Disabilities

Provide a variety of ways to respond: oral, choral, student boards, concrete models, pictorial models, pair share, and small group share. For example, use student boards to adjust "partner share" for deaf and hard-of-hearing students. Partners can jot questions and answers to one another on slates. Use vibrations or visual signs to elicit responses from deaf and hard-of-hearing students.

- Vary choral response with written response on student boards to ease linguistic barriers. Support oral or written response with sentence frames.
- Adjust oral fluency games by using student and teacher boards or hand signals. Use visual signals or vibrations to elicit responses.
- Adjust wait time for interpreters of deaf and hard-of-hearing students.
- Give students a chance to practice the next day's activities beforehand.
- Give students a few extra minutes to process the information before giving the signal to respond.
- Assess by multiple means, including "show and tell" rather than written.
- Have students check off or highlight each step as they work.
- Teach students to use self-questioning techniques.
- Concentrate on goals for accomplishment within a time frame versus a task frame.
- Make eye-to-eye contact and keep teacher-talk clear and concise. Speak clearly when checking answers for activities and problems.
- Check frequently for understanding.
- Assign a buddy or a group to clarify directions or process.
- Use songs, rhymes, or rhythms to help students remember key concepts.
- Point to visuals and captions while speaking, using your hands to clearly indicate the image that corresponds to your words.
- Incorporate activity. Get students up and moving, coupling language with motion. Make the most of fun exercises for activities.

- Follow predictable routines to allow students to focus on content rather than behavior.
- Reteach the same concept with a variety of fluency games.
- Allow students to lead group and pair-share activities (Intel, 2013).

Gifted Students

The term "gifted" applies to children whose abilities, talents, and potential for accomplishment are considered so developmentally advanced that they require special provisions to meet their educational needs. These students are capable of high performance or exceptional learning behavior due to intellectual ability, academic aptitude, creative thinking, leadership and human relations abilities, as well as artistic aptitude.

Students who perform far beyond their grade levels—despite being forced to comply with a lesson plan not tailored to their skills—will more than likely become disenchanted with school at some point, losing their motivation to learn.

This is where personalized learning comes into play. Driven by both emergent and existing technology, personalized learning can challenge gifted students with a differentiated curriculum without taking an inordinate amount of class time or tapping limited resources.

Differentiation of curriculum, instruction, and assessment is essential for meeting the needs of students who are gifted. With technologically supported education, parents and teachers can see where gifted children need improvement and where they surpass expectations and need additional challenges for full engagement.

Personalized learning provides support systems for students with exceptional abilities or potential, such as long-term planning and monitoring of progress, allowing them to learn and grow toward accelerated expectations. The pace of instruction is based upon individual experiences and needs and may include different forms of acceleration over time. It's a problem-solving process that uses data on students' strengths and interests to implement appropriate, rigorous, and relevant curriculum and instruction. A variety of assessments can contribute new data about students, so that their learning is dynamic and adjustments are made for pace, depth, and complexity of the evidence-based practices utilized.

With data from the assessments, each student receives both prescribed learning paths and enrichment activities that address and engage the each one's specific educational and social needs. This is particularly crucial for gifted students who grow bored when not

appropriately challenged. Personalized learning scales move adaptively with all students, taking them beyond grade levels as appropriate.

Personalized learning provides gifted students opportunities to build networks of concepts and apply learning in new contexts, building upon their knowledge base of facts. Multidimensional assessments and prescribed personalized learning paths help students to develop the critical thinking, analysis, personal, and technological skills necessary to succeed in K–12 classrooms and beyond.

Teachers making sure that all students are on their own best learning paths is especially important for children with any exceptionality. A child who is intellectually gifted in math, for instance, but struggling in English could have a plan that places emphasis on improving reading and writing. Similarly, if the student is having difficulty working as part of a team, collaborative tools, such as Google Docs and Edmodo, can be used to set up and maintain projects among multiple people with widely varying skill levels.

Every community has gifted children, so letting students reach out geographically, using Skype, email, or other collaborative tools, can be effective motivators.

Online classes can also differentiate education for gifted students. Massive Open Online Courses (MOOCs) are the most recent in a series of innovations.

The accelerated pace at which highly able students learn requires flexible pacing strategies, such as the following:

- Skill grouping
- Curriculum compacting, where a gifted student is allowed to spend less time on the regular curriculum and more time on advanced study and areas of interest
- Contracting when a student reaches a specified criterion on a pretest and may choose from a list of possible alternative or extension activities
- Program provisions for primary or original research, independent studies, mentorships, or courses at other schools through distance education or actually attending the school
- Individual and advanced interests may be met by offering:
  - Mini-courses
  - Interest groups
  - Clubs

- Science fairs
- Independent studies, investigating a "real life" problem, topic, or interest
- Tiered assignments, where students work on the same unit but do assignments at different complexity levels
- Thinking skills classes, where a teacher meets regularly with a group of students to develop their critical and creative problem-solving abilities

Even more than most students, gifted students require personalized learning programs that motivate and challenge them, as well as support their learning styles and needs. Approximately 15% of gifted students have learning disabilities and require assistive technology. It is believed that 20% to 50% of gifted students are underachievers (Weber & Cavanaugh, 2006). The integration of educational technologies can support these students, as well as other gifted students. Accommodations with computer technology can include changing text size; highlighting concepts; and providing quick dictionary access, note-taking tools, and bookmarking. Technology also provides for extension and enrichment of classroom curriculum.

This example explains how personalized learning might transform education for gifted students:

> Emma is an 8th grader identified as particularly gifted in science. In previous years, she was enrolled in a special class for gifted students. This year, with her parents' approval, Emma was placed in a regular science classroom where the teacher has adopted a personalized approach to instruction. As part of an astronomy unit, Emma's teacher has asked students to design projects around questions they would like to investigate and has connected Emma with a local applied physicist to mentor her as she works on designing a space exploration system. She is working on this project with Kyle, a classmate who did not test high enough to be in the gifted program but has a great interest in space exploration. The project is a success for the entire class because it gives Emma and Kyle the chance to challenge themselves by working on a project that interests them enough that they are willing to put in the necessary extra time. Having Emma in the classroom benefits the other students as they discuss their projects and see Emma as a model of an independent, critically thinking student. Emma enjoys interacting with the physicist, Kyle, and her peers.

Accommodating students who are performing above grade level is a unique challenge. It isn't about rushing through a curriculum, but about truly engaging students, so that they

avoid the trap of boredom that can lead to high-achievers squandering their promise. The following actions can be effective for engaging gifted students, as well as those who are highly interested in particular subject matter:

- Teach students how to ask questions to extend "think-pair-share" conversations. Model and post conversation "starters."
- Incorporate written reflection, evaluation, and synthesis.
- Allow creativity in expression and modeling solutions.
- Encourage students to explain their reasoning both orally and in writing.
- Extend exploration of topics by means of challenging games, puzzles, and brainteasers.
- Offer choices of independent or group assignments for early finishers.
- Encourage students to notice and explore patterns and to identify rules and relationships; ask them to share their observations in discussions and writing.
- Foster their curiosity. Facilitate research and exploration through discussions, experiments, internet searches, trips, and other creative activities.
- Have students compete in a secondary simultaneous competition while peers are completing the sprint.
- Let students choose their mode of response: written, oral, concrete, pictorial, or abstract.
- Increase the pace. Offer two word problems to solve, rather than one.
- Adjust difficulty level by increasing the number of steps or by enhancing the operation.
- Let students write word problems to show mastery and/or extension of the content.
- Push student comprehension into higher levels of Bloom's Taxonomy
- Celebrate improvement in completion time.
- Accept and elicit student ideas and suggestions for ways to extend games.
- Cultivate student persistence in problem solving and do not neglect their need for guidance and support (Intel, 2013).

English Language Learners

As the enrollment of English language learners (ELLs) continues to grow, teachers need to be aware of these students' needs, particularly by attending to their oral language development; supporting their use of academic English for speaking, reading, and writing;

and being sensitive to their cultural backgrounds. State adoption of the Common Core State Standards and the move toward high-stakes evaluation of teachers provide opportunities for implementing purposeful teacher effectiveness initiatives designed to improve outcomes among the nation's least-served students, including ELLs.

States throughout the country have set high academic standards for ELLs, who face the extraordinary challenge of learning academic English and mastering the same core content standards that are expected of all students.

English language learners can make rapid progress when their teachers use differentiated instruction. As soon as they feel confident expressing themselves in the new language, ELLs may share experiences that will enhance the classroom environment. These students' differences enrich teaching and learning. Here are some differentiated teaching techniques that will help ELLs:

- Provide multiple means of action, expression, and engagement.
- Know, use, and make the most of students' cultural and home experiences.
- Build on the students' background knowledge.
- Check for understanding frequently to benefit those who may shy away from asking questions.
- Couple talking with illustrative gestures.
- Vary your voice to guide comprehension.
- Speak dynamically with expression.
- Make eye-to-eye contact, and speak slowly and distinctly.
- Vary the grouping in the classroom.
- Provide sufficient wait time to allow students to process the meanings in different languages.
- Keep instructional talk clear and concise.
- Point to visuals while speaking, using your hands to clearly indicate the image that corresponds to your words.
- Get students up and moving, coupling language with motion.
- Celebrate improvement. Intentionally highlight students' math and other subject matter successes frequently.
- Provide a variety of ways to respond: oral, student boards, concrete models, pictorial models, pair share, and small group share.
- Treat first-language and experiences as resources, not as obstacles.

- Provide oral options for assessment rather than written multiple-choice questions.
- Support oral or written responses with sentence frames.
- Ask questions to probe what students mean as they attempt to express themselves in a second language.
- Scaffold questioning to guide connections, analysis, and mastery (Intel, 2013).

In order to make the most of instructional technology, ELLs need to have the language skills and vocabulary necessary to understand how to use the technology. Many ELLs may not have access to a computer or the internet in their home. They also may not know about the services available through the school or library, and they may be unable to get to the library on a regular basis. For ELL students who are learning to use technology, it is especially important to focus on effective teaching strategies that are commonly used in other content areas, such as academic language development, and to demonstrate meaningful interactions with these content areas.

The following instructional techniques and methods using technology are often effective for teaching ELL students:

- Hands-on labs
- Simple, step-by-step instructions
- Lots of large graphics
- Information presented in small chunks
- Real-world exercises

Offer a very basic introduction to technological vocabulary words that students are likely to encounter, including parts of the computer (mouse and screen); items that students may see on their screens (cursor and menu); and verbs referring to what they will be doing when they use their computers (click, double-click, scroll, cut, paste, highlight, etc.). For ELL students, be sure to demonstrate the meaning of the vocabulary word with a visual prop or an action.

Most students are excited about using computers and technology. They are most motivated, however, when they are applying technology skills to content they are interested in. For media projects, the same rules apply: introduce the technology with basic, well-known information, so all students can understand it. Give general guidelines to ensure the quality of projects, and allow students options for individual choices.

Software, online tools, and other technologies help students hone basic language skills they can apply not only in school, but also in other social settings. Technology use helps these students build vocabulary, achieve reading fluency, improve comprehension, access curriculum content, and strengthen their home-school connections.

To assist students who are learning English, work with their other teachers to preview each of their lessons and support the text with suitable images. Images will provide contextual clues and help ELL students determine meanings. Image searches, for example, allow you to search via key words for photographs and illustrations, which can be easily downloaded and printed.

Research shows that if students have literacy in their primary language, they are able to transfer those skills to reading in English (Snow, Burns, & Griffin, 1998). However, locating multilingual books can be a challenge, and buying them can be very expensive. Instead, suggest that teachers in all content areas invite students to publish their own multilingual books using word processing programs.

In the upper elementary and middle school grades, students study content areas in greater depth and are exposed to more complex vocabulary and complicated concepts than in the lower elementary grades. When given only a textbook, ELL students may experience enormous difficulties. Multimedia projects offer students hands-on, engaging ways to explore the content and concepts presented in science, social studies, and other areas. Interactive storybooks support language acquisition, allowing students to strengthen their language skills by hearing the language read to them.

Districts should use data to guide policy and instruction, targeting instructional interventions that have the potential to ensure continuous improvement. Matching assessment to students' language proficiency; differentiating homework; facilitating small, flexible group instruction; and providing alternative ways of accessing key content—such as books and charts written in their first language—all allow ELLs to master the same material as other students while they continue to develop their English language skills.

Recent advances in language translation technology also provide powerful tools for reducing language barriers. With proper design, technology can easily represent information so that there are multiple alternatives for English, multiple options for unfamiliar vocabulary or syntax, and even alternatives to language itself, such as the use of images and video and audio clips.

Meeting the Needs of English Language Learners

Here are key attitudes and approaches to keep in mind when teaching English language learners from Judy Haynes and Debbie Zacarian's book *Teaching English Language Learners across the Content Areas*.

Provide information that the beginning English language learner can understand. Beginning level ELLs must understand the messages that are being conveyed. Materials should be available in their native languages. Teachers need to speak more slowly and use gestures and body language to get across the meaning to English learners. Content area information can be used to teach language. However, educators need to differentiate the language used for instruction. All teachers need to become English language teachers.

Make lessons visual. Use visual representations of new vocabulary and concepts for beginners, including graphs, maps, photographs, drawings, charts, and videos. Tell a story about information in the textbook using visuals.

Link new information to prior knowledge. Teachers need to consider what schema ELLs bring to their classrooms and to link instruction to the students' personal, cultural, and world experiences. Teachers must understand how American culture impacts learning in their classrooms and tell ELLs that our teaching and learning methods may be quite different from those in their first countries. For example, U.S. elementary and middle school teachers do not give long lectures and do not expect students to memorize their textbooks. Secondary teachers may deliver some lectures, but they combine them with many other methods. Teachers also need to explain how our methods, including technology tools and personalized education, help students learn successfully.

Determine key concepts for the unit and define language and content objectives for each lesson. Teachers write the key concept for a unit of study in very simple English or in the native languages of beginning ELLs. During the lesson, teachers need to tie this new learning to the key concept. Additionally, teachers should begin each lesson by writing a content objective in very simple language on the board. At the end of the lesson, students should be asked if they learned the key concept and the content objective. Language objectives for ELLs that are suitable for their level of English language acquisition also need to be set. If all content area teachers set objectives that they share with

students and have them translated for beginning level ELLs, they will include their beginners in the content lesson as their vocabulary and listening comprehension start to build.

Modify vocabulary instruction for ELLs. English language learners require direct instruction of new vocabulary. Content area teachers need to go beyond the concrete nouns that are needed for the lesson. Beginners should also have multiple opportunities to practice the pronunciation and learn the meaning of new words. Teachers need to tie new vocabulary to prior learning and use visual aids to reinforce meaning.

Use cooperative learning strategies. Lecture-style teaching excludes beginning ELLs from the learning in a content area classroom. Working in small groups is especially beneficial to beginning ELLs who have an authentic reason to learn key concepts and use academic vocabulary. Beginning ELLs should be grouped with their same language peers when possible and encouraged to help each other. Beginning ELLs can gather supplies, draw pictures, and look for illustrations online.

Modify testing and homework for ELLs. Content area homework and assessments need to be differentiated for ELLs. Teachers should allow alternative types of assessment: oral, drawings, and manipulatives. Homework and assessment should be directly linked to classroom instruction, and students should be provided with study guides so that they know what to study.

Other points that are critical to the needs of ELLs are staff capacity; a schoolwide focus on English language development and standards-based instruction; shared priorities and expectations in regard to educating ELLs; and systematic, ongoing assessment and data-driven decision making.

A document camera can be particularly powerful for ELL students. Teachers can build students' language capacities by having them listen as the teacher explains various students' work. "In addition, the camera works with tactile objects, not just paper. Anyone who has taught ELLs knows the power of visual modeling and representation" (Bassoff, n.d.).

For example, this is how personalized learning might impact ELLs in the classroom:

> Chan is a bright, outgoing high school student from China who is learning English and has a moderate visual impairment. This year all freshmen at her school received Chromebook laptop computers, and Chan's parents are enthusiastic about how the device has helped their daughter be successful. Chan's chemistry teacher uses an e-textbook with a Chinese/English dictionary that helps her with technical vocabulary and allows her to enlarge the text so she can read it easily. Because the course is project-based, Chan is able to personalize her learning experiences to maximize her skills and give her more practice in areas where she needs review. Chan loves to work with new technologies and is enthusiastic about using her knowledge to design presentations and simulations. The range of options Chan has also allows her to connect her learning to events and experiences in China and to access data and information in her native language. Because she can modify websites so they are legible and can use a translator to double-check her understanding of English-only sites, Chan is able to stay on track with her content learning while improving her English skills.

It's important to provide ELLs with a good support group and to ensure that their first experiences help them to keep their goals high. Making ELLs a whole-school priority, encouraging collaboration, and keeping class sizes manageable are simple measures that can make significant, long-term impacts.

YOUR TURN

Personalized Learning for All Learners

Stop and Reflect: What challenges are you experiencing in your school with meeting the needs of all learners?

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Discuss: How have teachers in your school used technology to meet the needs of diverse learners?

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Apply: How can your school personalize learning for each of these student groups?

	Comments
At-Risk Students	
Students with Disabilities	
Gifted Students	
English Language Learners	

CHAPTER

How Can Personalized Learning Transform Teaching?

The key to learning is effective teaching. Given the laudable goals of personalized learning, how can a computing device for each child move instruction in that direction? Educators considering one-to-one programs have a variety of instructional models to study, enabling each institution to find a strategy aligned with the technology tools that will meet its particular needs and environment.

Instructional Models of Technology Integration

In 2008, Don Knezek, then the chief executive officer of the International Society for Technology in Education (ISTE), said that for more than 20 years research had shown a convincing trend, that "when implemented appropriately, the integration of technology into instruction has a strong positive impact on student achievement" (ISTE, p. 4).

The Common Core State Standards in math and language arts (2014) and the Next Generation Science Standards (2014) both explicitly and implicitly include technology as a separate set of skills and as a component of content instruction.

As with any educational innovation, the impact of technology depends on how it is integrated into instruction. ISTE (2008) describes seven features of successful educational technology programs.

- Effective professional development
- Teachers' direct application of technology to standards
- Technology as an integrated part of the daily learning schedule
- Technology used to individualize learning experiences for students
- Student collaboration using technology
- Student projects and real-world simulations
- Support, leadership, and modeling by administrators, teachers, and the community (p. 5)

Technology changes the way teachers teach, offering educators effective ways to reach different types of learners and assess students' understanding through multiple means. It also enhances relationships between teachers and students. When technology is effectively integrated into subject areas, teachers grow into roles of adviser, content expert, and coach. Technology helps make teaching and learning more meaningful and fun.

Different methods of technology-enabled learning have evolved with the greater availability of broadband and wireless connectivity and advances in the size and capability of devices. The umbrella term of technology integration includes several instructional models: blended learning, flipped learning, online learning, and mobile learning.

Blended Learning

The goal of blended learning is to take advantage of the best aspects of online and face-to-face instruction. In blended learning environments, students learn at least in part through online delivery of content and instruction with some element of control over time, place, path, and/or pace and at least in part at a supervised brick-and-mortar location away from home (Staker & Horn, 2012).

For example, a face-to-face discussion can be effective for brainstorming ideas and planning where fast-paced interactions can help students build on and react to each other's ideas. An online discussion, on the other hand, can encourage more thoughtful and thorough responses, where students are expected to develop arguments and provide support for their ideas.

In the past, digital materials have played only a supplementary role in the classroom. Yet, with a blended learning approach, classroom time can be used to engage students in advanced interactive experiences. The online portion of a course can provide students with multimedia-rich content at any time of day, anywhere students have internet access.

The term "blended" encompasses a broad continuum and can include any integration of face-to-face and online instructional content. The blend of face-to-face and online materials will vary depending on the content, the needs of the students, and the preferences of the instructor. Creating high-quality blended instruction can present considerable challenges. Foremost is the need for resources to create the online materials to be used in the courses. Materials development is a time- and labor-intensive process, just as it is in any instructional medium. In addition, blended instruction is likely to be a new concept to many students and faculty.

When blended learning is used successfully, it benefits students and teachers. Students work at their own pace and experience success on an individual level, using a range of digital tools and resources to improve their ability to think, communicate, and collaborate.

Teachers, meanwhile, use their time more productively, focusing on important activities like developing their students' critical thinking and writing skills and implementing project-based learning. By capturing students' performances in real time, teachers have more opportunities to personalize learning through frequent, timely feedback.

With the internet as the majority of students' key resource for information sharing, entertainment, and interaction, the learning potential of time online is irresistible. In fact, educators, seeking to use students' connectedness to their advantage, are integrating blended learning environments into core programming. This combination of the traditional and the digital creates a highly personalized, more productive learning experience with dramatically better results than traditional methods alone. In fact, a teacher's effectiveness may actually have more impact on student results in the digital age. As digital learning levels the global playing field for covering the basics, teachers' capability to handle the more complex instructional tasks will increasingly differentiate outcomes for students. "The best combination," U.S. Secretary of Education Arne Duncan has said, "is great teachers working with technology to engage students in the pursuit of the learning they need" (Duncan, 2010).

Blended learning promises to revolutionize literacy learning and boost reading growth trajectories by supporting key instructional strategies both in and outside the classroom. A distinctive tool for personalizing reading growth is the Lexile reading framework (http://lexile.com).

Lexile measures evaluate any text's reading level and complexity, enabling teachers to select reading material to target each student's needs with appropriate text selections. The Common Core State Standards for English Language Arts offers recommended Lexile bands by grade levels, which can be incorporated into instruction designed to prepare students for the reading demands of college and careers. Lexile measures are available from nearly 50 popular reading tests and programs, including more than 20 state assessments and the most commonly used norm-referenced and benchmark assessments.

Metrics and research tools have already transformed the way educators think about reading growth and the benefits of matching readers with texts. The Lexile Frameworks for reading and writing, for example, are currently being used to power more integrated, interactive utilities for technology-based personalized learning platforms. Teachers and administrators are already embracing these innovative learning systems, which recognize the value of blended learning. Organizations such as Capstone Digital and Achieve3000 have utilized the Lexile framework to offer programs and products that continue to spur the personalized learning movement.

To be ready for college, workforce training, and life in a technological society, students need to have mastered the skills to gather, comprehend, evaluate, synthesize, and report on information and ideas; conduct original research in order to answer questions or solve problems; and analyze an extensive range of texts in old and new media forms. The needs to conduct research and to produce and consume media are embedded in universities' curricula and professional work. Likewise, blended learning accommodates the priorities of higher education, professional careers, and lifelong learning in a technological society.

By elegantly blending assessment with daily classroom instruction, technology-based learning platforms can serve as the cornerstone of revolutionary educational change. They have the potential to personalize the learning process, support teachers in enacting best teaching strategies, and help students meet ambitious and rigorous standards.

Flipped Learning

The Flipped Learning Network defines flipped learning as, "a pedagogical approach in which direct instruction moves from the group learning space to the individual learning space, and the resulting group space is transformed into a dynamic, interactive learning environment where the educator guides students as they apply concepts and engage creatively in the subject matter" (http://flippedlearning.org, 2014).

In a "flipped" classroom, all students have personal computers they use at home and at school. Teachers post instructional material on the class website in the forms of links to videos, text files, and other resources for learners to review outside the classroom. For example, students may watch an instructional video online and the next day in the classroom work with a group on an activity to apply the information from the video. In the flipped environment, the teacher's classroom role is to listen to, question, and observe students as they work and to support their learning as necessary.

Instead of spending class time taking notes while teachers deliver lectures and filling out worksheets as homework, students access core content at home at their own pace and use classroom time for guided practice, experiments, and collaborative projects.

Students prepare for classes by watching videos, listening to podcasts, reading articles, and contemplating questions that access their prior knowledge. Some of the videos and podcasts may have been created by their classroom teachers as lectures or illustrated presentations. After accessing this content, students are asked to reflect upon what they have learned and organize their questions and areas of confusion. Students can then, in most cases, post their questions. Instructors sort through these questions prior to class, organize them, and develop class material and scenarios that address the various areas of confusion. Instructors do *not* teach material that students already understand. In classes, the Socratic method is used: Teachers pose questions and problems, and students work together to answer the questions and solve the problems.

The availability of a variety of online educational resources makes flipping a classroom particularly appropriate for some subject areas or topics. Teachers appreciate being able to tape their own tutorials and demonstrations—on their own time—to fit the specific circumstances of their classes and to post them to class websites or video-sharing tools.

Some educators may be concerned that exposing students to content presentations such as lectures and modeling outside the classroom environment limits engagement and critical thinking, making them passive consumers of content. In fact, flipped learning

strategies open up more possibilities for interaction by including activities such as online reflections and discussions to accompany presentations that include all students, rather than only those who usually participate in a whole-class discussion or activity.

Online Learning

Many students—perhaps without even realizing it—are already seeking ways to personalize their learning. They instinctively turn to online classes, tutorials, and wikis to study topics that pique their intellectual curiosity, to message and discussion boards to explore new ideas about their world, or to online collaboration tools to share their expertise with other students.

The annual report by the Evergreen Education Group, *Keeping Pace with K–12 Online and Blended Learning* (Watson, Murin, Vashaw, Gemin, & Rapp, 2013), investigated the state of online learning in the United States during the 2012–13 school year. The group found that:

- Florida is the only state that provides a full range of supplemental and full-time online opportunities to all students across the state.
- At least 24 states and Washington, DC have blended schools. Many of these schools are charters, allowing them flexibility in how they serve their students. However, an increasing number of these schools are traditional public schools that are changing their teaching and learning models to better meet student needs and sometimes to cut costs.
- Multidistrict fully online schools served an estimated 310,000 students in 30 states in SY 2012–13.
- In SY 2013–14 there are 20 states operating multidistrict fully online schools without restrictions, and nine states operating them with restrictions such as available grade levels, and caps on the number of students per class, school, district, and state.
- Consortium and education service agency programs are an increasingly important online learning access point for students and a way for districts to cost-efficiently invest in online blended programs. Keeping Pace has identified at least 75 consortium programs operating across the country, linking districts across counties and local education agencies to offer locally facilitated online options to students.
- State-supported supplemental options include two categories of programs: state virtual schools and states that support course choice programs. State

> virtual schools operated in 26 states in SY 2012–13, serving 740,000 course enrollments. Course choice programs are operating in seven states in SY 2013–14, expanding the number of students who have access to state-supported supplemental online courses. Course choice programs operating without a state virtual school remain very small, however.
> - An increasing number of private and independent schools are including supplemental online courses and blended learning in their options for students and as a result, Keeping Pace takes a closer look at private and independent schools in 2013. We count eight states that allow private students to take courses from state-supported supplemental programs while maintaining their status as private students (pp. 4–5).

In a Project Tomorrow "Speak Up" survey conducted in 2013—polling over 403,000 K–12 students, parents, teachers, administrators and community members—25% of district administrators viewed flipped learning as transformational to teaching and learning in their districts. Sixteen percent of teachers said that they implemented a flipped learning model using videos in their math and science classrooms, with an additional 15% percent of teachers and 40% of administrators expressing interest in "trying flipped learning" this year in their classrooms and schools.

Of the over 180,000 middle and high school students polled, nearly three-quarters cited flipped learning as a great way for them to learn, with 32% strongly agreeing with that idea. The students also revealed a 20% increase from 2012 to 2013 in their use of videos as part of their learning process. (Speak Up 2013 National Research Project Findings: A Second Year Review of Flipped Learning, 2014 www.tomorrow.org/speakup/pdfs/SU13SurveyResultsFlippedLearning.pdf).

While the creation of more personalized learning environments is not simply about implementing technology, the potential of many emerging technologies to be a catalyst for change—both in and out of school—is considerable. And because these students already see the value of games, simulations, and chat rooms as critical to implementing their vision for learning, parents and administrators may need to suspend their own views about the use of these nontraditional tools to better appreciate their potential value for education.

A digital curriculum should open up classroom walls to allow for collaboration among classrooms, communities, and cultures. Additionally, online learning should create classrooms that are hybrid in nature, preparing students for current and future avenues

of learning found on the web. Mobile devices allow learning to feel personal, opening students' worlds to a wealth of resources. As thousands of new apps and online courses are constantly being created, if a school doesn't offer a particular class, a student can more than likely take it online.

The 2013 Survey of Online Learning, conducted by the Babson Survey Research Group in the United States in 2012, found that more than 7.1 million students in higher education took at least one online course during the fall semester of 2012, an increase of 411,000 students compared to fall 2011, when over 6.7 million higher education students took at least one online course (Allen & Seaman, 2013). Most of the growth is occurring in blended-learning environments, in which students learn online in an adult-supervised environment at least part of the time. As this happens, online learning has the potential to transform America's higher education by serving as the backbone of a system that offers more personalized learning approaches for all students.

Mobile Learning

More and more teachers are discovering the benefits that mobile learning brings to the classroom every day. Technology that was forbidden within learning environments not so long ago is now pushing mobile learning forward. We define mobile learning as the integration of mobile devices, such as tablets and smartphones, into both in-school and out-of-school learning activities. Generally, these mobile devices work best as companions to desktop and laptop computers.

Professor Chris Dede says, "I've never seen technology moving faster than mobile learning" (Barseghian, 2012). A professor who teaches at the Harvard Graduate School of Education, Dede thinks students can use their cell phones to have "back-channel" discussions that happen during discussions that happen in class. This isn't surprising, considering that "80% of teens now have cell phones." Dede describes this as a "sea change in the education landscape" (2012).

The impact of mobile learning is even more dramatic for those students who struggle with learning. Special education students need ways to connect classroom learning to their world in order to make learning relevant. Mobile learning can do just that: take learning from the abstract to the real. Most mobile devices, for instance, can record audio and video and take pictures of a student's personal world, opening up new ways of connecting learning to their lives.

A Day in the Life of a Mobile Learner

7:00 a.m. Jack wakes up and checks his smartphone, where he finds an assignment to take three photos for his language arts class.

8:00 a.m. To complete this assignment, Jack takes three photos with his phone on the way to the bus stop.

9:00 a.m. Jack downloads the photos he took from his phone's cloud storage to the class wiki and then selects from his classmates' photos to illustrate a poem he wrote on the school laptop.

12:00 noon. During lunch, Jack gets a calendar reminder on his phone, reminding him of his drum lesson after school and an update to his reading assignment for English.

1:00 p.m. Jack continues reading *The Great Gatsby* on the school laptop, knowing that he can pick up where he left off on his tablet at home tonight.

2:00 p.m. Jack and his science group members Skype with a local environmental scientist and a team of students in Scotland on a group project on climate change.

6:00 p.m. Jack Skypes with his grandfather in California and plays him some drum music that he recorded on his phone during his lesson that afternoon. Jack's mom is grateful that her father is slightly deaf.

HIGHLIGHT

Read journalist Tina Barseghian's thoughts about mobile devices and education in her blog. This post is the first in a series Barseghian wrote on mobile learning in *Mind/Shift*, a blog she curates that "explores the future of learning in all its dimensions—covering cultural and technology trends, groundbreaking research, education policy, and more" for WQED Public Media for Northern California.

http://blogs.kqed.org/mindshift/2012/03/amidst-a-mobile-revolution-in-schools-will-old-teaching-tactics-prevail

YOUR TURN

Models of Technology Integration

Stop and Reflect: How would you describe your school's experiences with technology integration? Have you seen examples of any of these instructional models? How did they work?

Discuss: What has worked with educational technology in your school? What have you learned from your experiences?

Apply: Which of the instructional models would you like to explore in more depth? Are there teachers in your school who might like to experiment with these models?

Instructional Model	Teacher(s)	Comments
Blended Learning		
Flipped Learning		
Online Learning		
Mobile Learning		

Personalization of Learning Activities

Research has shown time and time again that what makes a difference in student learning is teaching. Using individual computing devices as instructional tools is only as effective as teachers' implementation of critical components of a personalized approach to teaching and learning. "Personalized forms of learning provide an approach tailored to the abilities, preferences, interests, and other diverse needs of the individual students" (Song, Wong, & Looi, 2012, p. 680).

School leaders initially may adopt mobile learning strategies thinking that the addition of mobile devices or tablets—whether provided by the school in one-to-one programs or by students in Bring Your Own Device (BYOD) initiatives—will provide students with more engaging and flexible tools for completing classroom tasks. Soon, however, educators realize that placing these powerful devices in students' hands requires more than simply modifying current instructional practices to include more computers. The introduction of individual devices into the learning equation demands that everyone involved in education rethink what it means to teach and to learn, placing more control and responsibility into learners' hands.

The role of effective teachers in a one-to-one learning environment is different from the role of effective teachers in a traditional environment. A student-centered approach is much more appropriate in a one-to-one learning environment, where students do not depend on the teacher to supply all subject area content, to be the sole monitor of their learning progress, and to make decisions about what, how, when, and where to learn. Thus, a one-to-one approach to instruction allows students to personalize their own learning paths.

Personalization and Student Choice

One way to personalize learning is by designing experiences that allow students to make choices about what and how they will learn. When teachers encourage students to make choices, students not only become more engaged, but they also assert ownership and take pride in their learning. All instruction in a personalized environment must still focus on standards, yet teachers have considerable flexibility in meeting those standards, especially in skills-based subject areas, such as math and language arts.

Language arts classes are often organized around specific works of literature, such as *Romeo and Juliet* or *Charlotte's Web*. In today's educational environment, however, English language arts standards allow for curricula to be more personalized, because the emphasis is on the skills that students develop from exposure to the literature, not on a specific piece of literature.

At the same time, it is important for parents and community members to understand that Common Core State Standards require that certain content areas be covered: "The English Language Arts standards require certain critical content for all students, including classic myths and stories from around the world, America's founding documents, foundational American literature, and Shakespeare. Appropriately, the remaining

crucial decisions about what content should be taught are made at the state and local levels. In addition to content coverage, the standards require that students systematically acquire knowledge in literature and other disciplines through reading, writing, speaking, and listening" (www.corestandards.org/about-the-standards/myths-vs-facts).

Consider the following English Reading Common Core Standard for 11th and 12th graders (CCSS.ELA-LITERACY.RL.11-12.5): "Analyze how an author's choices concerning how to structure specific parts of a text (e.g., the choice of where to begin or end a story, the choice to provide a comedic or tragic resolution) contribute to its overall structure and meaning as well as its aesthetic impact" (www.corestandards.org/ELA-Literacy/RL/11-12).

Certainly, students could work on this skill when they are all reading the same book, but how much more valuable and personalized would the learning be if students had a choice about which work of literature they used to practice the skill? Such a shift would require a different way of teaching, however, and a different way of organizing classroom activities. Instruction would have to focus on modeling the strategies a reader uses to think about the relationship between a text's structure and meaning, rather than on activities that focus on a specific book. Students would have to demonstrate their learning by showing how they are applying their interpretive skills to any book or work of literature they find, whether it is a Steinbeck novel, a Nancy Drew mystery, or a Lemony Snicket book.

Student choices about literary or nonfiction texts are easily enabled through the wide availability of ebooks and websites. The addition of related electronic media available over the internet can add other dimensions to critical thinking about literature, language, and communication. As with any educational goal, technology, particularly devices with the features of mobile devices, also provides greater opportunities for students to be creative about demonstrating what they are learning.

Mathematics instruction, which in some classrooms relies on isolated skill practice, also provides opportunities for personalization when students use the skills described in Common Core standards to solve problems related to their interests. For example, students can apply statistical reasoning to raw data available on the internet on thousands of different topics and display, analyze, and interpret their findings. A variety of apps and tools allow students to have digital, hands-on experiences with shapes, formulas, and trends, allowing them to add personal touches to traditional mathematical tasks.

Students, with teachers' support and recommendations in every subject area, can access online tutorials, quizzes, and a variety of internet resources to help them understand topics they are struggling with. Students may use these same types of resources to explore topics that interest them in more depth or to acquire advanced skills.

To incorporate these types of subject area activities and resources into personalized learning programs, teachers must have deep and wide understandings of their subject areas, as well as sophisticated understandings of how students think about particular content, the misconceptions they are likely to have, and the errors they are likely to

Personalization and Student Choice in an Elementary Classroom

Consider a 3rd grade science unit built around Next Generation Science Standards:

- 3-LS1-1. Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death (3-LS1-1)
- S1.B: Growth and Development of Organisms
- LS1.B: Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles
- Patterns of change can be used to make predictions. (3-LS1-1) (Next Generation Science Standards, 2012)

Although the standards specify the concepts that students need to learn, the teacher can engage students in projects with choices about what and how they will learn. Students, for example, could choose a pet they are interested in and do research online to learn about the animal's daily habits and needs. They create a final presentation in a format of their choice where they share what they have learned, guided by a rubric that describes the knowledge specified in the standards.

Allowing students to make choices does not mean that they are left to their own devices during this project. The teacher conducts frequent, short, small-group and whole-class instruction to build students' understanding of the required content, as well as to help them develop process skills, such as critical thinking and information literacy.

Personalization and Student Choice in a Middle School Classroom

Sixth graders are studying statistics and probability. Some of the standards they are expected to meet are the following:

- Develop understanding of statistical variability
- Summarize and describe distributions
  (National Governors Association Center for Best Practices, 2012)

The teacher begins the unit with traditional, full-class instruction and small-group activities to ensure that students have learned the important concepts. Instead of a final exam, however, students are asked to generate a statistical question that interests them and collect data to answer it. One student wants to learn more about a soccer team his team will be playing in a few weeks, and another wants to know how much and what kind of food is thrown away in the cafeteria each week. The students help each other develop plans for collecting data and create a final report in the format of their choice. The teacher adds a critical thinking component by asking students to include an action section, where they explain how they will use what they have learned.

For example, for his action section, one student asks five of his classmates to volunteer to attend the soccer match to observe both teams' strengths and weaknesses, which he has listed for them on the class's website. He asks a classmate, who plays soccer and likes to attend the matches, to make a videotape of the match. She will give him the video to use as he writes his action section with results of the match and comparisons between his pre-match listings and reality. The following week the class watches the video together and comments on a student's assessments and their observations. For her action section, another student asks various classmates who eat cafeteria lunches to choose different days of the next week and take notes on what they ate and what they threw away from the school lunch on that day. By the following Friday, they send her their notes plus before and after photos of their trays from their mobile devices, so she can use them to write her action section. She shares her results with the class online, exhibiting their photos and her photos of lunches and garbage, as well as a chart she's created, based on her findings and their notes.

make. Simply following a teacher's guide that does not account for students' individual differences will not bring about the desired results.

Teachers who use technology appropriately to engage students and meet their individual learning needs know how to facilitate students' learning in ways that challenge but do not overwhelm students—or the teachers themselves. They can recommend resources and predict problem areas to be addressed ahead of time. Tech-savvy teachers are focused on their individual students' strengths and needs hand-in-hand with content standards. These teachers plan instruction creatively and systematically to maximize each student's learning and engagement.

Personalization and Student Ownership

With choice comes control. Students who have options for what and how they learn, as well as for how they demonstrate what they have learned, soon develop strategies for taking responsibility for their own learning. Guided by standards and a knowledgeable teacher, students can set goals, monitor their progress toward those goals, and make adaptations as necessary to be more effective learners. Digital apps and tools, such as calendars and project management programs, help students organize and monitor their own learning. Giving students control over key aspects of their learning helps them develop self-efficacy and builds independent learners.

Certainly, all students can be held accountable for some goals and subject area standards, yet goals may be different for students with special needs. A student with advanced ability or interest in a particular topic, for example, could set a learning goal beyond the standards required of all students. Other students may need to catch up by setting more basic goals.

One significant area in which students can personalize their learning through goal setting is 21st-century skills. Collaboration as a general skill is addressed in many standards, including the English Language Arts Common Core standards, but specific subskills, such as listening to others or contributing to a small group, are ideal goals for individual students. Any 21st-century skill can be broken down into smaller skills that students can target through personalized goals and progress monitoring.

Giving students more ownership does not mean that teachers give up their responsibility to direct student learning. Many apps and tools, such as wikis and blogs, allow teachers to access student work and monitor their progress. Formative assessment also provides

information that teachers can use to recommend goals and strategies. Cloud applications, like calendars, can also be shared so teachers can make sure students meet standards while building critical self-direction skills.

Features of a personalized learning environment can be implemented at all grade levels by focusing on students' abilities to make sensible choices and to assert control over their learning. It's exciting to see how students at different grade levels personalize their learning experiences:

Personalization and Student Ownership in a High School Classroom

A high school sophomore is working on a project on ancient civilizations she designed for her world history class. She is interested in international relations and is also taking Spanish. She has received approval from her Spanish teacher to use her world history project on the Mayan people for a project in Spanish.

The student has to show which standards she will be meeting in both classes with this project. Her world history teacher requires all students to target 21st-century skills with each of their projects, and for this project, he has asked all students to focus on goals related to creativity. Within the general category of creativity, the student has written three goals, based on her own self-assessment and a conference with her teacher (numbers 1, 2, and 3). Because of her interest in international relations, her teacher encouraged her to set a more advanced goal related to ancient civilizations (number 4).

1. Increase the number of ideas I think of before I decide on what kind of project I want to do.
2. Get more feedback from my classmates and teacher on the value of my ideas before I decide.
3. Spend more time reflecting on what I could have done differently when I'm finished with my project.
4. Compare the relationship between the Mayans and other indigenous people of the Americas with the dominant cultures and relate these historical insights to current international relations issues within the Americas and between North America and Latin America.

YOUR TURN
Personalized Learning

Stop and Reflect: In your educational experience, when were you given choice and control over what and how you learned? What did you think of the experiences? In retrospect, can you think of times when more choice and control would have benefited you? How might that have been structured?

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Discuss: Have you seen examples of student choice and control in your school's classrooms? How effective do you think these experiences were?

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Apply: Based on what you know about your teachers, students, and curriculum, what are some specific ways you can see that more student choice and control could be included in learning activities?

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CHAPTER

One-to-One Computing and Personalized Learning

Students who are accustomed to using mobile devices to customize their lives outside school adapt easily to using individual computers for educational purposes. In fact, a study of students and mobile devices led by Project Tomorrow (2012) identified ways that students are already using mobile devices for schoolwork:

- 15% have informally tutored another student online or have asked an expert for help with school subjects.
- 18% have taken an online quiz to self-assess their understanding of subject area content.
- One-fifth have used a mobile app to keep their schoolwork organized.
- One-fourth have found videos online to help them understand something they're studying at school (p. 4).

These findings indicate a multitude of opportunities and tools for students and teachers to personalize learning experiences. Today, most teachers have asked students to take advantage of the wide range of high-quality online resources for research purposes. Some outstanding websites have been created by museums, such as the Smithsonian, and internationally recognized organizations, such as NASA and National Geographic.

Web resources, such as YouTube, Khan Academy, and quiz sites, provide tutorials and explanations, many of high quality, on any subject imaginable, from linear equations to

the structure of atoms. Most students can find these resources on their own, as Project Tomorrow found in its survey, though teachers committed to personalized learning can identify appropriate supporting resources for students when they need them. Additionally, the availability of electronic literary and academic texts, along with the burgeoning e-textbook industry, gives students access to a wider variety of text-based resources to enhance and personalize their learning.

Although mobile devices, such as smartphones and tablets, are useful for consuming content and doing research, laptop computers are better suited for content creation. Fully equipped laptops allow students to import content, such as videos or photos, from mobile devices into programs where they can manipulate them to create innovative, sophisticated projects.

Collaboration is an essential 21st-century skill, a skill that is especially appropriate for one-to-one technology. Project RED's comprehensive research study, conducted in 2010, found that online collaboration improves achievement and graduation rates. Though many students are using their mobile devices to collaborate on school projects, technologically aware teachers can find ways to support and encourage collaboration, leading to development of content knowledge and other 21st-century skills. Project RED's study determined that in schools where students collaborate with each other online compared with all other schools, that is, those that did not use online collaboration among students, the collaborative schools reported higher rates of disciplinary action reduction and higher rates of dropout reduction (see Figure 4.1).

The vision of a classroom of students using their own computers to engage actively in learning experiences with other students may be unfamiliar and slightly unnerving to some teachers, parents, and students. Some teachers may rely on students' undivided attention to maintain an orderly, controlled environment, while others may enjoy the performance aspect of teaching to a captive audience. The research has been clear for decades, however, that silent, seemingly attentive students are not necessarily students who are learning to their potential.

Research conducted by Project RED (2010) found that educational technology has the most impact when it is fully integrated into every aspect of the learning experience. When students always have one-to-one computers available and numerous opportunities to use their learning to creatively demonstrate their learning and stretch their minds, they can achieve far beyond achievement levels attained when they all have to follow the same path at the same rate.

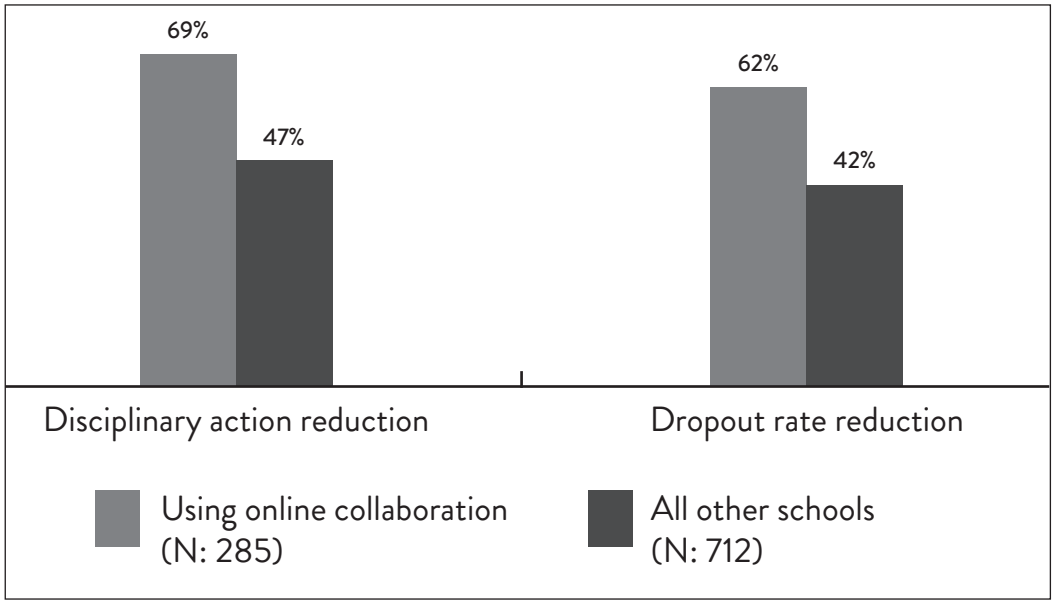

Figure 4.1. Percentage of respondents reporting improvement GREAVES, ET AL., 2010, PROJECT RED. *Reprinted courtesy of the publisher.*

A One-to-One Learning Environment—A Student's Perspective

A sixth grader at a rural middle school in Idaho studying the classifications of plants and animals in his science class was able to complete the following tasks with access to different computing devices:

- Taking photos of plants and animals in local environments
- Sharing photos and data, and teleconferencing with school in other parts of the world to gather information about their flora and fauna
- Using an app to create a mind map with photos to demonstrate classification of animals

The student might note the following benefits to learning in a one-to-one environment:

- Having permission to use a cell phone in class for academic purposes combined with access to a laptop or desktop makes it possible to be more creative with class projects.

- Because he always has his cell phone with him, he can use the camera for a variety of educational purposes, such as collecting samples.
- Collaborating with students in the classroom and around the world is possible with consistent online access, building both content and cultural understanding.

Using an app, the student collaborated with his classmates to create a mind map showing how the different animals might be classified. Once they thought they had a pretty good map, the group shared it with a biology professor who gave them some good feedback. After researching and adjusting their map some more, the students decided to make a website for their final project showing how they classified the animals and what they learned from their research and collaboration.

A One-to-One Learning Environment—A Teacher's Perspective

Consider how a middle school science teacher might integrate the use of mobile devices into science instruction with the adoption of a BYOD policy, the purchase of 10 tablets, and the upgrading of laptops in a mobile computer lab:

- Ask students to use their devices to take photos of local animals to post on the class wiki rather than finding images of unusual, exotic animals on the internet.
- Use Skype to connect students with a classroom in another country to collect data and use a mobile app to share photos, explanations, and conclusions about animal habitats.
- Build student self-direction skills by encouraging students to use their devices to resolve issues and make decisions.
- Connect with local experts on animal behavior through digital communication tools for feedback and support as students worked on their projects.

Before adopting BYOD, the teacher had asked students to find images on the internet and organize them in a chart that the teacher then put on her class wiki. The results were often disappointing because the students preferred to find images of exotic animals instead of looking at the animals they might see in real life. By incorporating mobile devices, the teacher could require students to take photos of animals found in their local environment.

In order to show her students how different environments support different kinds of animals, the teacher searched for other teachers looking for partners for classroom projects. She connected with an Australian teacher who was excited to collaborate. The two teachers used Skype and email to set up the project, create assessments, and establish a timeline.

The project was intended to be an inquiry type of activity, so the teachers agreed on the level of instruction they would provide while allowing students to evaluate their findings using scientific thinking. Some areas, such as communication, were left open for students to figure out for themselves. They quickly came up with solutions, using their mobile devices to find tools for communicating and collaborating across time zones.

YOUR TURN

Personalization in the Classroom

Stop and Reflect: What are some essential ways you use mobile devices in your daily life that could be applicable to students' learning?

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Discuss: How have you seen mobile devices being used for educational purposes in your school? How effective do you think they were? Are you interested in expanding or restricting their use, or is it just about right?

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Apply: What instructional roles would you like mobile devices to play in your school in the future? What will your role be in that process?

Assessment in a Personalized Learning Environment

Assessment is one of the most important tools in personalizing instruction, and one-to-one devices provide opportunities to enhance all forms of assessment. Many large-scale standardized assessments can now be taken with mobile devices, while summative assessments are frequently given online. When teachers and students work together, using mobile devices to conduct formative and benchmark assessments, they can use that information to set personalized goals and strategies, thus planning the most effective, adaptive learning programs.

Standardized Testing

A study by Hanushek and Woessmann (2008), "The Role of Cognitive Skills in Economic Development," found that improved academic test scores led to countries' increased gross domestic product (GDP). But, by aligning cognitive ability with GDP, we narrow our focus to the three areas tested by the researchers—science, math, and reading—to the exclusion of other areas where cognitive ability can be demonstrated. These areas include language training, music, and visual arts; sports; and combination skills. Creativity, resilience, and social adaptation require cognitive ability as well, but these would not be captured in conventional standardized tests in science, math, or reading. Therefore, limiting assessments to these three subject areas risks ignoring vast quantities of cognitive ability untested and, in so doing, a vast amount of GDP unrealized in this equation.

In their review of the basic results correlating cognitive skills with economic growth, Hanushek and Woessmann said, " . . . the existing evidence suggests that what students know as depicted in tests of cognitive skills is substantially more important for economic growth than the mere quantity of schooling" (2008, pp. 635–36).

Standardized testing is only a measure of a point in time in a specific category of material on a test—not an accurate measure of students' actual achievement or level of knowledge gained. A more personalized, differentiated approach to assessing students' performances provides a holistic assessment of students' full cognitive achievements and abilities (Alberta Education, 2012).

Standardized tests are not linked to specific educational materials, so it's difficult to know exactly which instructional sets produce specific results. As these tests are usually given only once a year, they provide only a single snapshot of what happens during the course of those 12 months. Ideally, assessment should be more frequent, so that teachers, students, parents, and administrators can see how students' performances improve at various points during the school year and—better yet—*why*, providing a peek behind particular test results.

Teachers, administrators, parents, students, and educational policy makers need frequent, regular feedback on a range of assessment tools so they can make informed decisions regarding school operations and budgetary allocations. Better information would help them judge what works in classrooms and what is not effective.

Educators want to know which curriculum works, which instructional techniques are most effective, and which lessons get through to students. Viewing standardized test

results once a year does not provide nuanced information because no one can be sure which activities during the course of that entire year produced specific test results. Was it a new curriculum that was introduced, new teaching techniques, money allocated to technology, or a particular subset of students who took the test? Digital technologies create opportunities to measure students' performances in more nuanced, multifaceted ways than ever before. No longer are teachers limited to standardized annual examinations or periodic classroom tests. Instead, they have the chance to provide feedback at virtually every step of the learning process and use this regular evaluation to gauge progress toward educational objectives for individual pupils (Cole, 2008).

Personalized learning allows for testing that boasts richer and more relevant questions, more efficient scoring capabilities, improved test security, greater equity via electronic accommodations, results that let students know whether they are on track, and opportunities to personalize instruction, based on detailed, timely feedback (Bailey, Schneider, & Vander Ark, 2012).

Teachers are empowered by regular results that are available to guide learning and professional development, while parents are given timely information about their children's progress.

Organizations such as the Partnership for Assessment of Readiness for College and Careers (PARCC) and the Smarter Balanced Assessment Consortium are working to develop and implement K–12 assessments of the Common Core State Standards with technology available in some mobile devices. Not only is the assessment more secure, it is also adaptive, automatically giving students easier or more challenging questions based on their responses. Thus, the results provide a more accurate picture of students' skills than a traditional paper-and-pencil test. Interim assessments are also available to give teachers and students critical feedback they can use to personalize instruction.

With online assessments and personalized learning, students are challenged to complete complex tasks and apply their knowledge in order to stay on track toward college and career readiness. Parents feel better knowing their child's class time is spent on learning rather than testing, providing more opportunities for improvement. Online assessments help teachers get the support they need to truly help students, using thoughtful, real-time data. And administrators and policy makers feel confident about tests they helped to build—tests that compare their school's performance and growth against world-class standards.

Assessment should be used as a teaching tool to extend rather than merely measure instruction. Educators' progression toward online assessments provides the perfect incentive to phase in better access to technology, shift to digital instructional materials, incorporate powerful digital tools, and create efficient blended school models. Though some may resist this change and urge setting the bar low with minimum requirements and protecting legacy systems, we advocate seizing the opportunity for broad, systemic updates to U.S. education.

Formative Assessment

One-to-one computers are particularly useful for formative assessment, supported by considerable research for its positive effects on students' learning (Black & Wiliam, 1998). To make a difference in student achievement, said Black and Wiliam, assessment should take place in different forms throughout the learning cycle and be conducted by teachers and students. The coauthors of this study concluded, "There is a body of firm evidence that formative assessment is an essential component of classroom work and that its development can raise standards of achievement. We know of no other way of raising standards for which such a strong prima facie case can be made. Our plea is that national and state policy makers will grasp this opportunity and take the lead in this direction" (p. 147).

Obviously, access to mobile devices outside the classroom allows students and teachers to use any number of online assessments, such as checklists and rubrics, at appropriate times to check and guide learning, through teacher, self- and peer assessment. The features and apps in mobile devices also provide opportunities to enhance formative assessment practices. Cameras, for example, allow students to document their learning with photographs or other recorded media. These artifacts can be uploaded into a laptop and integrated into portfolios complete with reflections and goal setting.

In the classroom, teachers can use apps on mobile devices to assess student learning while students are engaged in projects and activities. This kind of information, which is easy to collect with carefully designed instruments on a tablet or smartphone, can be used to identify areas of strength and weakness and addressed through personalized instruction.

Online Assessments

School systems place a high priority on formative assessment, meaning feedback designed to improve the learning process. This includes measurement of discrete subjects, such as concepts mastered, skills realized, and time spent on particular assignments.

Formative Assessment in a Mobile, Personalized Classroom

A middle school teacher might design a student project on probability in response to a district-wide assessment showing that students were particularly weak in that area.

In the project, students would create a game for a toy company, describing the rules for play and explaining mathematically why the game is fair, using appropriate mathematical language.

The teacher can send a rubric for assessing the final project and a checklist to the students' computers to help them assess their progress and stay on track. She can also ask them to submit to her a partially filled-out checklist every day to monitor how well they are doing.

While the students are discussing and planning their games, the teacher can use the tablet provided by the district to conduct a variety of observational assessments. She can use the speech-to-text feature of the app Evernote (http://evernote.com) to record comments on students' collaboration skills. She can also uses a checklist of mathematical problem-solving strategies they have been working on all year to note how students are using the strategies as they work. As the teacher circulates among students, she notes if they are using the mathematical terminology of statistics and probability correctly. The teacher can then use the results from these assessments to plan mini-lessons and to prepare for individual and group conferences.

When students have completed a prototype for their games, they can trade them with another group and practice playing them. The groups can use the rubric they received at the beginning of the project to assess their peers' games, and the creators of the game are expected to take their peers' comments seriously and modify their games based on the feedback.

Finally, students can prepare for presenting their games to the class by recording a practice presentation. They can use the rubric to assess themselves and to make sure that everyone speaks loudly and clearly, participates in the presentation, and addresses all the requirements.

The shift to online assessment, likely for most state tests by the 2014–15 school year, creates the opportunity for better and less expensive state tests with rapid results. Online assessments provide authentic, timely, comparable results across schools, districts, and states. They yield the data and techniques to match teaching and testing environments. Online assessments supply specific data to inform short-term instruction and long-term accountability efforts. Because these assessments are designed around the Common Core State Standards, they will better measure achievement against internationally benchmarked standards for college and career readiness. Additional prospects for next generation assessments would be to use them as pivot points to expand access to technology, shift to digital instructional materials and tools, and move toward personalized learning opportunities for all students.

Transforming the assessment process represents major ways to improve learning and drive educational change. In contrast with No Child Left Behind, which impelled teachers to "teach to the test," real-time online assessment encourages teachers to incorporate a broader array of assessment dimensions into the classroom, providing feedback on what is effective. This information helps teachers tailor instruction to individual students and enables students to see what learning modes work best for them. Typically, feedback is embedded in the instructional process, so that students and teachers receive real-time results on what is being learned and can monitor performance over time.

YOUR TURN
Assessment in a One-to-One Personalized Learning Environment

Stop and Reflect: How would you describe assessment practices in your school? How effective are these types of assessment at improving student learning, as well as measuring it?

Type of Assessment	Comments
Standardized Assessment	
Online Assessment	
Formative Assessment	

Discuss: What are your experiences with online assessment? What have been some challenges, and how have you addressed them? How prevalent is formative assessment? Are you satisfied with the assessment practices in your school?

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Apply: What kinds of assessment practices would you like to investigate further? How do you think teachers and administrators in your school would respond to a discussion about an increased role of formative assessment?

Assessment Practices	Notes

CHAPTER

Making Personalized Learning Work for You

As personalized learning adapts to individual learners, it also adapts to different institutions and environments. What mobile learning looks like in your school depends on the people who create it and the resources they employ.

Leadership

Successful implementation of mobile learning depends on effective leadership through strategic planning and the involvement of all stakeholders. While a principal's role is vital, all levels of leadership are important, individually and collectively. No single individual has the necessary skills and authority to bring about sustainable change in an organization.

The success of any educational innovation depends on effective leadership at every level, from superintendents and school boards to parents to informal teacher leaders. Parent and community engagement are vital to keep people excited and committed to agreed-upon initiatives. Teachers need to work together and within leadership teams or professional learning communities. Gaining teachers' support at the outset of planning not only will increase the effectiveness of implementation, but also will ensure crucial buy-in.

Each leader has a role to play if students are to receive the maximum benefits from a personalized one-to-one learning program, but the school principal is the key to success. In the *T.H.E. Journal*, Jennifer Demski (2012) described the "7 Habits of Highly Effective Tech-leading Principals":

1. Create an atmosphere that inspires innovation.
2. Foster collaboration.
3. Be open to new ideas.
4. Be a connected learner yourself.
5. Locate and provide adequate resources.
6. Take risks.
7. Have a visionary focus. (pp. 1–6)

Technology does, however, present unique challenges to principals. One major challenge is an antitechnology attitude, particularly toward mobile devices. Understandably, this perception likely comes from having to deal with disciplinary problems related to cyberbullying and the inappropriate use of smartphones, as well as complaints by teachers and parents about the distractions of mobile devices. When principals can see past these problems, they will be able to lead their schools toward the benefits that can be derived from mobile learning.

Speaking for the National Association of Secondary School Principals, Executive Director Gerald N. Tirozzi said, "For years, the conversation about mobile and social technology in schools has revolved around how to block it, . . . But it's becoming increasingly clear that simply blocking such technologies does students a disservice. An education that fails to account for the responsible use of mobile devices and social networks prepares students for our past, but not for their future" (2011, p. 1).

With good reason, principals also must focus on budgetary concerns and may tend to dismiss mobile learning out of hand without investigating options and alternative funding sources. Another barrier to principals' leadership in the area of one-to-one computing can be their own limited technology skills and knowledge. Many principals, of course, have taken to using the latest technology for work and pleasure, but others without a personal interest in technology may not care to carve out the time necessary to stay on top of the latest trends. This is an area where district-level administrators can take action. Professional development in technology, specifically the educational uses of mobile devices and apps, is as critical for principals as for teachers. With confidence and

knowledge, 21st-century principals can become enthusiastic about leading the school's stakeholders toward improved achievement and engagement through mobile learning.

The importance of a principal's role as instructional technology leader cannot be overemphasized. A self-assessment can help principals to set goals in modeling the effective use of technology. Use a simple checklist to assess your technology leadership. An example, Technology for Principals Self-Assessment, can be found in Appendix C: Forms, Surveys, and Checklists.

YOUR TURN

Leadership and One-to-One Computing

Stop and Reflect: How do you see yourself as a possible leader for a personalized mobile learning environment?

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Discuss: What experiences have you had leading and trying to lead educators into new practices with technology? What have you learned from these experiences?

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Apply: What steps can you personally take to be ready to be a leader with mobile learning in your school or district?

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A Day in the Life of Principal Perez

Elena Perez is the principal of Meadow View Elementary School, a suburban K–8 school just outside a medium-sized midwestern city. Perez began her career in education as a special education teacher and has served as principal of three different schools during her 25-year administrative career.

Perez remembers a time when the only computers in the school district were at the administration building. She also remembers when, as a teacher, she and her colleagues were given their own desktop computers and then computer labs for students. As a principal, she began her school's technology journey by placing four computers in each

classroom and then created two mobile laptop labs for teachers to share. With a declining budget, based on decreased enrollment, she knows that the district will not be able to fund the one-to-one computing program she would like to start, but she is looking into buying some tablets and beginning a BYOD program to complement the technology that is already available at the school.

One of Perez's fifth grade teachers, Samantha Day, has been an active innovator in the area of instructional technology and brought up the idea of BYOD with her. They discussed it with the district administration and a parent group before coming up with a modified BYOD program. So far, the program is doing very well, and parents and students like it. Perez has had to deal with a few instances of inappropriate use of smartphones, but she explains, "There are problems with every technology. Last year, a child was injured because someone tossed him a pencil when his lead broke during a test. We didn't outlaw pencils!" she laughs. "Any tool can be misused. We just need to be clear about expectations and consequences. We're not throwing out the baby with the bathwater!"

Perez writes a blog called *From Your Principal's Desk* about what's happening at the school and has persuaded the school librarian to start a podcast about good books. The librarian has enlisted students to participate, and parents and students are all using the podcast to learn about what's new in young adult literature.

Perez begins every faculty meeting with a brief highlight of a teacher's innovative use of technology or a demonstration by her or a teacher of an educational app or online tool. As these introductory presentations are scheduled to only take five minutes, she sets up an online discussion board for teachers to ask questions or discuss the topic in more detail. Some weeks, nobody has anything to say, but other ideas or apps foster lively, generative discussions.

Some of the teachers at Meadow View are reluctant to consider using mobile devices in their classrooms, and Perez expects that. She tries to give all the teachers a little push but relies mostly on teacher leaders to spread the word on the value of mobile learning. So far, her strategies have worked well, and her school is recognized in the district as being the most innovative elementary school (Scenario based on Oliver, Mollette, & Corn, 2012).

Policies that Support One-to-One Learning

At the school and district levels, one of the greatest considerations when implementing a mobile learning program is the creation or modification of policies that enable the use of mobile devices for constructive, educational purposes.

Legislators have attempted to address issues that arise with the use of educational technology. These regulations, such as the federal Child Internet Protection Act (CIPA), as well as some state laws governing internet use, may lag behind current views of technology

Update Your AUP

Does your AUP need a makeover? Consider the following when updating your policy:

Is your policy positive—focusing on how to use mobile devices constructively and safely—or negative—a long list of don'ts and consequences? Make sure your AUP has a good balance.

Is your policy compatible with most devices and tools and flexible enough to adapt to most educational situations? (Will your AUP adjust to technological advancements, changing community demographics, and personnel turnover?)

Does the policy meet state and federal legal requirements?

Who has input into the policy? The more that students, parents, and teachers are involved in its development, the more likely they will be to support it.

What specific issues regarding mobile devices and social media sites need to be addressed in the AUP?

- Privacy (cameras, personal information, etc.)
- Security
- Teacher-student relationships on social networking sites ("friending," following, etc.)
- Cyberbullying
- Online predators

in education; nevertheless, they cannot be ignored when planning and implementing one-to-one computing.

Locally, an Acceptable Use Policy (AUP) that describes what is permissible governs technology use in classrooms. Not that long ago, the "smart" approach to internet use for

HIGHLIGHT

Seat-Time Requirements

An even bigger threat to one-to-one initiatives than overly restrictive internet regulations are regional, state, and local policies that tie learning checkpoints to "seat time" requirements. The National Collegiate Athletic Association (2010), for example, will not recognize high school make-up courses that allow students to skip components of an online course, even when the students can show proficiency in specific course objectives. These policies keep schools and districts from taking advantage of blended and online learning approaches that help students personalize their paths to proficiency.

Modifications of seat-time requirements can take place at the state or local level and usually apply to high school classes that accrue credits for graduation. Several states and districts have introduced modifications and adaptations to give schools more flexibility (U.S. Department of Education, 2010):

> New Hampshire's High School Transformation defines competencies that must be achieved for graduation, rather than hours in class, and includes a variety of "Extended Learning Opportunities," such as internships, performing groups, and community service, as well as online learning (New Hampshire Department of Education, 2012).
>
> In Michigan, educational institutions may receive a "seat-time waiver" allowing students to meet graduation requirements without actually attending a physical school (Michigan Department of Education, 2013).
>
> The Reinventing Schools Coalition is a group that works with over 170 schools to institute a performance-based approach to assessment where students follow a Personal Learning Plan (Reinventing Schools Coalition, 2014).

students was to severely limit access. Unfortunately, many policies currently in place throughout the country still take a negative view of the web, focusing on dangers and misuses rather than on the possibilities for learning and student engagement. Unfortunately, these highly restrictive policies limit the educational potential of technology, and they prevent students from learning how to be safe and responsible when they go online outside the classroom environment.

Some AUPs focus on specific devices, software, and classroom situations that are sure to become irrelevant over time. Many were written years ago, when social networks and mobile devices either didn't exist or were summarily banned. One positive way to think about the regulation of students' technology use is to replace an Acceptable Use Policy with a Responsible Use Policy, which focuses on what students should do, rather than on what they should not do. Proponents of this approach emphasize educating students on smart and safe behavior online. This aspect of technology education is especially important in a mobile learning environment where students can be using online resources anywhere.

One-to-One Case Studies

Successful one-to-one projects all tend to have one thing in common: strong leadership. At Reed Spring School District in Missouri, that guidance trickled down to the building level, with lead teachers and lead students who received their new tablets early so they could give the implementation team feedback.

> While teachers and administrators were gearing up, the technology staff worked on infrastructure. . . . At parent meetings, which the district held to get input from the community, parents were pleased about the one-to-one direction and had one major request: offsite internet filtering.
>
> It all began in August 2011, when Superintendent Michael Mason compiled a six-person team to begin a one-to-one exploration process. That group . . . started writing goals and objectives and pulling additional people in to form a plan. Their goal was to have solid ideas in place before bringing the concept to the Board of Education.
>
> [Once the initiative was approved], teachers started their PD [professional development] nine months before the devices arrived. . . . Today, Reeds Spring

HIGHLIGHT

One-to-One Case Studies

Read more about Reed Spring's successful one-to-one initiative at www.k12blueprint.com/content/planning-pd-one-one-success-mo-district

teachers constantly revise goals and methods. They're encouraged to take risks, and because they're in a supportive environment, they do. . . . To help teachers with the transformation, the district developed a SAMR (Substitution-Augmentation-Modification-Redefinition) Model walkthrough tool, and administrators use their phones to collect data. Administrators also gather data via the Instructional Practices Inventory-Technology tool. All of these evaluations are used to help teachers change their pedagogy.

With the back end in place and PD underway, it was time to figure out the tool . . . to help the district achieve its goals. The answer? The Lenovo ThinkPad X230t Convertible Tablet.

In January 2013, . . . Reeds Spring passed out the tablets. Although they wanted to do it earlier, they waited a bit to give teachers more PD time. For the rollout, parents and students went to the gym to discuss the one-to-one [program before going to] their children's homerooms to watch instructional videos prepared by the tech team. They received paperwork and other details, signed a release, and went home with a brand new tablet. Not too surprisingly, 98 percent of the high school attended.

Five months later, one-to-one was still going smoothly. Because of the overall success, Reeds Spring [is going] one-to-one with its middle school students. . . . Seventh and eighth grade teachers received their tablets before the last day of school and began PD immediately." (Ullman, 2013)

YOUR TURN
Educational Policy and One-to-One Computing

Stop and Reflect: How effective is your local educational technology policy?

Discuss: What challenges to effective technology integration can be met with effective technology policies? What are the limits to what can be accomplished with policy?

Apply: How well would your current local and state educational policies support mobile, personalized learning?

What modifications might these policies need to be effective in a personalized one-to-one learning environment?

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What steps would be appropriate for you to take to get your technology policy up-to-date for personalized learning and one-to-one computing?

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CHAPTER

Devices and Services

Technology gives students opportunities for taking ownership of their learning. Personalized learning is paced to students' needs, tailored to their learning preferences, and customized to the specific interests of different learners. A student's educational path, curriculum, instruction, and schedule must be personalized to meet each child's unique needs. And it takes a wide range of resources and strategies to help students reach their optimum potentials.

The widespread use of mobile devices by 21st-century students enables a variety of instructional practices that personalize learning; here are three examples:

> Carlos, a high school student who is interested in music production, uses an audio editing app on his tablet to create a musical collage of WWII music as part of his website on wartime propaganda.
>
> Danielle, a middle school student who struggles with grade-level reading, uses a text-to-speech program to reinforce her understanding of science content she accesses on her smartphone.
>
> Jackson, a first grader who has exceptional artistic ability, uses a drawing app on his tablet to create a graphic story based on a book his teacher read to the class.

For years, schools considered learning devices to be desktops, laptops, and netbooks with an occasional portable digital device. Managing those devices required a certain set of skills and software tools. The devices were usually shared or part of a one-to-one rollout, but the choice of applications and uses was based on the needs of a larger group of users. Today, the technological options and approaches available are nearly as varied as the students they serve.

The basic notion of contouring learning to meet individual student's different strengths, interests, and ways of learning isn't new. Advancements in technology coupled with increased accessibility offer teachers many new opportunities to personalize learning for more students efficiently and effectively.

A key tenet of personalized learning is the ability of individuals to choose the right tools for the right tasks. As the functionality of the devices increases, plus individuals' abilities to tap into applications and tools that support more personalized learning, students may opt for a mix of device usage, each carefully chosen to support a particular educational goal.

When students are asked about how they use technology to support their schoolwork, most claim that technology increases the effectiveness of "how they do school," as well as how they direct their own learning through the use of emerging tools.

Students need to use the tools that are found in their world today in preparation for the tools of tomorrow. Social media, online classes, mobile devices, and other tools will help them become global communicators and lifelong digital learners able to adapt to the rapidly changing world of technology.

Mobile Devices

Student access to mobile devices is not simply about communication or convenience. The devices can serve as vehicles for changing the traditional classroom paradigm to incorporate more personalized learning. But just as one-size-fits-all learning fits no one, relying simply on one device may not answer all of a student's learning needs.

Laptops

The past decade has seen desktop sales cut nearly in half, with cuts to laptop PC more than four times higher than the decade previous. But—despite the convenience and utility of laptops—tablet and mobile smartphone sales are dominating the consumer technology space with no sign of slowing.

Pros: Video, camera, internet browser, full keyboard, runs educational applications, mouse control

Cons: No handwriting recognition

Summary: Laptops take learning to higher levels because their higher performance levels enable them to run educationally sound applications for music composition, graphics, and so on. The full keyboard also provides students with an easier way to take notes and manage their work than using smaller keyboards on other devices.

Apps-Based Tablets

Educators are increasingly seeing tablets as integral classroom tools, designed not to replace traditional instruction, so much as to supplement it. Apps-based tablets put more resources at a student's fingertips, making learning more engaging and efficient.

Pros: Video, camera, internet browser, lightweight, larger screen than smart phones

Cons: Does not support digital pen, so students have to "write" with their finger or type. Digital keyboard can be cramped.

Summary: For slightly more cost, tablets add the ability to use a keyboard for note taking and provide a larger screen that makes it easier to write, draw, and read. Also affords opportunities for content creation, communication, and collaboration.

Due to their affordability and portability, many schools are adopting tablets as their go-to device for technology in the classroom.

> Jack, a middle school student, picks up his tablet at lunchtime and uses it to continue reading *The Hobbit* by J. R. R. Tolkien, which he was reading during class. For this assignment, students were allowed to read any book they liked that met the teacher's requirements. Jack and a group of his friends have chosen to read *The Hobbit*, and they have had lively online discussions about it on their class social networking site. Jack

is about halfway through the book and enjoys reading it when he can. The nice thing about electronic books is that when he picks up his tablet computer later at home, it will remember where he left off, and he can carry on reading. Jack wants to try to finish the book in the next two weeks, as his class assignment is to post a review of the book on Amazon and on the Google Play Store.

High school English students produce a scene inspired by *Romeo and Juliet*, using the camera and a video-editing app on their tablets. The students create a screenplay that places the story in their community and get feedback from a partner class in another state that is also studying the play. When the script is ready to go, the students divide their group into actors, set designers, camera operators, and a director, based on their interests and abilities. The students in this class are encouraged to venture outside their comfort zones, so students are not necessarily working in their strongest areas. Some deliberately choose to take on tasks that are unfamiliar to them, so they can meet learning goals they have set for themselves. Finally, they record the scene, edit the recording on their laptops, and post the final video to YouTube to share with their classmates and the students in the partner class.

Tablet PC with Pen

These devices feature a keyboard, touch, and pen input, giving students and teachers the best of all worlds. For children who are learning to write, the movement involved in forming letters with a pen supports the development of good spelling. Tablet PCs with digital pens preserve the use of the pen for input, while allowing for digital manipulation of the writing. Most children are able to use the devices with very little instruction, and the text is highly visible.

Pros: Video, camera, internet browser, full keyboard, digital pen for handwriting input, educational applications

Cons: Tablet PCs offer the best of all worlds.

Summary: Tablet PCs are fully featured for learning, and they have the important extra ability of the digital pen, which opens up a whole range of pedagogical opportunities, including writing chemical and mathematical formulae and Asian language characters. They can also jot down notes that can be converted to typewritten text.

Chromebooks

Chromebook laptop computers are rapidly being adopted in K–12 education due to lower IT costs, the reduced time it takes to administer and deploy changes across classrooms, and the security advantages of Google's Chrome OS (operating system, based on Linux kernel).

Pros: Great for those familiar with Google Docs. Pricing is extremely low. Machine is rugged with a full-sized keyboard. Offline capability to use Google Applications and disk storage without an active internet connection. Lacking a traditional operating system can be an advantage for K–12. No virus protection is required, pop-up blocking is managed by the browser, auto updates are managed by Google, and students are prevented from installing applications.

Cons: No traditional operating system. Existing applications don't work unless they run inside a browser. Battery life is a challenge in K–12, where a "full school day" charge is preferred. Form factor is a hybrid, somewhere between a traditional laptop and a Netbook (small, inexpensive computer). The machine is more rugged than a Netbook but not industrial strength.

Summary: Chromebooks are optimized for the web's vast educational resources. Educators can integrate rich content into lessons, inspire collaboration, and encourage students to create and share their own content with the world. Chromebooks deliver a rich experience that is easy to use with fast start-up times. They provide a simple, scalable, and affordable way to put technology into the hands of more students and teachers.

Smartphones

Flexible devices like smartphones are able to move with the learner to deliver just-in-time insights at the points of need. On-demand learning resources and assessments recording can be offered with ubiquity and portability. Education does not necessarily mean four walls. A learning society is a mobile society.

Pros: Video, camera, internet browser, GPS, lightweight, facilitation of communication and collaboration

Cons: Small screen, the opportunity for voice calls or texting during class, control (it's hard to verify what students are really doing on their phones).

Summary: In several ways, students' smartphones can support learning. Students can research online if there is an internet connection. Video and still cameras can be used to record observations and presentations. Students can record classes to play them back later, and they can communicate and collaborate with one another and use educationally sound applications and ebooks for revision or learning.

YOUR TURN
Mobile Devices

Stop and Reflect: How are different devices currently being used in your school? Are they being used effectively?

Laptops	
Tablets	
Tablet PCs with pen	
Chromebooks	
Smartphones	

What have been barriers to the successful integration of technology in your school?

Discuss: What experiences have you had in your school with different computing devices? What have you found to be the pros and cons of these devices?

Notes:

Apply: At this point, which device(s) or model do you think would be most appropriate for your school? Why?

Services

In 2006, *Time* magazine shocked its readers by naming *you* the Person of the Year. The "new" web, called Web 2.0, allowed users to interact with the web instead of just consuming content through it. Now, such a concept seems almost quaint, as nearly everyone has learned to depend on the internet for services unimaginable just 10 years ago.

Cloud Computing

Many of your favorite personal resources—Google Apps, Gmail, Microsoft 365, Facebook, LinkedIn, Twitter, and YouTube—are all in the cloud, and you may not even know it! Cloud computing is the storage and management of data on a network of remote servers hosted on the internet, rather than a local server or a personal computer. It is poised to revolutionize the educational sector as well, and schools and learning institutions would be wise not to write off the cloud as just a business tool. Cloud computing—in concert with hardware and software that continue to function when the internet connection is lost—has been able to deliver a seamless computing experience. Cloud computing is not just setting the preconditions for anywhere, anytime learning, but is shaping its very nature by introducing rich, new ways for students to research, learn, and collaborate.

Pros: Reduced paperwork, lower transaction costs, minimized investment in hardware, reduced need for IT staff, scalability, easier collaboration

Cons: If cloud service goes down unexpectedly, users are left without access to information; data mobility and ownership are jeopardized (i.e., If you discontinue service, can you retrieve data? Will the provider destroy your data once you've canceled?). How much data are cloud providers collecting, and how is that information used?

Summary: Cloud computing has the power to drastically advance the goals of the educational system: to make it easier for institutions to empower their students to succeed while cutting costs and expanding accessibility. The cloud can also improve collaboration among teachers, administrators, students, and staff and allow for "information durability," which means information can be placed in cloud storage for as long as needed.

Social Media

Students' use of social media—such as online chats, discussion boards, blogs, and microblog tools like Twitter—can encourage self-directed learning and remediation, as

well as build collaborative learning environments. At the same time, it promotes student interaction and course content discussion inside and outside classes.

Pros: Personalized learning, enhanced collaboration, increased productivity. Social networks can connect resources and systems. Recommendations for further reading and other topic areas for study, based on recent inquiries and previous student research. Some sites, such as Twiducate (www.twiducate.com), provide education-specific solutions for elementary and secondary students. Twiducate also allows teachers to set up private networks for their own classes. Through social media, students contribute to diverse learning communities where social learning and developing and sharing knowledge is central to their experience. Community-based activities can enrich learning and help students apply learning to real-life contexts. Social media can encourage more reflective thought and critical thinking and can help teachers and students align content with larger perspectives. Social media sites can be useful for small group brainstorming sessions, allow instructors to become part of the collaborative process with their learners, and often encourage shy students to participate. Ning (www.ning.com) is a social-networking platform that contains sites dedicated to different specialties, such as geography and teaching English as a second language. A basic subscription costs $25 a month, with more sophisticated packages running up to $99 per month. Teachers can benefit greatly from joining networks of teachers, using social networking tools such as Classroom2.0 (www.classroom20.com).

Cons: Many administrators are concerned about distractions, network security, theft, and students' internet safety. Most school districts don't allow Facebook and Twitter for school use. Some states ban personal social media tools from being used by teachers and students for school work.

Summary: Mobile devices, when combined with social media tools, provide a foundation for transforming not only students' learning experiences but teachers' practices as well. The end result is the realization of the student vision for a more social-based, untethered, and digitally rich learning landscape.

YOUR TURN
Mobile Computing and Social Media

Stop and Reflect: How have you used cloud computing and social media in your personal and professional life? What advantages and disadvantages do you see with these technologies?

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Discuss: What opinions and challenges do you anticipate from students, teachers, and parents related to bringing mobile devices to use in school and using social media for schoolwork?

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Apply: What are some ways you could use social media and cloud computing as an administrator to be more effective in your job?

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CHAPTER

One-to-One Program Formats

The ever increasing availability of a variety of powerful computing devices makes the possibility of one-to-one computing more and more feasible for schools. With tablets, laptops, and other mobile devices, many schools that couldn't dream of a one-to-one program five years ago can now see one within their reach.

School-Provided Devices

Initiatives where laptops are given to students by their school have been around for many years, and there is considerable research on what makes these programs successful. Recently, as tablets have become more powerful and less expensive, many schools are investing in these devices as a low-cost, one-to-one alternative to laptop computers.

For any type of device your school or district decides to purchase for student use, some policy issues must be resolved in conjunction with funding, infrastructure, and curriculum requirements. The following questions should be asked:

- Will students be allowed to take the devices home or just use them at school? Although it is easy to understand why some educators are reluctant to let students take expensive equipment off the school grounds, the benefits

of one-to-one programs are greatly diminished if students only have access to the devices at school.
- Will all grades receive the devices, or will all grades receive the same devices?
- Will students be limited to using only the device provided by the school while they are in the classroom, or will they be allowed to supplement their learning with personal devices?

Bring Your Own Device (BYOD)

More and more students are coming to school with their own mobile devices in their backpacks. This fact is now prompting many administrators to think seriously about how to leverage student-owned devices within the classroom as an alternative to or in addition to school-provided devices. The perceived appeal of BYOD—Bring Your Own Device—initiatives is that, on the surface, BYOD seems to provide a way for schools to create personal learning programs without having to pay for hardware.

School and district administrators have often been reluctant to allow students to use their own devices at school, whether for instructional purposes or personal communications, due to concerns about the distraction factor (i.e., kids visiting Facebook rather than paying attention in class), as well as network security and student safety. A growing segment of education leaders, however, are starting to look at this situation differently. In 2011, the Speak Up National Research Project conducted a nationwide survey (facilitated by Project Tomorrow, a national educational nonprofit organization, in partnership with Blackboard, Inc.) titled *Learning in the 21st Century: Mobile Devices + Social Media = Personalized Learning*. With one-half of district administrators acknowledging that their education technology budgets have decreased in the past three years, it is not surprising that 27% of these leaders are now exploring the idea of having students use their own mobile devices in class, rather than having the district assume the significant financial burden of providing a one-to-one environment for all students (Project Tomorrow, 2012). For other district and school leaders, however, their interest in a BYOD model is driven by a strong desire to create a more personalized learning environment for their students.

In addition to student benefits, many principals and administrators are exploring the BYOD model to help teachers become more confident with technology for instruction. These principals and administrators were 24% more likely to include devices in the classroom to improve the skills of their teachers (Project Tomorrow, 2012a).

Although BYOD may seem, on the surface, to be a way to save money, does it really? Network, security, and technology management become more complex with widely different devices. The complexity brought about by allowing various types of devices can accrue greater costs for support.

Although it is true that many students are comfortable with technology and not timid about trying new applications, this does not mean they know how to find the most pedagogically appropriate technology tools. Educators must provide this type of guidance and support, and their job is made more difficult when students use a range of devices with diverse capabilities. In many ways, student-choice BYOD and the technical problems it creates can be a classroom distraction rather than a pedagogical benefit.

Without clear and strong leadership, schools could introduce inequity, complexity, and costly support and insurance issues into their technology programs—completely undermining their goals of making computing simple, powerful, and accessible to all.

Here are some points to consider before planning a Bring Your Own Device program:

- Students' own devices do not all have the same capabilities. Some have inferior tools, causing teachers to plan learning activities around the weakest capabilities.
- Some devices cannot perform consumption and production/creative tasks or even input full sentences easily.
- A variety of devices can create much more work for network managers.
- Teachers and tech support staff need to be familiar with several platforms and many devices.
- Most programs and applications are not available across all platforms and devices and may function differently for various devices.
- A wide variety of devices and varying degrees of device functionality can engender considerable complexity for whole class, group, and individual learning.

Despite these concerns and considerations, incorporating student-owned devices within classroom instruction is quickly becoming a viable solution for many schools and districts. And increased access to highly functional, multifeatured devices, such as smartphones and tablets, equals an increased familiarity with how to leverage these devices to benefit personalize learning.

BYOD Case Study

Oak Hills Local School District (OHLSD) in Ohio has implemented a successful Bring Your Own Device (BYOD) program that permits both students and staff to bring in their own devices. The district decided to try BYOD because they believe that using technology in the classroom will help to prepare their high school students for work in the 21st-century world. In the planning process, the district decided to take their BYOD program one step further by building a virtual desktop system, which can be accessed through any device students or teachers bring into school. So far, the virtual desktop system and the BYOD program have saved the district $1.27 million, proving that BYOD programs are not only great ways to bring technology into the classroom, they can also save millions that can be used for other essential school programs and services.

Every three years, the Oak Hills Local School District IT team hosts a series of community engagement sessions to define their goals for technology integration in the district. This community-based team developed a Vision for Technology and eLearning plan that outlined their goals as well as the required action steps to bring their schools into the world of 21st-century learning.

The following were the key points of the technology plan:

> Create and nurture a culture where technology-embedded instruction is an integral part of the everyday learning in all classrooms.
>
> Utilize a learning management system to provide one-stop, 24/7 access for students, teacher, parents, and community members.
>
> Explore the appropriate role and use of personal technology devices in and out of the school environment.

Like many schools, OHLSD was facing budget cut-backs and increased accountability for spending initiatives with long-term feasibility. While planning for future budget reductions, the district needed a solution that would maximize the number of devices, provide 24/7 access to learning, and reduce ongoing costs.

In the fall of 2010, OHLSD implemented a BYOD program and opened its high school to student devices. . . . At the core of the BYOD team, the director of eLearning, the

eLearning coach and course developer, and the education management information system (EMIS) coordinator took on the responsibilities of detailed planning, exploring new technologies, providing professional development, and troubleshooting technical issues.

With a strong team in place, OHLSD also required a strong network infrastructure to support the increased demands for bandwidth from student devices in the BYOD program. . . . The IT team worked with local vendors to analyze network demands and options, then determined . . . a network infrastructure that was . . . strong enough to handle the heavy demands that occur during peak access times, for example, at the beginning of classes when large numbers of students log in simultaneously. The IT team also budgeted for network growth, as new software applications demand an increasing amount of bandwidth. This need for future expansion was built into the existing network infrastructure.

When planning the BYOD initiative, the IT team recognized a significant challenge: how to provide software tools that can be utilized by all students on any device. This required considerable planning, and led to the team's decision to create a private and public cloud.

The availability of mobile devices for every student has proven to be invaluable for teachers working to incorporate 21st-century learning and technology skills into their curriculum. With anytime, anywhere access, OHLSD teachers have developed online companion sites for their classes. Some items featured on the companion sites include daily objectives, discussion forums, electronic textbooks and articles, course resources, a class calendar, and online assignments and assessments.

The supportive network infrastructure and virtual desktop application enables OHLSD students and staff to access learning applications, data, and services 24/7 from any mobile device. . . . In addition to student engagement and learning gains, the district also boasts a significant cost savings through the BYOD initiative. . . . The savings from this infrastructure comes in many forms, including hardware, space, energy, and administrative efficiencies. Although the initial costs of network infrastructure were substantial, the district saves annually on costly computer purchases, repairs, and necessary upgrades. This is not only saving the district money, but also resulting in more current, reliable computing devices for students.

Technology is a tool that can assist in the transitions needed for 21st-century learners. Incorporating the devices that students already use into educational programs will be critical to the future direction and success of schools. And making school buildings and networks accessible to these devices is as crucial as training teachers and staff to incorporate the devices into personalized learning programs.

CHAPTER

Funding

Locating the funds to fuel personalized learning initiatives can prove so challenging that many simply don't get off the ground. Funding, however, can be a crucial way of galvanizing support at a foundational level. Your school's or district's chosen funding model should be structured for sustainability rather than depending on one-time grants, appropriations, or limited tax concessions.

Partnerships

Asking local businesses to help or partner with schools is a fairly common practice, and some districts have honed their skills to gain profitable results. Some business partners have created programs to match equipment or money donated to the school. These types of programs stretch the technology budget. Building trust between the school or district and local businesses and the vendor community can benefit both sides. Banks sometimes have an interest in supporting teachers' or parents' purchase programs to attract customers.

Competition for grants is fierce and often limited by conditions, such as location, economics, and purpose. Another way to acquire funds for technology is to connect with a foundation that's closely tied to local priorities. Districts can also create a nonprofit

foundation to conduct cohesive fund raising for large-scale educational technology initiatives.

Schools have access to public sector and education-specific contracts that ensure better pricing than doing so on a purchase-by-purchase basis. Large school districts have an advantage in dealing with vendors: because they buy so much, they can demand the best prices. A strategy for small districts is to form consortia that can negotiate as single entities for better prices and services or even serve as purchasing cooperatives. A consortium can also manage network services and technology training for school districts of all sizes. In the absence of state or federal initiatives, schools can form consortia to negotiate PC purchases. Such consortia can even serve as cooperatives, pooling funds to support qualified, needs-based assistance.

Grants and Loans

When considering education funding options, administrators need to know that grants may provide opportunities for valuable endowments that can support innovative technology programs. The two main types of grants, public and private, can supply funds for initial capital outlays, as well as staggered deployment of technology in particular schools. Although the grant writing process can be difficult and the decision-making timeline can seem endless, the eventual rewards and benefits to students far outweigh administrative challenges.

Federal Government Grants and Loans

A government-backed loan is a loan secured by the government, thereby protecting lenders and allowing borrowers to secure lower interest rates. These loans provide schools and regions affordable options for purchasing technology goods and services. Some government-backed loans may also be available for individual purchases by teachers and parents. With low interest rates and flexible repayment schedules, these loans are viable options for funding technology integration.

In 2010, the federal government demonstrated a strong commitment to transforming education with the formal adoption of the new National Education Technology Plan, titled *Transforming American Education: Learning Powered by Technology*. It gives a

blueprint for reforming education by using technology on a grand scale (www.ed.gov/technology/netp-2010).

The Elementary and Secondary Education Act, today known as No Child Left Behind, was written to allow flexibility in using funds and included the option of allocating and combining funds from various titles to address priorities. Approval for technology expenditures is most likely when the technology is tied to NCLB goals.

Here are just a few of the many federally funded education programs that are serving today's educators and students:

- Federal education-technology funding: K–12 schools have benefited from the Enhancing Education through Technology Program (EETT) since 1994. EETT has provided direct federal funding for technology (www2.ed.gov/programs/edtech/index.html).
- Title I funding that assists local education agencies with large numbers of low-income students to ensure that all learners have an equal opportunity for a good education (www2.ed.gov/programs/titleiparta/index.html).
- The Race to the Top program funds teacher quality and improving assessments and data systems (www2.ed.gov/programs/racetothetop/index.html).
- The Individuals with Disabilities Education Act funds services to students with disabilities by defining how states and local educational agencies provide interventions, special education, and other services to those in need. Funds for assistive technologies emerge from this act (http://idea.ed.gov/explore/home).

Public grants are especially useful for projects that require a large budget because large legislative bodies fund these grants and typically increase the resources available for projects. However, the increased accountability associated with public grants needs to be considered when applying for government funding. In some cases, the funding of public grants is subject to political swings, and resources may vary annually, making them more ideal for one-time purchases or short-term funding needs rather than ongoing programs.

Private Grants

There is also enormous potential for technology support to schools and regions through private grants. Local education foundations are nonprofit organizations whose boards represent local community and education leaders and are financially accountable to their communities.

In addition to a straightforward application process, the limited amount of regulation and documentation of program gains is one main advantage attributed to private grants. Furthermore, the qualification process can potentially be much simpler for applicants for private grants, making them ideal for innovative programs lacking the research needed to qualify for a public grant. However, small private foundations do not have the same resources as large, publicly funded grants; therefore, the amount of the grant may be limited.

Philanthropic Grants

Foundations, corporations, and nonprofit organizations may also be good sources of financial assistance for technology in schools and districts, especially in the form of grants for programs. While each organization has unique priorities, districts should write proposals that address those priorities specifically. In general, philanthropic entities are interested in providing start-up funds for initiatives that are clearly focused, internally supported, and financially sustainable. A good place to start investigating this source of funding is the Foundation Center (http://foundationcenter.org).

Investing in Innovation Fund

The Investing in Innovation Fund gives money to districts and nonprofit organizations to drive development of educational reform (www2.ed.gov/programs/innovation/index.html). There are three categories for these grant monies:

1. Development: grants for promising new ideas and strategies
2. Validation: grants to support ideas and strategies that have demonstrated results
3. Scale-up: grants to expand programs that have had results

Effective Teaching and Learning for a Complete Education

This program is aimed at carving out a new approach to college and career readiness. There is a spotlight on using data for planning, decision making, and planning student progress. The program is intended to drive the shift to expectations of learners' growth and achievement instead of static test scores. It is also focused on turning around the lowest performing schools (www2.ed.gov/about/overview/budget/budget12/summary/edlite-section2a.html#etl).

E-Rate

E-Rate is the discount for which schools and libraries may be eligible to pay for telecommunication services. Eligible schools and libraries can receive discounts of 20% to 90% on telecommunication, internet, and internal connections that are needed to implement classroom technologies. Administered by the Federal Communications Commission (FCC), E-Rate is the largest stand-alone K–12 IT funding source in the country (www.fcc.gov/guides/universal-service-program-schools-and-libraries).

Other Sources

Other federal offices provide educational grants that offer broadband, scientific tools, networks, and classroom and laboratory infrastructures. Announced grants are aligned to each agency's unique mission and goals. Included are the Department of Commerce, the Department of Energy, the Department of Labor, the National Science Foundation, the Centers for Disease Control, and the National Aeronautics and Space Administration (NASA).

State Technology Funds

Each state Department of Education provides grant opportunities to schools and districts. Some states have instituted policies and practices for simplifying procurement processes that enable sites to utilize statewide contracting and reduce overall costs for services, software, and hardware.

Issuance of Local Bond (school district borrowing)

Districts can use bonds or tax increases for large-scale technology implementations, construction of buildings, and updating existing facilities. Bonds are usually funded through increases of homeowners' property value assessments. Of course, the viability of a successful bond vote varies with each district's community. Numerous variables come into play. Status of existing structures, needs, communication of plans, and culture are several factors to be considered before going for a bond vote.

Technology Financing

Technology financing, or leasing, has become popular, and districts have two options. With a straight lease, a district pays for equipment for a specified time and then returns it. With a lease/purchase, the district either owns the technology or purchases it for a very small residual amount at the end of the contract. Financing imposes fiscal restraint, as it limits expenditures to agreed-upon amounts and maintains a three- to five-year refresh cycle. Banks, local and state government pools, computer hardware and software manufacturers, and underwriters are sources of lease or financing opportunities.

The advantage of financing is being able to acquire the technology without paying the full purchase price at once, while aligning with refresh cycles. Financing allows districts not issuing long-term debt to make payments from the general operating budget over a period generally from 36 to 60 months. Some vendors offer a reduced price to districts that finance or lease their technology. At the end, they either own the equipment or begin a new cycle with a new program for new equipment.

YOUR TURN

Funding a One-to-One Program

Stop and Reflect: What are your concerns and priorities for funding a one-to-one program?

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Discuss: What funding sources and strategies have you used to begin and maintain technology in your school?

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Apply: What funding sources or strategies would you like to explore?

Source or Strategy	Steps to Take

CHAPTER

A Planning Process for a One-to-One Personalized Learning Program

The impetus for one-to-one computing may come from anywhere in a school system. A teacher or small group of teachers may ask to explore the idea in their classrooms, or an administrator may have a vision for implementing one-to-one learning in a school or district. Sometimes one-to-one initiatives are generated by large districts or even state education departments.

One-to-one programs, whether small or large scale, can entail a big move financially, culturally, and pedagogically, so careful planning is vital for success.

The first task for effective implementation of a one-to-one program is the creation of a shared vision, a vision that focuses on shared goals for student achievement, not on technology. The creation of a vision of what one-to-one computing can and should accomplish serves two purposes: first, its development sets up a process that includes important stakeholders and encourages buy-in, and second, a vision provides criteria for making decisions about equipment, policies, instructional strategies, and professional development (CMP Media, Integrated Marketing Solutions, 2005).

The process and steps for implementing a one-to-one personalized learning program are shown in Figure 9.1.

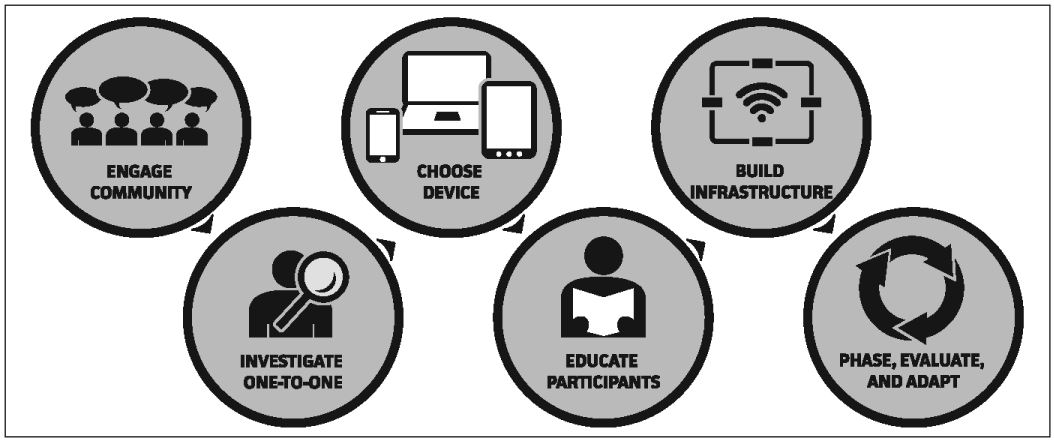

Figure 9.1. Steps for implementing a one-to-one personalized learning program

Tips for Implementing One-to-One Learning

Mobile devices are poised to transform education. One reason is because mobile devices are designed in a way that forces the teacher to give control to the learner. When we equip a classroom with tablets or smartphones, the learning is literally put in the hands of the students. The teacher has to facilitate and walk around the room to manage the learning. Here are some tips to keep your mobile learning initiative on track.

Remember that the technology itself is not the goal. Technology is a means to an end, and the end goals are improved student engagement and achievement. Focusing on specific technology needs or tools, rather than on technology as part of an overall plan to improve teaching and learning, will not produce the desired results (Overbay, 2011).

Make your plan fit your school environment. Implementation plans for technology and mobile learning are available from many sources, but a generic plan will not fit the specific needs of all school communities. Each school has unique demographics, resources, and needs. Taking the time to make adaptations to any good plan you find will increase your chances of success.

Collaboration must be an integral part of your strategy. An effective mobile learning program involves all stakeholders. The more that these groups have significant input during the planning process, the more successful the initiative will be.

Communicate often with diverse groups in the community. Don't forget the community outside the school when planning for mobile learning. Building connections with community organizations and demographic groups without direct ties to the school, such as business owners, seniors, and parents of preschool age children, can help build supportive networks that can contribute to a technology plan, both financially and otherwise (Tenbusch, 2011).

Plan for sustainability. An effective mobile learning program is a long-term investment. Of course, equipment and infrastructure make up a significant part of the financial commitment to a project. People, also, are important. Most technology initiatives depend heavily on a few knowledgeable and enthusiastic individuals (highly valued gurus). Be sure to plan for your program's long-term sustainability by setting aside time for the gurus teach the others. Part of the planning stage should involve professional development of expertise among participants, so turnovers do not bring a promising program to a halt (Tenbusch, 2011).

Ensure you have the political will to succeed. The journey to successful mobile learning can be full of challenges. Educators, students, and parents who are comfortable with a teacher-centered instructional paradigm may object to a more personalized learning environment. Others may have a negative view of certain practices, such as classroom use of smartphones or other mobile devices, and may need convincing to tolerate mobile learning, much less to support it. Like any significant educational innovation, proponents must address people's concerns while persevering with advocacy (Tenbusch, 2011).

Engage the School Community

Develop a Team

The first step to planning a personalized one-to-one program is to engage the community in order to learn from their vision and achieve consensus. A successful one-to-one program requires the support and buy-in of all the parties involved, and the best way to accomplish this is to make them an active part of the decision-making process.

Developing a team to plan for mobile learning implementation is critical for success. A well-defined team that includes representatives who meet regularly will move the objectives of a district forward.

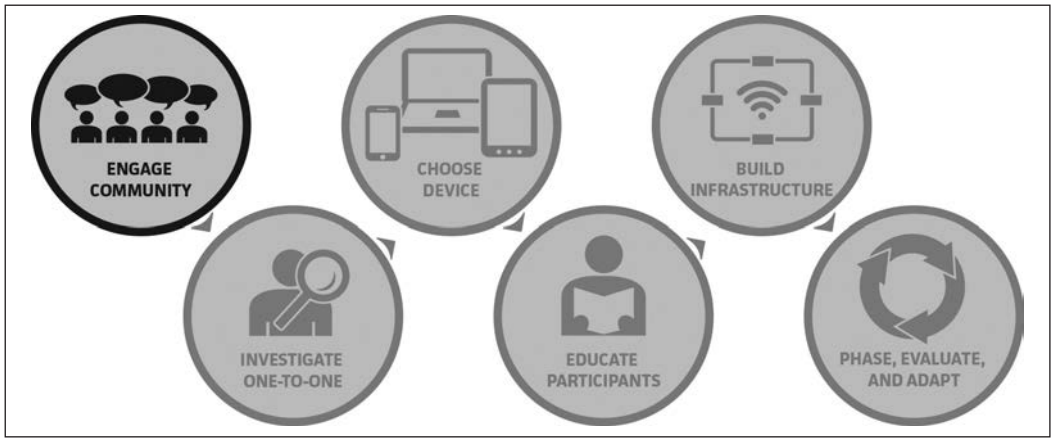

Figure 9.2. Engage the school community

Even if a one-to-one initiative is only being considered at one school, having the district administration involved is crucial. They may not be able to attend every meeting of the committee, but they should be kept in the loop about decisions. As one-to-one computing may require the waiving of some district technology policies, getting district leaders involved early is important.

Similarly, the school principal—the instructional leader of the school—is one of the most critical components of a successful personalized one-to-one program. Necessary changes in instruction, such as the move to student-centered classrooms, will not take place without the principal's support and leadership (Greaves, et al., 2010).

Of course, it is only natural that the people involved in technology be included in planning a one-to-one initiative. The best technology directors should have backgrounds not only in bytes, networks, software, and hardware, but also sophisticated understandings of how students learn. A technology leader is a strategic leader who ensures that the work of IT supports and enables the work of other district functions, an individual who brings innovative ideas to the table. A technology coordinator knows how to sift through apps and other software to recommend the ones that will contribute to student achievement most effectively. The coordinator must communicate well with teachers and be able to demonstrate how new apps and software work.

Committee members should include not only the formal teacher leaders, like department or grade-level heads, but also informal teacher leaders. Some teachers have a special interest in and talent for using technology in their classrooms or trying out new ideas with their students. Identifying these teachers is important because they are the ones whom less knowledgeable teachers will most likely go to for support. In casual conversations, they share their experiences and ideas; this kind of information is far more valuable to help teachers rethink their instructional practices than district or school proclamations.

More than many other kinds of educational innovations, one-to-one personalized learning will require support from parents. Whether it involves providing a mobile device their children can use in school or helping them make decisions about their personalized learning paths, parents will be involved and can provide important perspectives in the planning process. Also—depending on the scope and type of one-to-one learning initiative—getting local business people involved in planning can be helpful. They may provide connections for potential partnerships, public relations resources, or fund-raising opportunities.

The traditional role of school librarians is changing rapidly. Sadly, some schools in dire financial straits have replaced certified librarians with teacher's aides or eliminated the position altogether. A move to a personalized one-to-one learning approach can benefit greatly from an informed librarian who understands technology, the information literacy demands of 21st-century learning, and the culture of the school. This technology leader can identify resources and raise issues that others may not anticipate (Marcoux, 2012).

Planners also need to remember that many students know more about technology than most educators. While students may not be included in every phase of the planning process, they will offer meaningful input. Students will offer useful ideas on how they would like to use mobile devices for educational purposes to personalize their learning. They can also collect information from their peers about topics relevant to the planning process.

Tips for Engaging Community Support

Groups outside the school system can play significant roles in the success of a mobile learning initiative. Not only can they help with partnerships that contribute financially to a mobile learning program, they can also use their influence to drum up support and publicity with other groups (Gordon, 2012).

Form a stakeholder advisory committee that involves community members in technology decisions.

Develop a communications plan for your one-to-one learning program that details who, how, what, when, and where in terms of communicating and engaging the community.

Keep the school website engaging and up-to-date. If a website template has a place for sections such as a message from the superintendent or school board, make sure that users find current information in that section. One visit with an "under construction" page will deter many visitors from coming back and using the site to stay on top of school activities and messages.

Make sure your school and district sites are optimized for mobile devices. More and more often, parents and other community members check their smartphones for information when they have downtime away from home. If people know they can easily find what they need from their phones, they will access school sites more often and perhaps browse through different sections.

Someone in a school or district needs to evangelize about mobile learning in the community. The technology spokesperson should take every opportunity not only to make short presentations at staff and committee meetings, but also to be available to respond to requests to speak at community events, even asking for time to share information about mobile learning initiatives with community leaders (School CIO Advisors, 2012).

Ask for and honestly consider community input. Informal conversations with community members at public events and feedback received through surveys and comments on school websites will provide valuable feedback and make people feel

involved in school activities. Asking for opinions is not enough, however. Soon enough, community members will learn whether their ideas are taken seriously, so be careful to explain how feedback is used.

Showcase what students accomplish through a mobile learning initiative. Engaged and proud students are the best advertisements for any educational program. All people in the community, teachers, parents, and community members alike, love to watch clever students describe their work, particularly in an environment where presentation time is brief and interaction is encouraged. An online showcase can be effective, but a well-publicized and attended event is even more engaging. Holding a face-to-face activity or participating in a community-wide event along with an online showcase takes advantage of the best of both formats (School CIO Advisors, 2012).

YOUR TURN
Your One-to-One Technology Committee

Stop and Reflect: How well does your current school mission statement fit with a vision for one-to-one computing?

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Do you have an effective technology committee? What are its strengths and weaknesses?

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Discuss: What have you learned from your experiences working with technology committees and from other educational innovation committees that could have an impact on the development of your one-to-one program?

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Apply: Who are some people in your school community who would be good members of a one-to-one team?

Committee Member	Notes
District level administration	
Principal	
Technology staff	
Teacher leaders	

Committee Member	Notes
Parent leaders	
Community leaders	
Librarians/Media center directors	
Students	

What can you do to support or improve the effectiveness of your team in its planning of a one-to-one program?

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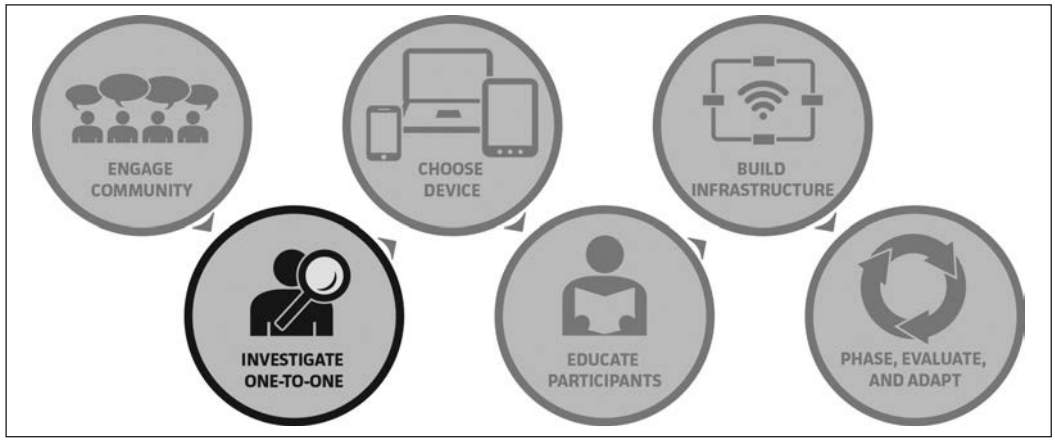

Figure 9.3. Investigate personalized and one-to-one learning

Investigate Personalized and One-to-One Learning

Committee members will doubtless bring vast experience and knowledge about one-to-one learning, but systematic, thorough studies of research and theory are critical to ensure a positive outcome. A clear vision for one-to-one learning will identify directions for research, including specific conditions and characteristics of the school environment, such as demographics, state and local requirements, and community characteristics. At the early stages of the investigation, committee members should not disregard ideas that seem unworkable so they can respond to potentially creative solutions during the planning process (Crockett, 2011).

If possible, committee members should visit schools that have implemented one-to-one learning in different formats. If a site visit isn't feasible, telephone interviews with different stakeholders can provide some practical information if interview questions are carefully designed to elicit critical information.

Although face-to-face visits are valuable and can be persuasive, the experiences of one school's program cannot necessarily be generalized to fit all your school's needs and characteristics. Committee members will also need to conduct more systematic studies from print and online resources that answer the following questions:

- What are best practices for one-to-one learning?
- How can teaching and learning be personalized with one-to-one computers?
- What are the benefits and challenges of different devices?

HIGHLIGHT

Interviewing and Surveying Stakeholders

Adapt questions to guide your visits to one-to-one environments. Sample interview and survey questions are provided in Appendix C: Interview Questions for Mobile Learning Practitioners.

Review information, resources, and tools to help you make wise decisions about mobile learning at Intel's Education Mobile Learning website (www.intel.com/content/www/us/en/education/k12/mobile-learning.html).

- What are some challenges for personalized learning and one-to-one implementation?
- Where are resources that can help schools with their plan?

Another important category of investigation is surveying the feelings and ideas of different stakeholder groups in the community. Through surveys and informal questioning of teachers, parents, students, and community members, the committee can be proactive by identifying areas of support and possible challenges.

The committee must also study the cost of different programs and sources of funding available within and outside the school system, both for beginning and sustaining a one-to-one program. Part of the leadership's role as visionaries at this stage is to keep the technology committee grounded in the practical considerations of a program, while keeping the long-term promise of technology integration alive.

Choose a Device

Tablets? Laptops? Chromebooks? Macs? PCs? BYOD? Or the best combination of devices for your program? Perhaps the most time-consuming decisions to be made when planning a one-to-one program are choices about devices and implementation models. Every stakeholder group should have input into these important decisions, but make sure all stakeholders understand that the majority will not necessarily rule. Competing

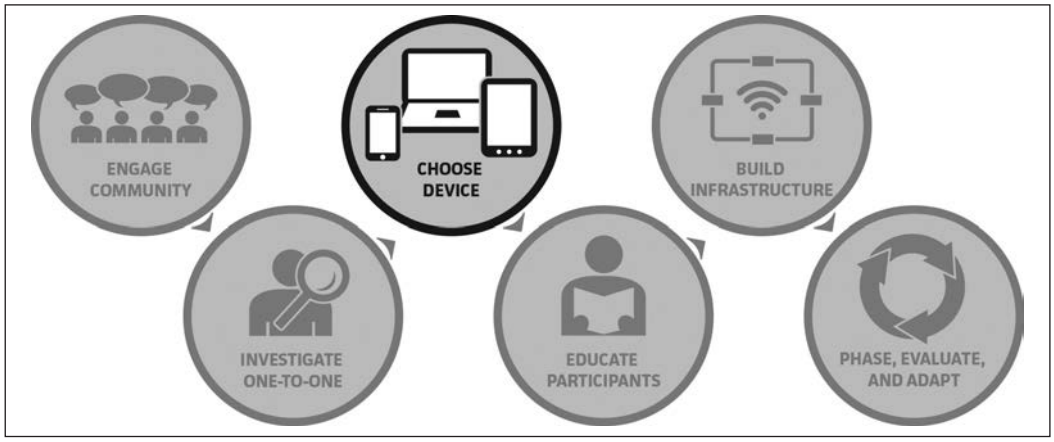

Figure 9.4. Choose a device

expectations must be balanced with technology requirements, financial considerations, and issues of access and equity.

As decisions about devices represent a significant financial investment and will have an impact on all the program's participants, consider all of the following major questions, as well as each one's related issues, before making final decisions:

How can the device support personalized instruction?

To specifically address the needs of a personalized learning environment, a device must be appropriate both for consuming and creating content, and these needs may vary by grade level. Consider the following productivity features when choosing devices:

- Multitasking between applications
- The capability of using common powerful applications, such as Microsoft Office and Adobe Photoshop
- Input through a keyboard, a touch interface, or a stylus

Additionally, how will the device prepare students for the workplace? Although technology will certainly change over time and students must learn to adapt to new technologies, they must be prepared, as much as possible, to use common industry applications.

What is the total cost of ownership?

The cost of purchasing devices to start a one-to-one program may be straightforward, but hidden or unanticipated expenses can quickly ramp up costs. Consider what kinds of maintenance will be required for the devices, how software will be updated, and what kinds of tech support will be necessary.

How will the devices interact with current systems, software, and devices?

Any school already has considerable money and effort invested in current technology. Before adding hundreds or even thousands of new devices, it's important to investigate how these devices will work with existing hardware, such as desktop computers, printers, and interactive whiteboards. Another consideration is compatibility with apps and tools that teachers and students are currently using, such as Adobe Flash or specific websites. Are the technological features of the publishing companies in your curriculum fully compatible with the devices?

How does the device deal with privacy and security?

For some stakeholders, security and privacy are the most critical considerations when choosing a device or devices for a one-to-one program. What process does the manufacturer have in place for handling security issues? Are security updates automatic? Will every user be informed when problems occur? Will the manufacturer of the devices promise not to share student data or target them with advertising?

How "manageable" is the device?

Although schools are becoming more open to online resources such as cloud computing and social networks, having a degree of control over how the devices are used, both inside and outside the school environment, is important. How easy will it be to set up, operate, store, charge, and maintain the devices? And in what ways will educators and parents cooperate on how the devices are used outside as well as inside school?

How durable and well made are the devices?

Let's face it. Students may not be the most cautious caretakers of computing devices, and adults may be careless with a device. Some devices have features such as spill-proof keyboards, scratchproof glass, and built-in cases that protect them from breaking. Avoid

HIGHLIGHT

Selecting a Device

Use a checklist to help you select a device and platform for your one-to-one program. An example can be found in Appendix C: Device Investigation Checklist.

devices that require fancy or expensive cases, and remember that students' devices are likely to be thrown into backpacks, dropped on the playground, and unintentionally knocked off desks. Investigate plans for repair and replacement.

What training does the manufacturer of the device provide?

The purchase of computers for a school or district is a significant sale, and many vendors offer teacher training programs along with a purchase. Be sure to investigate the quality of these trainings, however, to make sure that they support the goals of the one-to-one vision and personalized learning.

What accessibility and language features are available with the device?

When making decisions about a device, be sure that students and teachers with various types of disabilities can use it comfortably. Don't rely solely on a vendor's descriptions of accessibility features. Ask a representative sample of your disabled users to try out all devices being considered to determine whether all features are functional and work smoothly and intuitively. In today's multicultural learning environment, language is also a consideration. For example, does the device support a variety of languages through different keyboards (adapted from Microsoft Corporation, 2012)?

Educate Teachers and Other Stakeholders

All proponents of one-to-one computing agree that professional development is the key to success. They understand that the journey to a personalized one-to-one environment differs among teachers, depending on their teaching and learning experiences, their beliefs about how students learn, and their technological expertise.

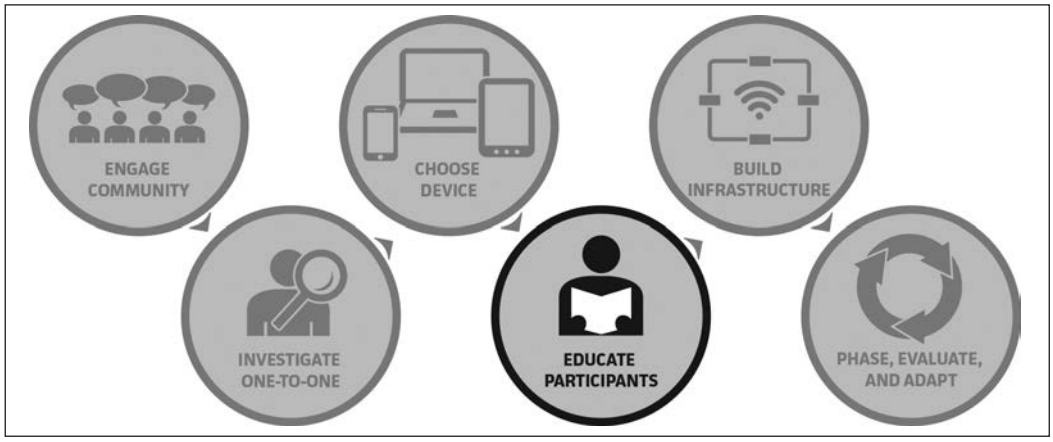

Figure 9.5. Educate participants

Standards for Effective Technology Professional Development

Learning Forward, an association promoting the implementation of effective professional development, focusing on technology and Common Core standards, warns that traditional methods for teaching educators will fail in 21st-century environments. The Learning Forward Association identifies seven critical attributes for effective professional learning:

Learning Communities: Professional learning that increases educator effectiveness and results for all students occurs within learning communities committed to continuous improvement, collective responsibility, and goal alignment.

Leadership: Professional learning that increases educator effectiveness and results for all students requires skillful leaders who develop capacity, advocate, and create support systems for professional learning.

Resources: Professional learning that increases educator effectiveness and results for all students requires prioritizing, monitoring, and coordinating resources for educator learning.

Data: Professional learning that increases educator effectiveness and results for all students uses a variety of sources and types of student, educator, and system data to plan, assess, and evaluate professional learning.

Learning Designs: Professional learning that increases educator effectiveness and results for all students integrates theories, research, and models of human learning to achieve its intended outcomes.

Implementation: Professional learning that increases educator effectiveness and results for all students applies research on change and sustains support for implementation of professional learning for long-term change.

Outcomes: Professional learning that increases educator effectiveness and results for all students aligns its outcomes with educator performance and student curriculum standards (cited in Killion & Hirsh, 2012, p. 8, from Learning Forward, 2011).

Some other strategies can help teachers make the leap to personalization with one-to-one devices:

- Provide teachers with regular time to collaborate and share ideas.
- Focus on encouraging small steps and risk taking, rather than on punishment and criticism.
- Model best practices in using technology in transformational ways and articulate how and why the methods are important.
- Minimize the fear of failure and share personal experiences that did not go as well as expected.
- Offer small grants for innovative practices with one-to-one technology.
- Give teachers a significant voice in decisions about the mobile learning program and listen to what they have to say (adapted from Demski, 2012).

Creating an effective one-to-one program cannot be realized without a full commitment to professional development (PD). Effective one-to-one programs transform classrooms into places where students are determining their own learning paths and taking responsibility for their progress. Before such transformations can take place, teachers must understand how to plan, lead, and manage personalized one-to-one learning.

Professional development for teachers on one-to-one instructional strategies should begin in a variety of formats as soon as a school has made a commitment to a mobile learning approach and should continue as part of a school's overall PD plan.

Of course, when one-to-one programs begin, students will need to learn how to use their mobile devices safely and securely. Even in a BYOD program, students who are familiar with their personal devices may have developed bad habits with those devices that inhibit their learning potential. All students need to have training on appropriate online behavior with frequent updates and reminders.

When schools supply mobile devices, the role of education is greatly expanded. Students need to know how to operate their devices safely, how to take care of them, and how to use them productively for educational purposes. If students are allowed to take the devices home, some training sessions for parents have proved beneficial for many schools.

James Tenbusch (2011) is the director of data, assessment, and technology in Illinois' Round Lake Area School District 116, where a one-to-one program has been implemented. In this program, in order for children to receive laptops, parents must take a

HIGHLIGHT

Professional Development Opportunities

Moving into Mobile Learning and *Creativity in the Mobile Classroom* are e-learning courses for teachers that explain and demonstrate the implementation of mobile learning with interactive activities and locally relevant classroom examples. These courses help teachers transition to mobile teaching and learning and give them the background rationales, planning strategies, technology apps, and online tools to make the transition comfortable and enjoyable. The courses offer suggestions for assessing student learning with mobile devices and managing a mobile learning environment. Learn more from the Intel .com website. A good place to begin is with an engaging article that explains the benefits to students when teachers study technology (www.intel.com/content/www/us/en/education/evaluations/intel-teach-elements-SRI-AIR-article.html).

Teachers can also visit Teachers Engage (http://engage.intel.com/welcome), Intel Education's online community of educators, where they can explore and share their mobile learning stories, questions, and answers.

Another way to learn is to register for free webinars or view archived webinars from an ongoing series on mobile learning.

90-minute course that covers the responsible use of technology, how to maintain the equipment, and how to monitor their children's computer use at home.

Ongoing professional development for administrators is necessary to keep them on top of the latest advances and enable them to evaluate teachers and provide support effectively, particularly in smaller schools where principals take on many roles.

YOUR TURN

Professional Development

Stop and Reflect: What are your overall feelings about your own professional development experiences? Which ones inspired and prepared you to try new things and be successful doing them? Why?

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Discuss: With what specific professional development experiences have you seen the most positive results in improving teaching and learning? Why do you think these programs were especially effective?

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Apply: What plans can you begin to make to provide teachers and other relevant personnel with professional development that will make your one-to-one program a success?

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Build Infrastructure

The infrastructure needs and demands of a mobile learning environment are extensive; if they are shortchanged, even the best implementation plan is bound to fail. In a one-to-one environment, there is no such thing as a nonlearning space. Opening school doors to students' and staff members' devices will create heavy demands on your network's infrastructure.

Broadband Internet Access

Digital textbooks, streaming video lectures, and online class discussions: these are a few examples of how education in the 21st century is moving toward the virtual realm. And with that movement, comes the need for faster and more reliable internet connections for students and teachers, both inside and outside the classroom.

Yet, according to the report *Speed Matters: A Report on Internet Speeds in All 50 States* (CWA, 2010), there is a growing disparity between the United States and other developed nations in terms of broadband speeds, and the United States ranks 15th in the world in terms of broadband adoption. The median download speed for the nation was 3.0 megabits per second (mbps) in 2010, which was only one-half a megabit per second (0.5 mbps) increase from the median download speed of 2.5 in 2009. A national broadband map created by the Federal Communications Commission (FCC) and the National Telecom-

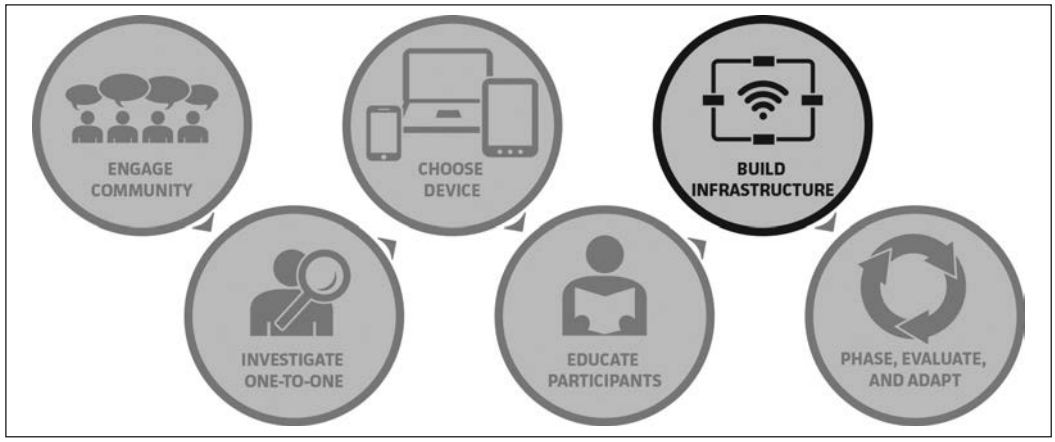

Figure 9.6. Build infrastructure

munications and Information Administration shows that 67% of U.S. schools subscribe to internet service below 25 mbps, half the speed recommended by the State Educational Technology Directors Association (SETDA) (Fox, Waters, Fletcher, & Levin, 2012).

In 2010, the FCC published *The National Broadband Plan*, which set a goal of download speeds of at least 100 mbps and upload speeds of a minimum 50 mbps for 100 million U.S. homes, with schools having a minimum of 1 gigabit per second (gbps).

In its report titled *The Broadband Imperative*, SETDA went further by recommending that the federal government, states, and districts take responsibility for ensuring easy access to robust broadband connectivity outside of schools (Fox, et al., 2012).

In June 2013, President Barack Obama introduced ConnectEd, an initiative to leverage the popular E-Rate program to connect 99% of America's students to the internet through a broadband connection. The president stated, "We are living in a digital age, and to help our students get ahead, we must make sure they have access to cutting-edge technology" (Office of the Press Secretary).

As the education sector moves closer to personalized learning—and as the number of connected digital devices per person continues to grow exponentially—students and educators are going to need greater broadband access beyond schools to keep pace with immersive digital content and online learning.

With easy access to reliable, robust, and cost-effective broadband, we can ensure that each student's school experience mirrors evolving societal expectations for public education. Access permits students to create engaging text and multimedia projects, such as videos, conduct research collaboratively with students on the other side of the state or the world, take online courses not available locally, and talk directly with authors and experts. Using online tools, teachers can collaborate with colleagues, participate in professional development, and immediately analyze the results from assessments to personalize instruction for each student.

Given that bandwidth availability determines which online content, applications, and functionality students and educators will be able to use effectively in classrooms, additional bandwidth will be required in many, if not most, K–12 districts in this country in the coming years. If we are serious as a nation about preparing all students for college and careers, a concerted national effort will be required to address both school-based bandwidth needs and out-of-school access for students and educators.

To remedy the broadband deficit and prepare for increasing usage, SETDA issued some connection speed targets and pointed to several state initiatives that demonstrate how states and localities can address the problem. By 2014–15, the association is pushing for schools to acquire broadband access from an internet provider of up to 100 megabits per second (mbps) per 1,000 students and teachers. By 2017–18, the goal would be to increase the broadband width to more than 1,000 mbps, which is equal to 1 gigabyte per second (gbps).

Software

In a one-to-one computing environment, schools will probably purchase devices with a customized software package. Software should support the school's mobile learning vision. For example, a vision that emphasizes personalizing student learning would mean student production tools would be more valuable than those designed for drill and practice.

Many schools or districts implementing one-to-one initiatives will purchase a learning management system. A learning management system (LMS) is a critical piece of technology infrastructure that can be used for many purposes, such as to create classroom portals that allow students and parents to view grades and assignments. Some can even be used for delivery of online courses.

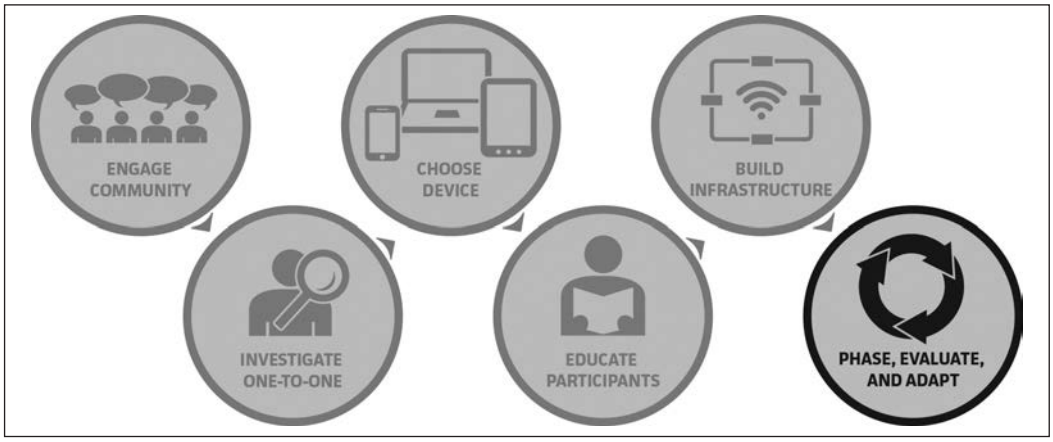

Figure 9.7. Phase, evaluate, and adapt

With a wide variety of personal mobile devices, successful BYOD implementation makes use of platform-independent tools. Web-based applications work on most platforms and can accommodate common software needs, including photo editing and multimedia presentations. To prevent file compatibility issues, BYOD programs are most effective when they use cloud-based online storage for sharing and collaboration that works on all devices.

Phase, Evaluate, and Adapt

Implementing personalized one-to-one programs should be a combination of slow and cautious moves forward and leaps of faith. One-to-one advocates can take a lesson from early attempts at technology integration, where expensive equipment purchased under technology initiatives gathered dust in closets due to ineffective implementation planning. On the other hand, waiting until everything is in place before starting a full-scale program can delay a potentially beneficial innovation indefinitely.

Moving quickly into a small pilot program, even when all components aren't yet in place, can make for a more successful, streamlined implementation. Some guidelines can help you conduct an effective pilot program:

- Determine what kinds of information you want from the pilot before beginning, based on the established vision, but be open to collecting additional information.
- Minimize consequences for failure. One of the purposes of a pilot is to detect problems. Pilot programs involving students, however, should not place any student at a disadvantage, so as much as possible, problems that affect student learning should be anticipated in the design or dealt with immediately.
- Every aspect of a pilot must be documented, and data should include both qualitative and quantitative data, such as how much the devices are used, what they are used for, and participants' feelings about the program.
- Conduct frequent evaluations of the program and make adjustments if they do not compromise the integrity of the pilot.
- Pilot programs start small and grow as successful features and methods are identified and duplicated.
- Remember when using pilot data to make decisions about larger implementation not to generalize beyond the conditions of the pilot. A program that works well with sixth graders would not necessarily be effective with fifth graders. The experiences of a teacher who is an early adopter (which is usually the case with technology pilots) may not be duplicated with a less proficient teacher. For this reason, for large-scale programs, multiple pilots may be helpful.

Most large-scale, one-to-one learning initiatives eventually follow a *phased* model, beginning with a class, grade, or school, and then expanding at regular intervals. In this way, the school or district can learn from each stage to make the next one smoother and more successful.

HIGHLIGHT

Evaluation Tools

Explore surveys and questions for evaluating your one-to-one program in Appendix C: Program Evaluation Tools.

In whatever way your school decides to implement its one-to-one initiative, ongoing evaluation is critical if the program is to improve and grow. A program's design should identify regular checkpoints and clear benchmarks to assess how well the program is meeting the goals established in the vision. Systematic evaluations, including self-evaluations from all participants, will keep a program on track and lead to the ultimate goal of improved student learning (Crockett, 2012).

A variety of methods can contribute useful data to the evaluation of a one-to-one learning program:

- Teacher and student self-assessments
- Classroom observations by technology coordinators and administrators
- Teacher, student, and parent surveys
- Test scores
- Attendance and discipline records

Like any educational innovation, a one-to-one program needs to mature and grow to stay relevant. New features and devices will be developed; teachers and administrators will come and go. A vibrant program will continually evolve to adapt to new technologies and teaching strategies and build on the expertise of school personnel, particularly the interests and abilities of younger teachers who grew up in the digital age.

Continuous evaluation of a one-to-one program is critical for keeping the focus on student learning and engagement. Part of an effective, overall one-to-one strategy is a systematic plan for assessing the strengths and weakness of the program and making necessary adjustments to improve its effectiveness.

No single evaluation method will yield all the information needed to determine the effectiveness of a one-to-one program. A variety of formal and informal methods, such as those used in pilot programs, will paint a picture of what works and what needs to be improved. Making the effort to conduct thorough evaluations will ensure a one-to-one program's longevity and success.

YOUR TURN

Program Implementation

Stop and Reflect: What processes have you used in the past to adopt educational innovations, technology, and other ideas?

_____

_____

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_____

What adaptations would make the process more effective?

_____

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Discuss: What have you learned from your experiences as you've implemented new programs in your school, not just in technology?

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Apply: Create a strategic plan for implementing a one-to-one personalized learning initiative in your school.

Conclusion

The 21st century is an exciting time to be an educator and should also be an exciting time to be a student. Good teaching has always focused on the needs of individual students. Today, fortunately, the availability of high-quality online resources and the ubiquity of all kinds of computing devices are making it possible to teach students in ways that can help them achieve the greatest success. Students, to a great degree, are already there. It is up to the education community to learn how to make the best use of all available resources. The rewards will surely be worth the effort.

APPENDIX A

Introduction to Project RED

Project RED (Revolutionary EDucation) is a coalition of research organizations focused on supporting school leaders in the effective use of technology to improve teaching and learning, specifically through one-to-one computing programs. When you register at the Project RED website (www.projectred.org), you will have access to research-based tools and information to help you plan, design, and implement your one-to-one program.

Research

The resources available in Project RED are based on a comprehensive research project analyzing technology implementation in nearly 1,000 schools in 49 states and the District of Columbia. The study incorporated 11 different measures of educational success, student to computer ratios, 22 categories of independent variables, and demographic data to determine how technology can have the greatest positive impact on student learning. The researchers found that when specific processes and characteristics are in place, programs with one computer per student have great benefits.

Project RED Tools

School leaders who join Project RED will find a complete set of tools they can use to implement a one-to-one program:

Transformational Change and Project Planning Overview. Helps educators move to an "irreversible new system" that breaks with traditional methods.

Professional Development Tools. Study the Common Core State Standards and inquiry-based pedagogy to develop new approaches to instruction.

Implementation Tools. Plan your one-to-one program with the One-to-One Cost Savings Calculator, the Cost Comparison Calculator, a Readiness Tool, and a Sample Implementation Plan.

Success Stories. Explore colleagues' stories of successful implementation of one-to-one computing.

RED Hub

The Project RED website provides a social network where participants can share ideas and discuss issues related to one-to-one implementation. Members can also post messages in a forum and explore videos created by project leaders about their experiences.

Red Events

Project RED conducts face-to-face institutes for technology leadership teams in districts with successful one-to-one programs. Monthly webinars also introduce topics relevant for schools or districts considering, planning, or implementing a one-to-one computing initiative.

Other Resources

Project RED members can explore links to various implementation tools, covering the following topics:

- Financial implementation
- Tools for principals
- Infrastructure
- Policy
- Parent and community education
- Professional development
- Classroom procedures and management
- Case studies of successful one-to-one implementation

Project RED Sponsors

Project RED's founding sponsor is Intel, and in 2012–2013, Hewlett Packard, Pearson Foundation, and SMART Technologies became sponsors.

APPENDIX B

Common Core State Standards Overview

The Common Core State Standards are informed by the content, rigor, and organization of standards of high-performing countries and states, so that all students are prepared to succeed in a global economy and society. The inclusion of all types of learners was also a priority, with writers selecting language intended to make the standards documents accessible to different learners.

The standards development process has incorporated best practices and research from across the nation and the world. As new research is conducted, the implementation of the Common Core standards is evaluated, with the intent of revising the standards on a set review cycle.

The Common Core standards

- Are aligned with college and work expectations
- Include rigorous content and application of knowledge through high-order skills
- Are focused and coherent
- Build upon strengths and lessons of current state standards
- Are informed by top-performing countries, so that all students are prepared to succeed in the global economy and society
- Ensure that standards are evidence- and/or research-based
- Are state led

Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects

These standards—built on the best standards work of the states—align with college and career readiness and maintain focus on what matters most to achieve these goals. They provide an integrated model of literacy with media requirements blended throughout. These standards are broken up into three main sections: Grades K–5 (cross-disciplinary); Grades 6–12 English Language Arts; and Grades 6–12 Literacy in History/Social Studies, Science, and Technical Subjects; and four strands: Reading (including Reading Foundational Skills); Writing; Speaking and Listening; and Language.

Reading

Reading comprehension standards for reading literature and informational texts feature strong and growing across-the-curriculum emphasis on a student's ability to read and comprehend literary and informational texts. The broad range of content areas employs a "staircase" of growing text complexity across grades, using high-quality literary and informational texts in a range of genres and subgenres.

Reading Foundational Skills

- Print concepts (Grades K–1)
- Phonological awareness (Grades K–1)
- Phonics and word recognition (Grades K–5)
- Fluency (Grades K–5)

Writing and Language

The standards feature strong and growing across-the-curriculum emphasis on students writing arguments and informative/explanatory texts, all aligned with the National Assessment of Educational Progress (NAEP) Writing framework. Other crucial aspects of these standards include:

- Developing and strengthening writing
- Using technology to produce and enhance writing
- Engaging in research and writing about sources
- Writing routinely over various time frames
- Sharing of information and concepts formally, including through the use of technology

- Using standard English in formal writing and speaking
- Using language effectively and recognizing language varieties
- Determining word meanings and word nuances
- Acquiring general academic and domain-specific words and phrases

Standards for Mathematics

The standards for mathematical content carry across all grade levels. Content standards define what students should understand and be able to do. Clusters are groups of related standards, and domains are larger groups that progress across grades. The K–8 standards are presented by grade level and are organized into domains that progress over several grades. High school standards are presented by conceptual themes: number and quantity, algebra, functions, modeling, geometry, statistics and probability.

The standards begin with extending the counting sequence, understanding place value, and using place value understanding and properties of operations to add and subtract. Next, students represent and solve problems involving addition and subtraction and work to understand and apply properties of operations and the relationships between addition and subtraction.

In Grades 3–6, students develop an understanding of fractions as numbers, build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers, understand decimal notation for fractions, and compare decimal fractions. Students then develop an understanding of statistical variability, leading up to algebra in Grade 8, where students explore properties of operations, similarity, ratio and proportional relationships, and the rational number system. Students in Grades 7–8 are also expected to master the following standards:

- Work with radicals and integer exponents
- Understand the connections between proportional relationships, lines, and linear equations
- Analyze and solve linear equations and pairs of simultaneous linear equations
- Define, evaluate, and compare functions
- Use functions to model relationships between quantities.

In high school, the mathematical standards grapple with conceptual themes such as:

Number and Quantity

Algebra

Functions

Modeling

Geometry

Statistics and Probability

The Common Core standards focus on key topics at each grade level and coherent progressions across grade levels. They are a balance of concepts and skills, with content standards that require both conceptual understanding and procedural fluency. In terms of mathematical practices, they foster reasoning while constructing an ambitious yet achievable bridge toward college and career readiness. See www.corestandards.org/math/content/mathematics-glossary for further details.

APPENDIX C

Forms, Surveys, and Checklists

Technology for Principals Self-Assessment

- ❒ I am confident in my abilities to use mobile devices to learn and research topics of importance both for my profession and my personal interests.
- ❒ I am confident in my abilities to use mobile devices to communicate and share ideas.
- ❒ I am confident in my abilities to use mobile devices to create different kinds of products and presentations.
- ❒ I frequently investigate the latest educational apps and tools.
- ❒ I often model the use of new technologies for my staff and students.
- ❒ I use a variety of apps and tools to collect and analyze data.
- ❒ I have used or participated in the following activities or resources:
  - ❒ Personal Learning Networks (PLNs)
  - ❒ Blogs
  - ❒ Podcasts
  - ❒ Webinars
  - ❒ RSS feeds
  - ❒ Technology-specific conferences
  - ❒ Technology training
  - ❒ Instructional technology professional development
- ❒ I am aware of how the teachers in my school are currently using technology.
- ❒ I can identify some teacher-leaders in the area of instructional technology.
- ❒ I can illustrate how mobile devices can be used in classrooms.

- ❒ I can identify teachers or programs that show a culture that encourages risk taking.
- ❒ I can name some innovative practices or programs that my teachers have implemented.

What am I doing well to support technological innovation in my school?

_____

_____

_____

_____

_____

What can I improve?

_____

_____

_____

_____

_____

What steps will I take to make necessary changes happen?

_____

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_____

Interview Questions for Mobile Learning Practitioners

Interview Questions

What was your purpose for implementing mobile learning?

_____

_____

_____

_____

_____

What was your vision for the program?

_____

_____

_____

_____

_____

What steps did you go through to begin your program?

_____

_____

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_____

What results have you seen so far for your program?

_____

_____

_____

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_____

What are some of the biggest challenges you are encountering?

_____

_____

_____

_____

In what ways has mobile learning affected teaching and learning?

_____

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_____

How do teachers and students use the mobile devices?

_____

_____

_____

_____

How do you measure success?

_____

_____

_____

_____

_____

How did you decide on a model of mobile learning with a specific device or BYOD?

_____

_____

_____

_____

What software did you purchase or choose? Why?

_____

_____

_____

_____

What do administrators, teachers, parents, and students think of the program?

_____

_____

_____

_____

What recommendations would you have for a school that is just beginning to investigate mobile learning?

_____

_____

_____

_____

One-to-One Stakeholder Surveys

You may want to copy these questions into an online tool, such as SurveyMonkey for easy distribution and analysis.

Students

1. What mobile devices do you own or have ready access to? Select as many as apply.
   - **a.** Laptop
   - **b.** Smartphone
   - **c.** Tablet
   - **d.** E-Reader
   - **e.** Other mobile internet-connected device, such as iPod touch
   - **f.** None

If you do not have access to a mobile device, skip to question 7.

2. What operating systems do your devices use? Select as many as apply.
   - **a.** iOS (Apple)
   - **b.** Android
   - **c.** Windows
   - **d.** Other
   - **e.** I don't know.

3. Do you have broadband internet access at home?
   - **a.** Yes
   - **b.** No
   - **c.** I don't know.

4. How often do you use a mobile device for schoolwork?
   - **a.** Often—a few times a week
   - **b.** Sometimes—once a week or so
   - **c.** Rarely—maybe once every few weeks
   - **d.** Never

5. How do you use your mobile device for schoolwork? Select as many as apply.
   - **a.** Watching subject-area related media
   - **b.** Doing research

c. Collaborating with peers
d. Communicating with teachers
e. Working on school projects
f. Reading literature or textbooks
g. Other _____

6. How enthusiastic would you be about having more opportunities to use your mobile devices at school?
   a. I would love it!
   b. It's a good idea.
   c. It's okay, but not that great.
   d. I don't know how I feel about this.
   e. I wouldn't like it.

Skip to question 9.

7. If the school allowed you to use a mobile device in the classroom, would you get one?
   a. For sure
   b. Maybe
   c. Probably not
   d. No way

8. If you could get a mobile device, what kind would you like to get?
   a. Laptop
   b. Smartphone
   c. Tablet
   d. E-Reader
   e. Other

9. What, if any, are some benefits you can think of for using mobile devices at school?

_____

_____

_____

_____

_____

10. What, if any, are some problems you can think of related to using mobile devices at school?

_____

_____

_____

_____

_____

Parents

1. How many children do you have in this school and what are their grades?
   - **a.** ___ children in Grades K–3
   - **b.** ___ children in Grades 4–6
   - **c.** ___ children in Grades 7–8
   - **d.** ___ children in Grades 9–12

2. What mobile devices do your children have access to? Select as many as apply.
   - **a.** Laptop
   - **b.** Smartphone
   - **c.** Tablet
   - **d.** E-Reader
   - **e.** Other mobile internet-connected device, such as iPod touch
   - **f.** None

3. Would you like for your children to be able to use their mobile devices in the classroom?
   - **a.** Yes, I think it's a great idea.
   - **b.** It might be a good idea.
   - **c.** I'm not sure.
   - **d.** It's probably not a good idea.
   - **e.** It's a terrible idea.

4. What, if any, are some benefits you can think of for using mobile devices at school?

_____

_____

_____

_____

_____

_____

_____

5. What, if any, are some problems you can anticipate related to using mobile devices at school?

_____

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_____

6. If your children do not have mobile devices, would you provide one if they could use them at school?
   - **a.** Absolutely
   - **b.** Probably
   - **c.** Maybe
   - **d.** No

Teachers

1. What do you teach? Select all that apply.

Subject	Grade
a. Art	m. K–1
b. English Language Learners	n. 2–3
c. Language Arts	o. 4–5
d. Math	p. 6–8
e. Music	q. 9–10
f. Physical Education	r. 11–12
g. Science	
h. Social Studies	
i. Special Education	
j. Technology	
k. World Languages	
l. Career and Technical Education	

2. How long have you been teaching?
   - **a.** 1–3 years
   - **b.** 4–10 years
   - **c.** 11–15 years
   - **d.** More than 15 years

3. What mobile devices do you own? Select as many as apply.
   - **a.** Laptop
   - **b.** Smartphone
   - **c.** Tablet
   - **d.** E-Reader
   - **e.** Other mobile internet-connected device, such as iPod Touch.

4. How technologically proficient are you?
   - **a.** Very proficient
   - **b.** Rather proficient
   - **c.** Not very proficient

5. How often do your students use their mobile devices outside your classroom for your class?
   a. Probably quite a bit
   b. Some
   c. Seldom
   d. Hardly ever

6. How important is technology to your instructional methods?
   a. Critical
   b. Rather important
   c. Useful, but not necessary
   d. Not at all important

Device Investigation Checklist

Modify and use this checklist to make notes and rate the devices (with 1 being the lowest and 5 being the higest) you are considering for your one-to-one program.

	Device 1		Device 2	
	Rating (1–5)	**Notes**	**Rating (1–5)**	**Notes**
Personalized learning support				
Total cost of ownership				
Compatibility with current system				
Privacy and security				
Manageability				
Durability				
Training				
Accessibility				

Program Evaluation Tools

The following questions can be modified and used to evaluate the effectiveness of a personalized learning program in your school.

Teacher Reflection

How have you given your students responsibility for their learning?

_____

_____

_____

_____

_____

How have you given your students more choices about how and what they will learn?

_____

_____

_____

_____

_____

What have you tried to make your classroom more personalized that was successful?

_____

_____

_____

_____

What have you tried that was not as successful as you had hoped? Why did it not work out as you expected? Will you try it again with changes?

_____

_____

_____

_____

_____

_____

Do you think your students are getting the greatest benefit from their mobile devices? Why or why not?

_____

_____

_____

_____

_____

_____

What is your biggest challenge in personalizing your students' learning?

_____

_____

_____

_____

_____

_____

Teacher Evaluation Survey

1. How much responsibility do you give your students for their learning?
   - **a.** Major responsibility
   - **b.** Some responsibility
   - **c.** A little responsibility
   - **d.** No responsibility

2. How often do your students make choices about what they are learning?
   - **a.** Once a week or more
   - **b.** Every few weeks
   - **c.** Less than once a month

3. How often do your students make choices about how they learn or show what they have learned?
   - **a.** Once a week or more
   - **b.** Every few weeks
   - **c.** Less than once a month

4. How often do students use mobile devices in your classroom?
   - **a.** Once a week or more
   - **b.** Every few weeks
   - **c.** Less than once a month

5. What kinds of learning activities do you ask your students to do with mobile devices?
   - **a.** Collaborate with peers, mentors, or others
   - **b.** Communicate
   - **c.** Create multimedia projects
   - **d.** Use online files
   - **e.** Watch multimedia presentations
   - **f.** Self- or peer assess learning processes or products
   - **g.** Other _____

6. How successful do you feel your mobile learning program is with your students?
   - **a.** Very successful
   - **b.** Rather successful

c. I'm not sure
d. Not very successful
e. Very unsuccessful

7. How do you think your students feel about using their mobile devices for schoolwork?
   a. Very enthusiastic
   b. Positive
   c. I'm not sure
   d. Negative
   e. Very negative

What are your biggest successes with mobile learning?

_____

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_____

What are your biggest challenges with mobile learning?

_____

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_____

_____

What comments do you have about the mobile learning initiative?

_____

_____

_____

_____

Student Evaluation Survey

1. How much responsibility do you feel you have for your own learning?
   - **a.** Major responsibility
   - **b.** Some responsibility
   - **c.** A little responsibility
   - **d.** No responsibility

2. How often do you make choices about what you are learning?
   - **a.** Once a week or more
   - **b.** Every few weeks
   - **c.** Less than once a month

3. How often do you make choices about how you learn or show what you have learned?
   - **a.** Once a week or more
   - **b.** Every few weeks
   - **c.** Less than once a month

What mobile devices do you use for schoolwork and how much do you use them?

4. Laptop computer
   - **d.** Practically every day
   - **e.** At least once a week
   - **f.** Every few weeks
   - **g.** Hardly ever
   - **h.** Do not use

5. Smartphone
   - **a.** Practically every day
   - **b.** At least once a week
   - **c.** Every few weeks
   - **d.** Hardly ever
   - **e.** Do not use

6. Tablet
   - **a.** Practically every day
   - **b.** At least once a week

c. Every few weeks
d. Hardly ever
e. Do not use

7. Other device _____
   a. Practically every day
   b. At least once a week
   c. Every few weeks
   d. Hardly ever

8. How often do you use mobile devices in the classroom?
   a. Once a week or more
   b. Every few weeks
   c. Less than once a month

9. What kinds of learning activities does your teacher ask you to do with your mobile device?
   a. Collaborate with peers, mentors, or others
   b. Communicate
   c. Create multimedia projects
   d. Use online files
   e. Watch multimedia presentations
   f. Self- or peer assess learning processes or products
   g. Other _____

10. What kinds of learning activities do you do on your own with mobile a device?
    a. Collaborate with peers, mentors, or others
    b. Communicate
    c. Create multimedia projects
    d. Use online files
    e. Watch multimedia presentations
    f. Self- or peer assess learning processes or products
    g. Other _____

11. How do you feel about using your mobile devices for schoolwork?
    a. Very enthusiastic
    b. Positive

c. I'm not sure
d. Negative
e. Very negative

What are your biggest successes with mobile learning?

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What are your biggest challenges with mobile learning?

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What comments do you have about mobile learning?

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APPENDIX D

ISTE Standards

ISTE Standards for Students (ISTE Standards•S)

All K–12 students should be prepared to meet the following standards and performance indicators.

1. Creativity and Innovation

Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology. Students:

- **a.** apply existing knowledge to generate new ideas, products, or processes
- **b.** create original works as a means of personal or group expression
- **c.** use models and simulations to explore complex systems and issues
- **d.** identify trends and forecast possibilities

2. Communication and Collaboration

Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others. Students:

- **a.** interact, collaborate, and publish with peers, experts, or others employing a variety of digital environments and media
- **b.** communicate information and ideas effectively to multiple audiences using a variety of media and formats

- **c.** develop cultural understanding and global awareness by engaging with learners of other cultures
- **d.** contribute to project teams to produce original works or solve problems

3. Research and Information Fluency

Students apply digital tools to gather, evaluate, and use information. Students:

- **a.** plan strategies to guide inquiry
- **b.** locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media
- **c.** evaluate and select information sources and digital tools based on the appropriateness to specific tasks
- **d.** process data and report results

4. Critical Thinking, Problem Solving, and Decision Making

Students use critical-thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources. Students:

- **a.** identify and define authentic problems and significant questions for investigation
- **b.** plan and manage activities to develop a solution or complete a project
- **c.** collect and analyze data to identify solutions and make informed decisions
- **d.** use multiple processes and diverse perspectives to explore alternative solutions

5. Digital Citizenship

Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior. Students:

- **a.** advocate and practice the safe, legal, and responsible use of information and technology
- **b.** exhibit a positive attitude toward using technology that supports collaboration, learning, and productivity
- **c.** demonstrate personal responsibility for lifelong learning
- **d.** exhibit leadership for digital citizenship

6. Technology Operations and Concepts

Students demonstrate a sound understanding of technology concepts, systems, and operations. Students:

- **a.** understand and use technology systems
- **b.** select and use applications effectively and productively
- **c.** troubleshoot systems and applications
- **d.** transfer current knowledge to the learning of new technologies

ISTE Standards for Teachers (ISTE Standards•T)

All classroom teachers should be prepared to meet the following standards and performance indicators.

1. Facilitate and Inspire Student Learning and Creativity

Teachers use their knowledge of subject matter, teaching and learning, and technology to facilitate experiences that advance student learning, creativity, and innovation in both face-to-face and virtual environments. Teachers:

- **a.** promote, support, and model creative and innovative thinking and inventiveness
- **b.** engage students in exploring real-world issues and solving authentic problems using digital tools and resources
- **c.** promote student reflection using collaborative tools to reveal and clarify students' conceptual understanding and thinking, planning, and creative processes
- **d.** model collaborative knowledge construction by engaging in learning with students, colleagues, and others in face-to-face and virtual environments

2. Design and Develop Digital-Age Learning Experiences and Assessments

Teachers design, develop, and evaluate authentic learning experiences and assessments incorporating contemporary tools and resources to maximize content learning in context and to develop the knowledge, skills, and attitudes identified in the ISTE Standards for Students. Teachers:

- **a.** design or adapt relevant learning experiences that incorporate digital tools and resources to promote student learning and creativity
- **b.** develop technology-enriched learning environments that enable all students to pursue their individual curiosities and become active participants in setting their own educational goals, managing their own learning, and assessing their own progress
- **c.** customize and personalize learning activities to address students' diverse learning styles, working strategies, and abilities using digital tools and resources

d. provide students with multiple and varied formative and summative assessments aligned with content and technology standards and use resulting data to inform learning and teaching

3. Model Digital-Age Work and Learning

Teachers exhibit knowledge, skills, and work processes representative of an innovative professional in a global and digital society. Teachers:

a. demonstrate fluency in technology systems and the transfer of current knowledge to new technologies and situations
b. collaborate with students, peers, parents, and community members using digital tools and resources to support student success and innovation
c. communicate relevant information and ideas effectively to students, parents, and peers using a variety of digital-age media and formats
d. model and facilitate effective use of current and emerging digital tools to locate, analyze, evaluate, and use information resources to support research and learning

4. Promote and Model Digital Citizenship and Responsibility

Teachers understand local and global societal issues and responsibilities in an evolving digital culture and exhibit legal and ethical behavior in their professional practices. Teachers:

a. advocate, model, and teach safe, legal, and ethical use of digital information and technology, including respect for copyright, intellectual property, and the appropriate documentation of sources
b. address the diverse needs of all learners by using learner-centered strategies and providing equitable access to appropriate digital tools and resources
c. promote and model digital etiquette and responsible social interactions related to the use of technology and information
d. develop and model cultural understanding and global awareness by engaging with colleagues and students of other cultures using digital-age communication and collaboration tools

5. Engage in Professional Growth and Leadership

Teachers continuously improve their professional practice, model lifelong learning, and exhibit leadership in their school and professional community by promoting and demonstrating the effective use of digital tools and resources. Teachers:

- **a.** participate in local and global learning communities to explore creative applications of technology to improve student learning
- **b.** exhibit leadership by demonstrating a vision of technology infusion, participating in shared decision making and community building, and developing the leadership and technology skills of others
- **c.** evaluate and reflect on current research and professional practice on a regular basis to make effective use of existing and emerging digital tools and resources in support of student learning
- **d.** contribute to the effectiveness, vitality, and self-renewal of the teaching profession and of their school and community

ISTE Standards for Administrators (ISTE Standards•A)

All school administrators should be prepared to meet the following standards and performance indicators.

1. Visionary Leadership

Educational Administrators inspire and lead development and implementation of a shared vision for comprehensive integration of technology to promote excellence and support transformation throughout the organization. Educational Administrators:

- **a.** inspire and facilitate among all stakeholders a shared vision of purposeful change that maximizes use of digital-age resources to meet and exceed learning goals, support effective instructional practice, and maximize performance of district and school leaders
- **b.** engage in an ongoing process to develop, implement, and communicate technology-infused strategic plans aligned with a shared vision
- **c.** advocate on local, state, and national levels for policies, programs, and funding to support implementation of a technology-infused vision and strategic plan

2. Digital-Age Learning Culture

Educational Administrators create, promote, and sustain a dynamic, digital-age learning culture that provides a rigorous, relevant, and engaging education for all students. Educational Administrators:

- **a.** ensure instructional innovation focused on continuous improvement of digital-age learning
- **b.** model and promote the frequent and effective use of technology for learning
- **c.** provide learner-centered environments equipped with technology and learning resources to meet the individual, diverse needs of all learners
- **d.** ensure effective practice in the study of technology and its infusion across the curriculum
- **e.** promote and participate in local, national, and global learning communities that stimulate innovation, creativity, and digital-age collaboration

3. Excellence in Professional Practice

Educational Administrators promote an environment of professional learning and innovation that empowers educators to enhance student learning through the infusion of contemporary technologies and digital resources. Educational Administrators:

- **a.** allocate time, resources, and access to ensure ongoing professional growth in technology fluency and integration
- **b.** facilitate and participate in learning communities that stimulate, nurture, and support administrators, faculty, and staff in the study and use of technology
- **c.** promote and model effective communication and collaboration among stakeholders using digital-age tools
- **d.** stay abreast of educational research and emerging trends regarding effective use of technology and encourage evaluation of new technologies for their potential to improve student learning

4. Systemic Improvement

Educational Administrators provide digital-age leadership and management to continuously improve the organization through the effective use of information and technology resources. Educational Administrators:

- **a.** lead purposeful change to maximize the achievement of learning goals through the appropriate use of technology and media-rich resources
- **b.** collaborate to establish metrics, collect and analyze data, interpret results, and share findings to improve staff performance and student learning
- **c.** recruit and retain highly competent personnel who use technology creatively and proficiently to advance academic and operational goals
- **d.** establish and leverage strategic partnerships to support systemic improvement
- **e.** establish and maintain a robust infrastructure for technology including integrated, interoperable technology systems to support management, operations, teaching, and learning

5. Digital Citizenship

Educational Administrators model and facilitate understanding of social, ethical, and legal issues and responsibilities related to an evolving digital culture. Educational Administrators:

- **a.** ensure equitable access to appropriate digital tools and resources to meet the needs of all learners
- **b.** promote, model, and establish policies for safe, legal, and ethical use of digital information and technology
- **c.** promote and model responsible social interactions related to the use of technology and information
- **d.** model and facilitate the development of a shared cultural understanding and involvement in global issues through the use of contemporary communication and collaboration tools

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