Wired to Learn: K-12 Students in the Digital Classroom

A white paper from the Center for Promise at America's Promise Alliance

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Acknowledgements

America's Promise Alliance would like to recognize the 13 interviewees who enthusiastically shared their perspectives and experiences related to their school district's digital learning initiative(s). Their insights and expertise elucidate key lessons that we hope will contribute to other efforts around the country that seek to spark and sustain students' love for learning and prepare them for thriving futures.

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"The challenging and rapidly changing demands of our global economy tell us what people need to know and who needs to learn. Advances in learning sciences show us how people learn. Technology makes it possible for us to act on this knowledge and understanding."

National Education Technology Plan[1]

Harnessing technology for education reform

Technology has been touted as an important tool to prepare all young people for educational and life success, particularly given the rapid changes taking place in the world. The transformation from a manufacturing to a knowledge-based economy demands higher educational attainment and skill acquisition.[2] Sixty-five percent of jobs are predicted to require postsecondary education and training by 2020, compared to only 28 percent in 1973.[3] This new economic landscape will also require, as the National Research Council has argued, "knowledge that can be transferred or applied in new situations,"[4] as well as what are called 21st century skills, such as critical thinking, creativity, communication, and collaboration.[5]

Unfortunately, many U.S. students have a long way to go to be competitive in the current (and future) job market. No more than two-fifths of elementary and secondary school students are proficient in math and reading,[6] 20 percent of U.S. students are not graduating high school on-time, if ever,[7] and an estimated 40 percent of the young people enrolled in four-year colleges and 70 percent of those in two-year programs are not obtaining degrees.[8] Young people also overwhelmingly report feeling disengaged in school,[9] which can lead to poor academic achievement and an elevated risk for dropping out.[10]

In 2010, the Obama administration produced the National Education Technology Plan. It championed digital learning - a broad term referring to any instructional practice that uses technology to enhance students' education[11]- as a powerful pathway for preparing youth for college and career and raising the college graduation rate. The technology plan targeted learning, assessment, teaching, infrastructure, and productivity in order to help close the achievement gap.[12] In particular, the plan proposed the following steps:

- **Learning:** deploy technology to facilitate student-centered, standards-based educational practices that engage and empower young people
- **Assessment:** utilize technology to evaluate the effectiveness of instructional techniques and student knowledge
- **Teaching:** leverage technology to foster collaboration among educators and connect them to resources and data
- **Infrastructure:** provide access to information and online communities and enable continuous learning regardless of location or time
- **Productivity:** integrate technology to enhance efficiency[13]

The rise of digital learning

Digital learning surfaced within K-12 education in the 1990s as mainly state-operated virtual schools that enrolled students in supplemental online classes.[14] It drew on the precedent of distance education, which originated in the 1930s as a method for delivering instruction to students separated from their teachers in time and/or space. Distance education has since evolved to employ electronic and nonelectonic tools for formal learning. Electronic methods are telecommunications-based, such as audio and video conferencing, and Internet-based. Distance education was deployed as a strategy to ensure equitable access to learning, especially among rural and small schools.[15] This approach aimed to address the needs of students at risk of dropping out due to insufficient credits and to offer options to those who wanted to enroll in courses not available at their school, such as Advanced Placement classes.[16] These functions are still considered a valuable role for digital learning. In a 2008-09 survey, for example, 79 percent of high school principals perceived that offering online and blended classes (i.e., courses that use both online and offline pedagogies) is important for providing courses unavailable to students; 73 percent

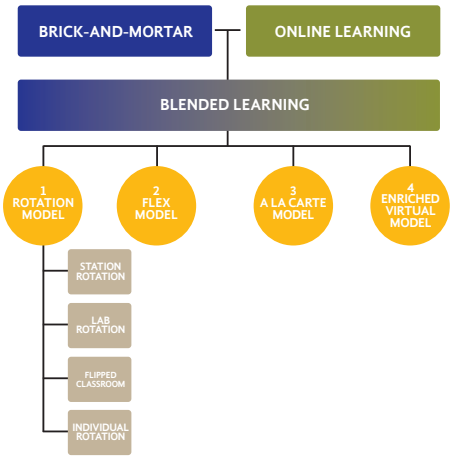
for credit recovery; 61 percent for Advanced Placement classes; and 60 percent for addressing students' specific needs.[17]

Although still most common in postsecondary education,[18] digital learning is growing quickly within the K-12 sector, especially at the secondary level.[19] Approaches differ according to factors such as whether they operate at a state, district, or consortium level; whether they serve students from across the state, multiple districts, or a single district; and whether they deliver all courses online, offer supplemental classes, or combine online and face-to-face instruction.[20] Most common and fastest growing are single-district online programs, in which students typically take supplemental web-based classes while attending traditional school, and blended learning programs, a hybrid of online and face-to-face instruction.[21]

Recently, blended learning has attracted attention within K-12 education for its potential to offer "the best of both worlds" by integrating effective elements of both online and face-to-face instruction.[22] Blended learning benefits students through several key features:[23]

- **Time:** learning extends beyond the traditional school day and year
- **Place:** learning transcends the classroom and occurs in other locations
- **Path:** students choose mediums tailored to their learning needs
- **Pace:** students advance through material according to their ability

A variety of models fall under the blended learning umbrella. The Clayton Christensen Institute's taxonomy (depicted in the figure below) provides an example of how blended learning models have been categorized. Four models have been developed, which include rotation, flex, á la carte, and enriched virtual. Within rotation, instruction occurs across multiple modalities – such as online and small group activities - on a set schedule. Four subtypes further distinguish the rotation model. The flex model involves a predominantly online format on a fluid schedule in which teachers provide guidance as needed (initially designed for dropout and credit recovery). Within á la carte, students enroll in at least one online class in addition to traditional classes (originally intended to expand access to courses not offered at a school, such as Advanced Placement and foreign language classes). Lastly, enriched-virtual consists of the entire student body participating in online and occasional face-to-face classes (aimed at enhancing learning for students in full-time virtual schools and to provide online learning options in states without virtual schools).[24]



Source: Christensen Institute, Blended learning model definitions

Prior to 2000, less than 10 percent of K-12 districts had enrolled students in an online class, a number that grew to over 20 percent in 2007-08. Blended learning reflects a similar pattern: fewer than 10 percent of districts had students attending a blended learning class before 2000, compared to over 25 percent in in 2007-08.[25] Collectively, the percent of districts with students enrolled in online and blended learning increased by a striking 47 percent between 2005-06 and 2007-08.[26]

This trend is accelerating. According to the most recent data available by the U.S. Department of Education, over half of public school districts offered online learning opportunities during 2009-10, enrolling almost two million students (nearly all of whom were in high school).[27,28] The annual Keeping Pace report, which surveys online and blended learning nationwide, estimated that over 75 percent of districts provided online or blended learning options during the 2013-14 school year.[29] Continued growth is anticipated: approximately 5 million K-12 students (mainly at the secondary level) are predicted to enroll in an online class by 2016.[30]

The rise of digital learning resonates with young people. A 2012 survey by the Pew Research Center's Internet & American Life Project found that 95 percent of youth ages 12-17 regularly use the Internet, and 93 percent either have a computer or possess access to one at home (the majority share a desktop or laptop computer with another family member).[31] According to the survey, teens also increasingly connect via mobile devices: 74 percent use their cell phones, tablets, and other devices to access the Internet at least occasionally, with a quarter predominately using their cell phone.[32] Other data highlights the prevalence of social media within young people's lives: 80 percent of teens reported using social networking sites in 2011.[33] Youth from low-income and less educated families are somewhat less likely to go online, though socioeconomically disadvantaged youth are as likely – and at times more likely – to primarily connect through their cell phones.[34,35]

1:1 computing and BYOD initiatives

The advent of blended learning illuminates another trend: the evolution of 1:1 computing and Bring Your Own Device or Technology (BYOD/T) initiatives. As devices have become more affordable and lighter weight, and wireless access has grown, states and school districts have increasingly adopted 1:1 computing initiatives.[36,37] "1:1" refers to a ratio in which each student has his or her own device, such as a laptop or tablet.[38] States that have launched large-scale 1:1 initiatives include Florida, Maine, Michigan, North Carolina, South Dakota, and Texas. Districts are also implementing BYOD/T initiatives, which allow students to use their own digital devices for instructional purposes during school.[39]

Why digital learning matters

Technology and digital media represent a powerful pathway for advancing the goals of education reform, including raising academic achievement and preparing students for college and career. Digital tools help to promote these goals by facilitating student-centered, personalized learning practices,[40] which are flexible and responsive to young people's learning needs and interests, enable them to progress at their own pace to master core competencies, and maximize opportunities for learning beyond the classroom.[41]

Research demonstrates that this type of learning environment increases student engagement.[42, 43] For example, student choice related to course enrollment, academic material, and strategies employed in learning tasks was found to strengthen students' desire to complete their work.[44] Additionally, classes involving higher-order thinking, active participation, variety, collaboration, and meaningful connection to students' lives bolstered their interest and enjoyment in learning.[45] In a study of high school students, connective instruction, defined by teacher-student relationships that are caring, understanding, affirming, and use humor, as well as teaching that promotes self-expression and relevance, was more than seven times as significant for student engagement compared to two other teaching practices.[46]

Evidence also suggests that relevant and rigorous learning experiences can enhance students' quality of work.[47]

Empirical evidence has shown vast variation among individuals in how they learn most effectively, pointing out the importance of customizing information.[48,49] By personalizing learning, educators can develop stronger relationships with students and tailor curriculum, instruction, and assessments according to individual learning styles, strengths, interests, and motivations.[50] Because digital media involves many formats, including text, image, video, and animation, it can display material in different ways and be transformed to construct new content.[51] Enabling students to access an essay in different formats, for instance, would allow a dyslexic student to listen to an audio version through a podcast, while an English Language Learner could use online software to translate digital text into Spanish.[52]

Digital media also has the capacity to differentiate learning beyond the level of traditional instruction by scaffolding lessons and regulating supports and/or challenges according to students' individual strengths,[53] and enabling them to progress at their own pace.[54] Technology tools can model abstract processes and explanations through simulations and animations.[55] For example, students in a math class increased their knowledge about concepts such as proportions and rates through an interactive computer program that visually depicted the material.[56]

As part of the personalized learning approach, educators become facilitators and coaches rather than experts and lecturers, and use pedagogical practices such as project- and problem-based learning that immerse students in independent and collaborative work to investigate meaningful, real-world topics.[57] Project- and problem-based learning is an instructional method in which youth address a question or problem by applying 21st century skills to demonstrate their knowledge through generating a product of their choice.[58] Digital media expand possibilities for student expression, collaboration, and relevant, real-world learning experiences.[59] These tools amplify collaborative opportunities within the classroom and across districts, states, and even countries, and connect youth to authentic learning experiences aligned with their interests.[60] In a survey, for example, teachers attributed students' deeper investment in writing to digital tools that enabled students to share their work with larger and more diverse audiences, promoted collaboration, and fostered creativity and self-expression.[61]

Digital technologies also deliver real-time, relevant feedback and facilitate formative assessments that determine students' understanding during a class.[62] This data helps teachers evaluate student growth, and tailor instruction based on learners' comprehension.[63] Individualized feedback from computer-based assessments is considered a promising strategy for motivating students by identifying their strengths and showing ways to improve while they are focused on a learning task.[64] Finally, digital tools promote "anytime, anywhere" learning, regardless of location and time.[65]

Empirical evidence: Does technology pass the test?

As more districts develop digital learning initiatives, researchers are evaluating the impact of these approaches. At this point, the evidence is mixed.

Scholars have noted that benefits tend to be more substantial when blended learning (versus a purely online experience) is used and when the time devoted to instruction with technology supplements, and not replaces, the time spent without it.[66] A meta-analysis of 40 years of studies on the use of technology in education found that technology has had a consistent, positive small to moderate effect on student achievement, with the

effects most apparent in approaches that use technology as a supportive teaching modality instead of used as direct instruction.[67]

As an example, a national 2010 study found that effective K-12 1:1 computing initiatives ameliorated disciplinary problems, and improved academic performance and dropout and graduation rates compared to both traditional classrooms and schools that had poorly implemented 1:1 initiatives.[68,69] The authors conclude that factors associated with successful technology implementation include incorporation into all classes, professional development, consistent student online collaboration, integration of technology within core curriculum, online formative assessment, low student-computer ratio, virtual field trips, student use of search engines, and training of school principals. The data also indicated that 1:1 initiatives are cost-effective since they decrease paperwork and paper and copy machine expenses.[70]

Reviews of K-12 1:1 initiatives suggest similar positive effects, among them include higher student engagement and academic achievement,[71] and reduced absentee rates and behavioral issues.[72] While effect sizes vary related to academic achievement, 1:1 initiatives appear to most significantly affect writing outcomes.[73]

Studies have also found limited gains, however. For instance, some K-12 1:1 computing initiatives show either a lack of positive effects on student outcomes or mixed results.[74] Overall, scholars highlight a need for further research to evaluate the effectiveness of digital learning on K-12 student outcomes.

"Broadband has become the enabling technology of modern learning environments."

(Fox et al., 2012, p. 3)

Capacity as a critical foundation

Realizing the potential of digital learning to promote student success depends on the broadband and wireless capacity to deliver online content, applications, and functionality to schools.[75] For example, video streaming, now common within K-12 classrooms, requires ample bandwidth.[76] Other demands, such as the increased use of mobile devices, the transition to e-textbooks, upcoming online assessments related to the Common Core State Standards or similar initiatives focused on higher standards, and the installation of cloud computing, reinforce the need for high-speed connectivity.[77,78]

The Telecommunications Act of 1996 established the Schools and Libraries Program, widely known as E-rate. It is now the country's largest educational technology program.[79] Telecommunications companies direct a portion of their interstate and international revenue - usually representing a small charge for consumers[80]– to the federal Universal Service Fund (USF), originally created to subsidize telephone service for low-income individuals and high-cost areas.[81]This fund provides discounted telecommunications and Internet service to eligible schools and libraries that apply through the E-rate program.[82] The program has successfully connected nearly all schools and libraries to the Internet - a significant boost since the legislation's enactment, when only 14 percent had online access.[83] Discounts on telecommunications, Internet, and wireless services range from 20-90 percent, varying according to the income levels of a school's students and its location.[84] E-rate was capped at $2.25 billion annually and hasn't been raised since 1998, except to account for inflation.[85,86] Requests, however, continually exceed the cap: in 2013 schools and libraries applied for $4.9 billion.[87]

Despite widespread connectivity, a majority of schools and libraries lack the bandwidth to drive digital learning. In a 2010 Harris Interactive, Inc. survey commissioned by the Federal Communications Commission (FCC), almost 80 percent of E-rate funded schools and libraries reported inadequate broadband capacity, and a majority worried about slow connection speeds.[88] Only 10 percent of respondents reported a speed of at least 100 megabits per second, and just half of E-rate-supported schools indicated 3 megabits per second or less, the minimum speed sufficient for streaming high-definition educational video content and utilizing many other sophisticated instructional tools.[89,90]

Home access to high-speed bandwidth is another important dimension of digital learning. Robust connectivity enables students to submit homework online, receive academic support, collaborate with peers, conduct timely research, produce multimedia material, and utilize myriad features of electronic textbooks.[91] Yet almost one-third of adults lack this type of access,[92] with indicators such as age, socioeconomic status, and educational attainment most strongly correlated to home broadband adoption.[93] This disparity can stymie students' ability to participate in digital learning experiences, such as the activities listed above.

Wireless connectivity is another integral part of infrastructure. E-rate has historically delivered limited funding for internal connections such as wireless.[94,95] According to the FCC, almost 60 percent of schools lack the wireless access to power digital devices, with rural schools and libraries having the most limited capacity.[96]

Leading education organizations, such as the Alliance for Excellent Education, International Society for Technology in Education, National Education Association, and State Educational Technology Directors Association, have strongly advocated for addressing schools' pressing infrastructure needs.[97] Policymakers are responding to the urgency of modernizing the country's wireless and broadband infrastructure. In 2010, the FCC issued the National Broadband Plan, which contained several policy recommendations for expanding broadband across health care, public safety, energy, and education, and included a target goal of at least 1 gigabit speed to anchor institutions such as schools.[98] In 2012, the State Educational Technology Directors Association identified a similar goal in its report The Broadband Imperative, specifying 1 gigabit per 1,000 students and staff by 2018.[99] More recently, President Obama launched ConnectEd in 2013, calling for connecting 99 percent of public schools to high-speed broadband and wireless networks by 2018.[100]

The push for reform has also culminated in the FCC's passage of the first major E-rate reform since the program's inception.[101] While the annual funding cap remains in effect, the FCC's Modernization Order, approved in 2014, will use existing reserves to increase wireless support. Other reforms to E-rate include improving cost-effectiveness and restructuring administrative and application processes.[102] The program will distribute $1 billion per year in 2015 and 2016 for wireless services – projected to reach more than 10 million students and thousands of libraries each year - and predicts a similar amount of funding for the subsequent three years as a result of the program's enhanced efficiency.[103] According to analysis by the nonprofit EducationSuperHighway and the Consortium of School Networking (CoSN), this amount will cover the estimated cost related to attaining ConnectEd's 99 percent goal.[104] The investment in wireless connectivity is expected to result in a 75 percent increase in wireless funding for rural schools and 60 percent for urban schools.[105] To offset these investments in wireless technology, the FCC will phase out funding of older technologies, such as pager and voicemail services, and web- and email-hosting.

The aforementioned education organizations all endorsed the plan, and also called for increased investment in broadband capacity.[106] The National Education Association had previously raised concerns about another proposal for expanding wireless service in schools and libraries, arguing that without raising the E-rate annual cap, such an expansion would "raid" funding from basic broadband service.[107] The FCC allayed some of these concerns by ensuring continued broadband support, pledging to augment connectivity in rural communities, and committing to pilot and review reforms over a two-year period.[108] It is also soliciting public input regarding E-rate's future funding needs.[109]

Looking ahead, the Obama administration aims to continue to advance national educational technology goals. The upcoming fiscal year 2015 federal budget designates $200 million for a new initiative called ConnectEDucators, which would train 100,000 teachers in 500 districts that already have access to high-speed internet and digital devices, showing them how to institute individualized learning; $165 million for the Investing in Innovation Fund (i3), which would distribute a portion of this amount to fuel research within educational technology; and $150 million for a new grant program to support high schools' efforts to implement comprehensive strategies that enhance student learning, such as improving instructional time through the use of technology.[110]

National private funders also have supported efforts to modernize the K-12 education system to leverage digital resources in the classroom. For example, the MacArthur Foundation designated Digital Media and Learning as a grant making area in 2006 and established a research hub at the University of California - Irvine in 2009,[111] the Gates Foundation and Carnegie Foundation helped to found the Digital Learning Institute (DigiLEARN) in January 2014,[112] and the Gates Foundation promotes technology as a core component of its College-Ready Education initiative by investing in the development of courseware and game-based learning that is adaptable to individual students' skills.[113]

5 districts unleash digital learning

The advantages of digital learning, as well as the resources required to make it effective, come through most clearly through a look at school districts that have instituted significant programs. The following five case studies examine efforts from across the country in systems that were carefully chosen based on specific criteria:

- Geography
- District locale (ie., rural or urban)
- School size
- Student racial/ethnic composition
- Socioeconomic composition
- Type of technology initiative
- Duration and progression of initiative

To make comparing the five districts easier, each profile addresses key aspects of the Project 24 framework, a systemic – and free - planning and implementation tool developed by the Alliance for Excellent Education to guide school systems' efforts around digital learning.[114] Project 24 urges districts to use a process that meshes seven gears:[115]

- **Budget and resources:** Digital learning environments deploy technologies that are efficient and produce cost-savings; align with district- and building-level strategic and tactical plans; receive consistent funding from the district maintenance and operations budget; and allocate funding for technology based on its relationship to student learning goals.

- **Community partnerships:** Digital learning settings connect students to resources and services outside of school, such as after-school programs and social services;

enable young people to work with community members on real-world topics aligned with the curriculum; ensure consistent access to online content, data, and learning standards; provide mechanisms for collaboration and teamwork; and effectively communicate with parents.

- **Curriculum, instruction, and assessment:** Digital learning initiatives focus on college and career readiness, 21st century skills, and deeper learning; use personalized learning; expect students to collaborate; and emphasize topics that are relevant and require student to apply their knowledge.

- **Data and privacy:** Schools use technology for formative and summative assessments to improve student learning; establish data systems that support evidence-based decision-making; and employ various methods to maintain student privacy.

- **Professional learning:** Educators are trained in research-based instructional practices that hone 21st century skills and prepare students for college and career; have access to assorted professional development opportunities, including online formats, as well as tools to collaborate with professional networks; and participate in evaluating their teaching performance based on multiple benchmarks, such as student achievement and engagement, 21st century skill mastery, and improved instructional practice.

- **Technology and hardware:** Digital learning environments require appropriate technology devices to enable student learning; bandwidth and infrastructure that allows for consistent online connectivity; sufficient support to teachers and students when introducing new technologies; and regular monitoring of technologies, software, hardware, and infrastructure in order to upgrade and replace as necessary.

- **Use of time:** Digital learning settings restructure instructional time by using online and blended learning to extend educational experiences outside of the classroom, and use competency-based learning in which students progress when they master the standard.

Since some gears overlap, the profiles integrate similar topics. For instance, *curriculum*, *instruction*, and *assessment* includes content related to *use of time*, *data and privacy*, and *community partnerships* (when applicable to the district).

Key findings

The overall work in this field, along with the districts' collective experiences, have produced a series of lessons that can guide other districts as they use digital learning to improve student learning.

1. **Plan and expand.** Adequate bandwidth and wireless connectivity is essential for powering digital learning. Profiled districts systematically built their infrastructure and networks – in most cases, several years prior to implementation – in order to ensure ample support for 1:1 and/or BYOD/T computing initiatives. Districts also regularly assess their infrastructure needs as technology evolves and greater high-speed and wireless access may become necessary.

2. **Provide training in technology and pedagogical techniques.** Spotlighted districts emphasized the importance of ongoing professional development opportunities to equip educators to employ a dramatically different instructional approach, as well as to learn practical strategies for integrating technology into the curriculum. Many of the districts deliver professional learning in both face-to-face and online formats to tailor training according to teachers' needs.

3. **Restructure roles - and rooms.** Digital learning transforms the traditional learning environment by altering both pedagogy and the physical layout of classrooms. Featured districts shifted traditional teacher and student roles to personalize learning according to individual needs and interests. Some districts have also changed the classroom settings – through removing desks for flexible learning spaces and painting walls in vibrant colors – to foster a more dynamic learning and teaching environment.

4. **Venture beyond the classroom.** Districts can develop creative strategies by visiting other innovative learning settings across the country, such as in schools, universities, and libraries. Profiled districts illustrate examples of embracing new ideas through experiencing other learning environments. These visits can also lead to building strategic relationships with local businesses, universities, foundations, and other organizations that can bring different points of view and types of expertise, which can stimulate creative thinking and secure fiscal support.

5. **Use data systematically.** A commitment to data is important for personalizing learning and improving instruction, as well as for assessing the effectiveness of digital learning initiatives. While the five district initiatives are relatively young, each consistently draws on data to guide learning and instruction and to track student outcomes.

APPENDIX A

Case study methodology

Telephone interviews were conducted with 13 stakeholders from five school districts from June – July 2014, using a protocol developed by America's Promise Alliance. Interviews were approximately 30 to 45 minutes in length and were recorded with the interviewee's consent. Extant documents were compiled and reviewed, including strategic and technology plans, annual reports and other district materials, and media coverage. Administrative data was drawn from the National Center for Educational Statistics, as well as from state department of education and district websites.

APPENDIX B

Case study school districts (appear in alphabetical order)

DISTRICT NAME	STATE	WEBSITE
Elizabeth Forward School District	Pennsylvania	www.efsd.net
Lewisville Independent School District	Texas	www.lisd.net
Mobile County Public School System	Alabama	www.mcpss.com
San Jose Unified School District	California	www.sjusd.org
West Allis-West Milwaukee School District	Wisconsin	www.wawm.k12.wi.us

APPENDIX C

Case study interviewees (appear in alphabetical order by school district)

Elizabeth Forward School District, Pennsylvania

NAME	TITLE
Dr. Todd Keruskin	Assistant Superintendent
Mary Beth Wiseman	Director of Technology

Lewisville Independent School District, Texas

NAME	TITLE
Jerram Froese	Director of Educational Technology
Patrick Johnson	Manager of Network and Technical Services
Karen Permetti	Chief Communications Officer

Mobile County Public School System, Alabama

NAME	TITLE
David Akridge	Executive Manager, Information Technology
Dr. Pamela Moore	Technology Resource Teacher
Michele White	Instructional Technology Coordinator

San Jose Unified School District, California

NAME	TITLE
Rupa Gupta	Project Manager, Strategic Projects
Jason Willis	Assistant Superintendent, Community Engagement and Accountability

West Allis-West Milwaukee School District, Wisconsin

NAME	TITLE
Johnna Noll	Director of Instructional Services
Paula Kaiser	Next Generation Learning/Personalization and Assessment Coordinator
Rachel Schemelin	Digital Learning Coordinator

ENDNOTES

[1] National Education Technology Plan, 2010, p. 8.

[2] National Research Council, 2012.

[3] Carnevale et al., 2013.

[4] National Research Council, 2012, p. 23.

[5] Partnership for 21st Century Skills, n.d.

[6] Aud et al., 2013.

[7] Balfanz, Bridgeland, Fox, DePaoli, Ingram, & Maushard, 2014.

[8] National Center for Education Statistics, 2013.

[9] Yazzie-Mintz, 2010.

[10] Archambault Janosz, Morizot, & Pagani, 2009; Fredericks, Blumenfeld, & Paris, 2004.

[11] Alliance for Excellent Education, n.d.

[12] National Education Technology Plan, 2010.

[13] Ibid.

[14] Barbour, 2013.

[15] Cavanaugh, Gillian, Kromrey, Hess, & Blomeyer, 2004; Smith, Clark, & Blomeyer., 2005.

[16] Smith et al., 2005.

[17] Piccano, Seaman, Shea, & Swan, 2012.

[18] Smith et al., 2005.

[19] Barbour, 2013; Piccano et al., 2012; Smith et al., 2005; Watson et al., 2013.

[20] For a detailed description of each type of online and blended model, see Watson et al., 2013.

[21] Watson et al., 2013.

[22] Christensen, Horn, & Staker, 2013.

[23] Christensen et al., 2013; Staker & Horn, 2012.

[24] Ibid.

[25] Picciano et al., 2012.

[26] Ibid.

[27] Queen & Lewis, 2011.

[28] The exact percentage of online and blended learning programs isn't readily captured because many states don't mandate that districts distinguish this type of enrollment from traditional class enrollment (Watson et al., 2013).

[29] Watson et al., 2013.

[30] Piccano et al., 2012.

[31] Madden et al., 2013.

[32] Ibid.

[33] Lenhart, 2012.

[34] Madden et al., 2013.

[35] The strongest indicators for Internet use are age, education, and socioeconomic status: older adults and individuals without a high school education or who are socioeconomically disadvantaged are less likely to go online (Zickhur & Smith, 2012).

[36] Penuel, 2006.

[37] 1:1 initiatives were first introduced in the mid-1990s, though they significantly differed from the contemporary version because they provided either limited or no Internet access (Penuel, 2006). The first large-scale 1:1 laptop program was Microsoft's Anywhere Anytime Learning (Mouza, 2008).

[38] Richardson et al., 2013.

[39] Ibid.

[40] Rose Gravel et al., 2012.

[41] Darling-Hammond, Friedlaender, & Snyder, 2014; Jobs for the Future, n.d.

[42] Student engagement involves a process that embodies behavioral, emotional, and cognitive dimensions. Behavioral engagement refers to student participation, such as school attendance and conduct and involvement in class and extracurricular activities; emotional dimensions relate to student feelings toward school, including peers and teachers; finally, cognitive factors involve employing various strategies to deepen learning (Fredericks et al., 2004).

[43] National Research Council, 2004; Toshalis & Nakkula, 2012.

[44] National Research Council, 2004.

[45] Ibid.

[46] Cooper, 2014.

[47] Mitchell, Shkolnick, Song, Uekawa, Murphy, Garet, & Means, 2005.

[48] Ibid.

[49] Hinton, Fischer, & Glennon, 2012.

[50] Yonewaza, McClure, & Jones, 2012.

[51] Rose Gravel et al., 2012.

[52] Ibid.

[53] Rose Gravel et al., 2012.

[54] Alliance for Excellent Education, 2012.

[55] Rose Gravel et al., 2012.

[56] Ibid.

[57] Alliance for Excellent Education, 2012; Yonewaza, McClure, & Jones, 2012.

[58] Alliance for Excellent Education, 2012; Buck Institute for Education, n.d.

[59] Ibid.

[60] Rose Gravel et al., 2012.

[61] Purcell et al., 2012.

[62] Andrade, Huff, & Brooke, 2012; Rose Gravel et al., 2012.

[63] Rose Gravel et al., 2012.

[64] Andrade et al., 2012.

[65] Alliance for Excellent Education, 2012.

[66] Means, Toyama, Murphy, Bakia, & Jones, 2010

[67] Tamim, Bernard, Borokhovski, Abrami & Schmid, 2011.

[68] Project Red, 2010.

[69] The results are considered exploratory due to limitations related to the self-selected sample and self-reported data (Sell, Cornelius-White, Chang, McLean, & Roworth, 2012).

[70] Project Red, 2010.

[71] Bebell & O'Dwer, 2010; Holcomb, 2009; Penuel, 2006; Sell et al., 2012.

[72] Holcomb, 2009.

[73] Holcomb, 2009; Penuel, 2006; Sell et al., 2012.

[74] Holcomb, 2009; Sell et al., 2012.

[75] Fox et al., 2012; National Education Technology Plan, 2010.

[76] Ibid.

[77] Common Core State Standards Initiative, n.d.

[78] Fox et al., 2012.

[79] Federal Communications Commission, 2014b.

[80] Telecommunications providers choose whether to charge consumers to cover the cost of their contribution to the Universal Service Fund (Federal Communications Commission, n.d.c)

[81] Federal Communications Commission, n.d.c.

[82] Ibid.

[83] Federal Communications Commission, 2014a.

[84] Federal Communications Commission, n.d.c.

[85] Ibid.

[86] Rosenworcel, 2013.

[87] Federal Communications Commission, n.d.b.

[88] Harris Interactive, Inc., 2010.

[89] Ibid.

[90] Rosenworcel, 2013.

[91] Fox et al., 2012.

[92] Rainie, 2013.

[93] Zickuhur & Smith, 2013.

[94] Wheeler, 2014.

[95] Federal Communications Commission, 2014.

[96] Wheeler, 2014.

[97] Alliance for Excellent Education, 2014; International Society for Technology in Education, 2014; National Education Association, 2014; State Educational Technology Directors Association, 2014.

[98] Federal Communications Commission, 2010.

[99] Fox et al., 2012.

[100] The White House, n.d..

[101] Federal Communications Commission, 2014.

[102] Ibid.

[103] ibid.

[104] Consortium of School Networking and EducationSuperHighway, 2014.

[105] Federal Communications Commission, 2014.

[106] Alliance for Excellent Education, 2014; International Society for Technology in Education, 2014; National Education Association, 2014; State Educational Technology Directors Association, 2014.

[107] National Education Association, 2014

[108] Ibid.

[109] Federal Communications Commission, 2014.

[110] Alliance for Excellent Education, 2014.

[111] MacArthur Foundation, 2009, 2012.

[112] edSurge, 2014.

[113] Gates Foundation, n.d..

[114] Free resources include a digital readiness survey, an online course, webinars, and other materials (Alliance for Excellent Education, n.d.)

[115] Alliance for Excellent Education, n.d.

REFERENCES

Alliance for Excellent Education. (2014). *Creating anywhere, anytime learning for all students: Key elements of a comprehensive digital infrastructure.* Washington, DC: Report.

Alliance for Excellent Education. (2014, July 11). *Federal Communications Commission votes to modernize E-rate, expand Wi-Fi access in schools and libraries.* Alliance alert. Retrieved on July 11, 2014, from http://all4ed.org/federal-communications-commission-votes-to-modernize-e-rate-expand-wi-fi-access-in-schools-and-libraries/

Alliance for Excellent Education. (2014, March 18). *Straight A's: Public education policy and progress, 14*(5). Retrieved on April 25, 2014, from http://all4ed.org/newsletters/straight-as-public-education-policy-and-progress-volume-14-no-5/

Alliance for Excellent Education. (2012). *Culture shift: Teaching in a learner-centered environment powered by digital learning.* Washington, DC: Author.

Alliance for Excellent Education. (n.d.). *Digital learning day.* Retrieved on April 16, 2014, from http://www.digitallearningday.org/media-inquiries/

Alliance for Excellent Education. (n.d.). *Digital learning.* Retrieved on August 17, 2014, from http://all4ed.org/issues/digital-learning/

Andrade, H., Huff, K., & Brooke, G. (2012). *Assessing learning.* Students at the Center, Teaching and learning in the era of the Common Core. Teaching and learning in the era of the common core. A Jobs for the Future Project.

Archambault, I., Janosz, M., Morizot, J., & Pagani, L. (2009). Adolescent behavioral, affective, and cognitive engagement in school: Relationship to dropout. *Journal of School Health, 79*, 408-415.

Aud, S., Wilkinson-Flicker, S., Kristapovich, P., Rathbun, A., Wang, X., & Zhang, J. (2013). *The condition of education 2013* (NCES 2013-037). U.S. Department of Education, National Center for Education Statistics. Washington, DC. Retrieved February 20, 2014, from http://nces.ed.gov/pubsearch

Balfanz, R., Bridgeland, J. M., Fox, J. H., DePaoli, J. L., Ingram, E. S., & Maushard, M. (2014). *Building a grad nation. Progress and challenge in ending the high school dropout epidemic.* Washington, DC: Annual Update. Retrieved on April 28, 2014, from http://gradnation.org/resource/building-gradnation-progress-and-challenge-ending-high-school-dropout-epidemic-2014

Barbour, M. K. (2013). The landscape of K-12 online learning: Examining what is known. In M. G. Moore (Eds.), Handbook of distance education (3rd ed.) (pp. 574-593). New York, NY: Routledge.

Bebell, D., & O'Dwyer, L. M. (2010). Educational outcomes and research from 1:1 computing settings. *Journal of Technology, Learning, and Assessment, 9*. Retrieved on July 5, 2014, from http://www.jtla.org.

Bebell, D., & Kay, R. (2010). One to one computing: A summary of the quantitative results from the Berkshire Wireless Learning Initiative. *Journal of Technology, Learning, and Assessment, 9*(2). Retrieved on July 5, 2014, from http://www.jtla.org.

Bernard, R. M., Abrami, P. C., Borokhovski, E., Wade, A. C., Tamim, R. M., Surkes, M. A., & Bethel, E. C. (2009). A meta-analysis of three types of interaction treatments in distance education. *Review of Educational Research, 79*, 1243–1289.

Bill & Melinda Gates Foundation. (n.d.). College-Ready Education. Retrieved on April 16, 2014, from http://www.gatesfoundation.org/What-We-Do/US-Program/College-Ready-Education

Bureau of Labor Statistics. (2013). *Employment projections.* Retrieved on May 16, 2014, from http://www.bls.gov/emp/ep_chart_001.htm

Carnevale, A. P., Smith, N., & Strohl, J. (2013). *Recovery: Projections of jobs and education requirements through 2020.* Georgetown University: Center on Education and the Workforce.

Cavanaugh, C., Gillian, K. J., Kromrey, J., Hess, M., & Blomeyer, R. (2004). The effects of distance education on K-12 education outcomes: A meta-analysis. Naperville, IL: Learning Point Associates.

Center for Promise. (2014). *Don't call them dropouts.* Washington, DC: America's Promise Alliance.

Christensen Institute. (n.d.). Blended learning model definitions. Retrieved on July 3, 2014, from http://www.christenseninstitute.org/blended-learning-definitions-and-models/

Christensen, C. M., Horn, M. B., & Staker, H. (2013). *Is K-12 blended learning disruptive? An introduction to the theory of hybrids*. Clayton Christensen Institute for Disruptive Innovation.

Common Core State Standards Initiative. (n.d.). *Standards in your state*. Retrieved on May 21, 2014, from http://www.corestandards.org/standards-in-your-state/

Common Core State Standards Initiative. (n.d.) *Frequently asked questions*. Retrieved on May 21, 2014, from http://www.corestandards.org/about-the-standards/frequently-asked-questions/

Cooper, K. S. (2014). Eliciting engagement in the high school classroom: A mixed-methods examination of teaching practices. *American Educational Research Journal, 51*(2), 363-402.

Darling-Hammond, L., Friedlaender, D., & Snyder, J. (2014). *Student-centered schools, policy supports for closing the opportunity gap.* Stanford Graduate School of Education: Stanford Center for Opportunity Policy in Education.363-402.

edSurge. (2014, January 26). *Gates, Carnegie Foundations support new effort for digital learning.* Retrieved on April 16, 2014, from https://www.edsurge.com/n/2014-01-26-gates-carnegie-foundations-support-new-effort-for-digital-learning

Federal Communications Commission. (2014a). *Modernizing E-rate*. Retrieved on August 31, 2014, from http://www.fcc.gov/e-rate-update

Federal Communications Commission. (2014b). *FCC modernizes E-rate program to expand robust Wi-Fi networks in the nation's schools and libraries*. Retrieved on July 12, 2014, from http://www.fcc.gov/document/fcc-modernizes-e-rate-expand-robust-wi-fi-schools-libraries

Federal Communications Commission. (2014c). *FCC adopts landmark E-rate modernization order to bring high-speed Wi-Fi to every school and library nationwide*. Retrieved on July 12, 2014, from http://www.fcc.gov/article/doc-328172a2

Federal Communications Commission. (2010). *National broadband plan executive summary*. Retrieved on April 9, 2014, from http://www.broadband.gov/download-plan/

Federal Communications Commission. (n.d.b) *Universal Services Fund*. Retrieved on April 19, 2014, from http://www.fcc.gov/encyclopedia/universal-service-fund

Federal Communications Commission. (n.d.c). *Universal service for schools and libraries (E-rate)*. Retrieved on June 20, 2014, from http://www.fcc.gov/guides/universal-service-program-schools-and-libraries

Fox, C., Waters, J., Fletcher, G., & Levin, D. (2012). *The Broadband Imperative: Recommendations to Address K-12 Education Infrastructure Needs.* Washington, DC: State Educational Technology Directors Association (SETDA).

Fredericks, J., Blumenfeld, P., & Paris, A. (2004). *School engagement: Potential of the concept, state of the evidence.* Review of Educational Research, 74, 59-109.

Harris Interactive, Inc. (2010). *2010 E-rate program and broadband usage survey: Report*. Federal Communications Commission, Wireline Competition Bureau. Retrieved on July 3, 2014 from http://transition.fcc.gov/010511_Eratereport.pdf

Hinton, C., Fischer, K. W., & Glennon, C. (2012). *Mind, brain, and education*. Students at the Center, Teaching and learning in the era of the Common Core. Teaching and learning in the era of the common core. A Jobs for the Future Project.

Holcomb, L. B. (2009). Results & lessons learned from 1:1 laptop initiatives: A collective review. *TechTrends, 53*(6), 49-55.

iNACOL.. (n.d.). *Fast facts about online learning.* Retrieved on May 5, 2014, from http://www.inacol.org/resources/publications/inacol-reports/

International Society for Technology in Education. (2014). *Help increase E-rate.* Retrieved on July 13, 2014, from http://www.iste.org/advocacy/public-policy/e-rate

Jobs for the Future. (n.d.) *What are student-centered approaches to learning.* Retrieved on August 17, 2014, from http://www.studentsatthecenter.org/about#whatisscl

Ladd, H. F. (2012). *Presidential address: Education and poverty: Confronting the evidence. Journal of Policy Analysis and Management, 31*(2), 203-227.

Lenhart, A. (2012). *Digital divides and bridges: Technology use among youth.* Washington, DC: Pew Research Center

MacArthur Foundation. (2009). *New center at UC Irvine to seed research and collaboration on digital media & learning.* Retrieved on April 16, 2014, from http://www.macfound.org/press/press-releases/new-center-at-uc-irvine-to-seed-research-and-collaboration-on-digital-media-learning/

MacArthur Foundation. (2012). *Digital media & learning.* Retrieved on April 16, 2014, from http://www.macfound.org/programs/learning/strategy/

Madden, M., Lenhart, A., Duggan, M., Cortesi, S., & Gasser, U. (2013). *Teens and technology 2013.* Washington, DC and Cambridge, MA: Pew Research Center and the Berkman Center for Internet & Society at Harvard University.

Mitchell, K., Shkolnik, J., Song, M., Uekawa, K., Murphy, R., Garet, M., & Means, B. (2005). *Rigor, relevance, and results: The quality of teacher assignments and student work in new and conventional high schools.* Washington, DC: American Institutes for Research and SRI International.

Mouza, C. (2008). *Learning with laptops: Implementation and outcomes in an urban, under-privileged school.* Journal of Research on Technology in Education, 40(4), 447-472.

National Center for Education Statistics. (2013). *Fast facts.* Retrieved on May 16, 2014, from http://nces.ed.gov/fastfacts/display.asp?id=40

National Education Association. (2014). *NEA supports E-Rate proposed changes that keep Internet connectivity intact.* Retrieved on July 12, 2014, from http://www.nea.org/home/59738.htm

National Education Association. (2014). *NEA president: FCC E-rate proposal is bad policy*. Retrieved on July 12, 2014, from http://www.nea.org/home/59434.htm

National Education Association. (n.d.). *Untitled*. Retrieved on July 12, 2014, from http://www.nea.org/home/59434.htm

National Research Council. (2004). *Engaging schools: Fostering high school students' motivation to learn.* Washington, DC: The National Academies.

National Research Council. (2012). *Education for Life and Work: Developing Transferable Knowledge and Skills in the 21st Century. Committee on Defining Deeper Learning and 21st Century Skills, J.W. Pellegrino and M.L. Hilton, Editors. Board on Testing and Assessment and Board on Science Education, Division of Behavioral and Social Sciences and Education.* Washington, DC: The National Academies Press.

Partnership for 21st Century Skills. (n.d.). *Framework for 21st Century Learning*. Retrieved on April 29, 2014, from http://www.p21.org/about-us/p21-framework

Piccano, A. G., Seaman, J., Shea, P., & Swan, K. (2012). Examining the extent and nature of online learning in American K-12 education: The research initiatives of the Alfred P. Sloan Foundation. *Internet and Higher Education, 15*, 127-135.

Project RED. (2010). *Findings*. Retrieved from http://www.projectred.org/about/research-overview/findings.html

Purcell, K., Buchanan, J., & Friedrich, L. (2013). *The impact of digital tools on student writing and how writing is taught in schools.* Washington, DC: Pew Research Center's Internet & American Life Project.

Purcell, K., Heaps, A., Buchanan, J., & Friedrich, L. (2013). *How teachers are using technology at home and in their classrooms.* Washington, DC: Pew Research Center's Internet & American Life Project.

Queen, B., & Lewis, L. (2011). *Distance education courses for public elementary and secondary school students: 2009-10* (NCES 2012-009). U.S. Department of Education, National Center for Education Statistics.

Rainie, L. (2013). *The state of digital divides.* Washington, DC: Pew Research Center's Internet & American Life Project. Retrieved on April 20, 2014, from http://www.pewinternet.org/2013/11/05/the-state-of-digital-divides-video-slides/

Richardson, J. W., McLeod, S., Flora, K., & Sauers, N. J. (2013). *Large-scale 1:1 computing initiatives: An open access database*. International Journal of Education and Development using Information and Communication Technology, 9, 4-18.

Rose, D. H., & Gravel, J. W. (2012). *Curricular opportunities in the digital age.* The Students at the Center Series. Teaching and learning in the era of the common core. A Jobs for the Future Project.

Rosenworcel, J. (2013). *Remarks. Washington education policy summit*. Retrieved on July 3, 2014, from http://www.fcc.gov/document/washington-education-technology-policy-summit

Sell, G. R., Cornelius-White, J., Chang, C., McLean, A., Roworth, W. R. (2012). *A meta-synthesis of research on 1:1 technology initiatives in K-12 education*. Ozarks Educational Research Initiative, Institute for School Improvement, Missouri State University.

Staker, H., & Horn, M. B. (2012). *Classifying K-12 blended learning.* San Mateo, CA: Innosight Institute.

State Educational Technology Directors Association. (2014). *SETDA comment on FCC vote on E-rate modernization*. Retrieved on July 12, 2014, from http://www.setda.org/outreach/press-releases/#!/setda-comment-on-fcc-vote-on-e-rate-modernization

Spires, H. A., Wiebe, E., Young, C. A., Hollebrands, K., Lee, J. K. (2012). Toward a new learning ecology: Professional development for teachers in 1:1 learning environments. *Contemporary Issues in Technology and Teacher Education, 12*(2), 232-254.

Toshalis, E., & Nakkula, M. J. (2012). *Motivation, engagement, and student voice*. Students at the Center, Teaching and learning in the era of the Common Core. Teaching and learning in the era of the common core. A Jobs for the Future Project.

The White House. (n.d.). *ConnectEd initiative*. Retrieved on April 5, from http://www.whitehouse.gov/issues/education/k-12/connected

U.S. Department of Education. (2010). *Evaluation of evidence-based practices in online learning: A meta-analysis and review of online learning studies*. Office of Planning, Evaluation, and Policy Development, Policy and Program Studies Service.

Wheeler, T. (2014). *Closing the Wi-Fi gap in America's schools and libraries*. Retrieved on June 20, 2014, from http://www.fcc.gov/blog/closing-wi-fi-gap-america-s-schools-and-libraries

Yazzie-Mintz, E. (2010). *Charting the path from engagement to achievement: A report on the 2009 High School Survey of Student Engagement*. Bloomington, IN: Center for Evaluation & Education Policy, Indiana University School of Education.

Yonezawa, S., McClure, L., & Jones, M. (2012). *Personalization in schools*. The Students at the Center Series. Teaching and learning in the era of the common core. A Jobs for the Future Project.

Zickuhr, K., & Smith, A. (2013). *Home broadband 2013*. Washington, DC: Pew Research Center's Internet & American Life Project. Retrieved on April 16, 2014, from http://www.pewinternet.org/2013/08/26/home-broadband-2013/

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CASE STUDY

Making, moving, and learning with technology-rich resources in Elizabeth Forward School District

MAKING, MOVING, AND LEARNING WITH TECHNOLOGY-RICH RESOURCES IN ELIZABETH FORWARD SCHOOL DISTRICT

Evoking Willy Wonka, the middle school students eagerly create chocolate products. They produce them in the Dream Factory, a state-of-the-art space opened in their school in 2013 that applies ideas from the "maker" movement, an international grassroots effort that promotes hands-on, do-it-yourself (DIY) learning across diverse settings, including libraries, museums, schools, and online.[1,2] The students are producing a prototype for a chocolate bar as part of an interdisciplinary course integrating computer science, the arts, technology, and family consumer science.[3] The Dream Factory offers them an array of resources, such as a robotics lab, a professional workshop with laser engravers, 3D printers, and wood benches, and a video production room. These tools facilitate independent and group projects that can equip students with 21st century skills essential for future success in the labor market.[4]

The Dream Factory represents just one of several inventive, technology-charged initiatives at Elizabeth Forward School District, a rural system located outside of Pittsburgh.[5,6] Todd Keruskin, assistant superintendent of schools, reports that people joked about this being the most unlikely place for change,[7] but today Elizabeth Forward exemplifies forward thinking. It launched the state's first district-wide 1:1 iPad initiative, supplying every student with that device[8] to integrate blended learning – a combination of online and face-to-face instruction[9] – in addition to other types of digital learning, which refers to any instructional practice that uses technology to enhance students' education.[10] The district has been recognized as an Apple Distinguished Educators Program[11] and is a member of the League of Innovative Schools by Digital Promise, a national coalition of public school districts dedicated to digital innovation to bolster student success.[12] Visitors travel to the district from across the country, even from as far away as Turkey and Asia, to see the trailblazing work firsthand.

Elizabeth Forward has undertaken a remarkable transformation, creating a digital learning environment that reshapes the traditional classroom. In order to accomplish this goal, the district deliberately developed partnerships with businesses, universities, and foundations. This case study describes the district's planning and implementation process, including in areas like professional learning, curriculum, instruction, and assessment, technology and hardware, and budget and resources. It concludes by examining Elizabeth Forward's plans to continue innovation and by offering advice from district leaders to guide similar efforts elsewhere.

Planning and implementation

Named after Elizabeth borough and township and Forward township, this small rural district enrolls approximately 2,400 students in six schools: a high school, a middle school, and four elementary schools. Students are predominately white and about 35 percent are low-income.[13,14]

When they joined the district five years ago, Keruskin and Superintendent of schools Dr. Bart Rocco faced immediate challenges because of a shrinking budget and a growing number of students leaving for cyber charter schools. Elizabeth Forward was "primed and ready for [Rocco and Keruskin] to come in and blaze a trail," said Mary Beth Wiseman, who has served as director of technology since 2001. During Wiseman's tenure, she has fostered a culture friendly to technology and equipped schools with resources such as interactive white boards, laptops, and video and digital cameras.

To identify ways to reshape teaching and learning, the leadership team toured the Entertainment Technology Center at Carnegie Mellon University in Pittsburgh, which conducts applied research in the interdisciplinary fields of art and technology. The team explored strategies for increasing engagement and learning through approaches such as games, design, and story.[15] "[The visit] really got

our minds churning about different possibilities," said Wiseman. Next, they travelled to Chicago Public Library's YOUMedia, a youth-centered space where young people create digital media.[16] Here they were impressed not only by the technology tools they saw, but also by the inviting and open physical settings that appeared to stimulate learning and creativity.

Returning to Elizabeth Forward, Rocco and Keruskin crafted a vision that would produce engaging, exciting, and flexible learning environments similar to what they had experienced during their visits to Carnegie Mellon and the Chicago Public Library. The leaders sought to realize this vision by building strategic partnerships to access digital resources that would reinvigorate learning in a redesigned school environment, which they determined was both financially and instructionally feasible. This vision aligns with the district's 2006-12 strategic plan and its goal of equipping students with 21st century skills like critical thinking, creativity, communication, and collaboration.[17]

The district initially worked on one space at a time, a process emblematic of their thoughtful and intentional approach. In 2012, they began with the high school computer lab, painting the room vibrant colors, removing a wall and traditional seating, and installing mobile technology. "Teaching PowerPoint, Word, [and] Excel were just not cutting it for future careers and college readiness," Keruskin said. The district emulated Carnegie Mellon's Entertainment Technology Center by developing its own version called the Entertainment Technology Academy. In elective courses, students began to explore skills and interests, such as digital storytelling, 3D and 2D programming, 3D design, and create their own videogames and apps. Students form teams to produce games for actual clients that include the Pittsburgh Symphony and the Andy Warhol Museum.

The 1950s-era high school library (where some books hadn't been checked out for decades) was another target in 2012. Inspired by Chicago's YOUMedia, the school added features such as audio and video production labs where, for example, a social studies class can reenact a historical event. The newly dynamic library also has a café staffed by students enrolled in life skills classes, and comfortable hang-out spots conducive for group projects, individual studying, or just relaxing.

Next, Elizabeth Forward experimented with schools for the lower grades. At its middle school, a $20,000 STEAM — or science, technology, engineering, the arts, and mathematics — grant from the Allegheny Intermediate Unit's Center for Creativity in 2012 enabled the installation of a Situated Multimedia Arts Lab (SMALLab), a concept developed by researchers, educators, and designers at Arizona State University that centers on embodied learning, which blends kinetic, multi-modal (such as sight, sound, and touch), and collaborative components.[18] Physical movement in a multi-sensory, interactive setting powered by digital technologies is considered a promising method for engaging students in academic content.[19] The Elizabeth Forward Middle School is the first public school in the country with this resource.[20] The district painted an unused classroom in bold purple and green and outfitted it with motion capture cameras, a projector, and a 15'x15' foam mat.[21] This high-tech equipment allows students to participate physically in learning games and scenarios, all designed by Carnegie Mellon University, by using wands and moving their bodies to interact with a backdrop projected onto the mat.[22] Students might work in small groups to fuse colors on the mat with their wands in a science lesson on the electromagnetic spectrum,[23] or they could explore the concept of prefixes and suffixes by picking up and combining parts of words with their wands.[24] The district also established the aforementioned Dream Factory, which was funded through a $20,000 joint grant from the Grable Foundation, Benedum Foundation, and Allegheny Intermediate Unit, as well as a $10,000 award from the Sprout Fund.[25]

At the elementary school level, Elizabeth Forward employed a similar "one room at a time" approach, converting a space with bland white walls and seats in a row into an animated environment that includes Xbox Kinect motion sensing devices that students use for a variety of learning activities, including telling time through physical arm movements. Similar to the SMALLab in the middle school, technology enables elementary students to participate in interactive, kinesthetic lessons about core content that can stimulate their interest.

Partnerships with higher education and the private sector – both traditionally siloed from the K-12 system – were instrumental for executing these initiatives. The district maintained its connection with Carnegie Mellon, which led to the university designing educational games for specific content areas. The district also partnered with a teaching college whose student teachers assist in the Entertainment Technology Academy while enhancing their multimedia skills. With the private sector, Elizabeth Forward reached out to a nearby plastics company, which has since provided materials, and Shell Games, one of the largest gaming businesses in Pittsburgh. The leadership team has also cultivated relationships with foundations that have provided much needed support.

As part of its overall strategy to reinvigorate teaching and learning, Elizabeth Forward launched a 1:1 iPad initiative in grades K-12 in 2013,[26] a natural evolution from the collection of digital devices it already had. The goal of this initiative was to enable teachers of core academic subjects to combine face-to-face and online instruction in a variety of blended learning methods. The initiative produces equitable access to devices, which enable students to progress at their own pace and acquire multimedia skills for digital content creation. According to Keruskin, "The future is technology, and we're trying to get kids programmed to get into tech at an early age to hook them in,"[27] underscoring the value of these computer-based skills in the 21st century economy. Students can take their devices home, and are able to access resources even if they don't have Internet connectivity. According to Wiseman, only minor updating of existing district guidelines and expectations to add emerging technologies and social media was necessary.

Professional learning

Reconfiguring physical spaces, painting walls, and installing industry-standard equipment alone wasn't enough to transform curriculum and instruction; teachers needed to embrace an ideological shift. "Teachers are the driving force behind success in a district," Wiseman emphasized. While many of the current teachers were already technologically-savvy – most grew up with digital devices - they needed to adopt a different instructional style and education paradigm. Elizabeth Forward sought to replace the traditional "sage on the stage," lecture format with a student-centered pedagogy in which teachers facilitate learning through a collaborative, project-based approach. Rocco and Keruskin engendered staff support by consistently reinforcing their vision and goals for attaining an engaging educational environment, and encouraging experimentation. "[We] built the culture where it's ok if you try something and it doesn't work," said Keruskin.

Elizabeth Forward has a long tradition of putting digital resources into the classroom, and has prepared teachers to effectively use these tools. Back in 2002-2003, Wiseman selected 16 teachers to participate in a two-year Apple-led training that targeted tools in its iWork and creativity apps (formerly iLife) suites, such as iPhoto and iMovie. These teachers then became mentors to other teachers. Another cohort of 16 teachers subsequently attended this Apple-led training. During the next phase of digital deployment, Keruskin and Wiseman jointly trained teachers on further strategies for implementing digital technologies into the curriculum. The pair continues to oversee professional learning: Keruskin instructs teachers on integrating technology into the curricular content, while Wiseman

addresses delivery methods. According to Wiseman, building teachers' confidence is the largest challenge. She stresses the importance of preparing teachers to have a plan B if a tool fails to function properly. While challenges invariably arise, Wiseman observes that the various technologies are inspiring teachers and enhancing their instructional practices. "[Teachers] see the big picture ... that technology is part of the world that we live in. ... They see an urgency and a destination of where we want to go," she said.

Curriculum, instruction, and assessment

The district has tightly woven technology into curriculum and instruction, enabling every student to experience a more interactive and engaging educational experience and developing critical 21st century skills. "A lot of districts have add-ons... we offer [these tools] to every single student in the district," Wiseman said. According to Rachel Egan, a 6th grade language arts teacher, her students learn team building and communications through interactive activities in the SMALLab.[28]

Not only have these tools helped equip youth with the skills necessary for success in an increasingly computer-based world, they have also expanded perspectives of college and career options. "Students are exposed to so much more which might spark an interest in a career that they may never have thought about... perhaps that career takes additional schooling and that's something the child thought that they never could do or wanted to do," described Wiseman.

The infusion of digital resources facilitates project-based learning. Dynamic, technology-powered projects, such as the interdisciplinary unit involving the chocolate bar cited earlier, enable students to master core content while pursuing their interests and passions. For example, a music enthusiast might create a history project in the sound studio.[29] The assorted technologies expand creative options for student learning, which enhances their engagement, according to Keruskin. Technology tools can also help engage students in topics required by state standards that might initially seem less interesting. Wiseman described a teacher who regularly lost the attention of the class during a required unit on resource materials like atlases since students no longer use these tools. Now students work in small groups and use Aurasma (a free augmented reality platform app) to create videos in which they narrate information about the reference tools. They then attach the videos to the resource materials, which they can scan and play on their iPads. "It's a simple app and [the teacher] just made that lesson come alive," said Wiseman. Egan adds that tools in the SMALLab[28] have increased her students' motivation and deepened their desire to learn.[30]

Digital resources also empower students to learn at their own pace. A student struggling with the times table can download appropriate resources at his/her skill level to practice, while an advanced student can accelerate. This technology-powered personalization also helps engage students in content instead of "the lecture style where [teachers] were losing kids," as Keruskin noted. During 2013-14, the district piloted eSpark — a fee-based iPad product – in kindergarten and for students in 1st and 2nd grade who needed additional math and reading support. Apps are then selected according to students' skill levels; one student may have three apps, while another might have 55. Students spend approximately 40 minutes per day practicing math and reading.

Additionally, technology has transformed data and assessment, allowing students to demonstrate their mastery of material on their iPads in real time and providing instant feedback to teachers. Results can then be disseminated to a school's principal and facilitate conversations between the principal and teacher. For instance, a principal can review differing results from two different math classes to discern why students in one class outperformed those in another on certain problems.

"There's this great discussion between the principal and the teacher. We don't have to wait three months like [with] the state exam ... these local assessments are done digitally and we're able to assess them right away," Keruskin said.

Technology and hardware

Elizabeth Forward developed robust infrastructure to support technology nearly ten years ago, such as installing wireless throughout all buildings and classrooms. More recently, the district has upgraded its bandwidth to 40 mbps to accommodate the addition of more devices through the 1:1 initiative. Even with the faster speed, the district has found that it needs to restrict some online access in order to ensure smooth functioning. Wiseman plans to remedy this issue by increasing bandwidth again, this time to 100 mbps.

Budget and resources

Elizabeth Forward's infrastructure, including broadband and wireless connectivity, is supported through a combination of E-rate, AlleghenyCONNECT, which offers affordable Internet services to school districts in Allegheny County, and capital funds from the system. The district launched the 1:1 initiative by reallocating funding from maintaining its collection of 2,100 digital devices to leasing iPads, and is actually paying less now. This approach gives students and teachers have access to the latest technology, especially since iPads are replaced every two years. The district also continues to seek funding to support its technology initiatives from local foundations.

Measurable outcomes

Elizabeth Forward has seen progress related to its digital learning initiatives on multiple fronts. The district carefully tracks achievement data from students using various software and apps to assess the effectiveness of that technology. For example, students displayed impressive growth using eSpark (the iPad learning platform discussed earlier): On average, they increased from the 46 to 74th percentile on a national test. "To see a child who struggles every day and the highest they ever got was 70 percent on an exam... this system allows them to get 100 percent because they are working at their own level and building their confidence," said Wiseman. The district is now exploring implementing the platform into additional grades (and during the 2014-15 academic year will offer the resource to all K-2 students and grade 3-5 students who need extra support).

While data has not demonstrated causal connections, there are other indications that technology is benefitting students. Results include a dramatic decline in the number of students exiting Elizabeth Forward for cyber charter schools (generating substantial savings since districts' level of state funding varies according to the number of pupils enrolled), fewer students dropping out, increased state standardized test scores, and improved state ranking over the last five years (moving from 240 to 145).[31]

Looking forward and lessons learned

In the coming years Elizabeth Forward plans to use technology to spread the earlier cited "maker movement," as embodied in its Dream Factory, by further promoting student design and hands-on learning. The district would like to adapt the middle school's Dream Factory to the high school and elementary schools, integrating robotics and computer programming. This would enable students' curiosity and creativity to flourish throughout the entire school system, while helping to cultivate their interests and skills critical for success in college and career. A recent grant will allow the district to install a fabrication lab in the high school during the 2014-2015 academic year, which will enable students to design projects using tools such as laser and vinyl cutters, 2D and 3D softwares, and 3D printers and scanners.

Based on the pilot's success, Elizabeth Forward would like to scale the eSpark personalized learning pathways throughout K-12, and is currently exploring opportunities to do so.

Keruskin advises districts interested in similar innovative initiatives to "start with one room, one teacher, and one program at a time," while Wiseman emphasizes the need for preparation of infrastructure and a school-wide culture to support implementation. Since issues invariably arise related to the technology, a game plan for how to respond to the unexpected is advisable. Elizabeth Forward has also immensely benefited from its strategic partnerships and urges other districts to "leave your school" and "use resources [both] within and outside of your area."

ENDNOTES

[1] McKibben, 2014.

[2] Peppler & Bender, 2013.

[3] Todd, 2014.

[4] Ibid.

[5] Elizabeth Forward School District, n.d.

[6] Allegheny County, n.d.

[7] Alliance for Excellent Education, 2014.

[8] Todd, 2014.

[9] Christensen, Horn, & Staker, 2013.

[10] Alliance for Excellent Education, n.d.

[11] Ibid.

[12] Digital Promise, n.d.

[13] National Center for Education Statistics, 2011-2012.

[14] Pennsylvania Department of Education, 2012-2013.

[15] Carnegie Mellon University Entertainment Technology Center, n.d.

[16] The YOUMedia Network, n.d.

[17] Partnership for 21st Century Skills, n.d.

[18] Arizona State University, n.d.a, b; Bock, 2012; Sprout Fund, n.d.

[19] Ibid.

[20] Sprout Fund, n.d.

[21] Ibid.

[22] Whipple, 2012.

[23] Bock, 2012.

[24] Elizabeth Forward School District, 2013.

[25] Todd, 2014.

[26] Ibid.

[27] Todd, 2014.

[28] Sprout Fund, n.d.

[29] Alliance for Excellent Education, 2014.

[30] Sprout Fund, n.d.

[31] Alliance for Excellent Education, 2014.

REFERENCES

Allegheny County. (n.d.). *Homepage*. Retrieved on July 11, 2014, from http://www.alleghenycounty.us/index.aspx

Alliance for Excellent Education. (2014). *Transforming spaces to transform learning: Connected learning in action*. Webinar. Retrieved on April 20, 2014, from https://www.youtube.com/watch?v=GgePmGmgwH4

Alliance for Excellent Education. (n.d.). *Digital learning*. Retrieved on August 17, 2014, from http://all4ed.org/issues/digital-learning/

Arizona State University. (n.d.a). *SMALLab K-12 embodied and mediated learning*. Retrieved on August 27, 2014, from http://emlearning.asu.edu/overview

Arizona State University. (n.d.b). *SMALLab*. Retrieved on August 27, 2014, http://emlearning.asu.edu/smallab

Bock, M. (2012, October 10). *'Embodied learning' blends movement, computer interaction. Education Week*. Retrieved on August 12, 2014, from http://www.edweek.org/ew/articles/2012/10/10/07embody.h32.html

Carnegie Mellon University Entertainment Technology Center. (n.d.). *Our history*. Retrieved on July 11, 2014, from www.etc.cmu.edu/learn/history/

Christensen, C. M., Horn, M. B., & Staker, H. (2013). *Is K-12 blended learning distruptive? An introduction to the theory of hybrids*. Clayton Christensen Institute for Disruptive Innovation.

Digital Promise. *League of innovative schools*. Retrieved on May 7, 2014, from http://www.digitalpromise.org/districts/elizabeth-forward-school-district

Elizabeth Forward School District. (2013). Remaking learning in Elizabeth, Pennsylvania – long version. Retrieved on May 7, 2014, from https://www.youtube.com/watch?v=J9rZM0Qjw0c

Elizabeth Forward School District. (n.d.). *About E.F.* Retrieved on May 7, 2014, from http://www.efsd.net/district.cfm?subpage=48

McKibben, S. (2014). *If you build it: Tinkering with the maker mindset*. ASCD Education Update, 56(6). Retrieved on August 10, 2014, from http://www.efsd.net/district.cfm?subpage=6418

National Center for Education Statistics. (2011-2012). Retrieved on May 7, 2014, from http://nces.ed.gov/ccd/districtsearch/district_detail.asp

Partnership for 21st Century Skills. (n.d.). *Framework for 21st Century Learning*. Retrieved on April 29, 2014, from http://www.p21.org/about-us/p21-framework

Pennsylvania Department of Education. (2012-2013). *Loan cancellation, low-income schools*. Retrieved on May 7, 2014, from http://www.education.state.pa.us/portal/server.pt/community/data_and_statistics/7202/loan_cancellation,__low_income_schools/811106

Pennsylvania Department of Education. (2013-2014). *Public school enrollment reports*. Retrieved on May 7, 2014, from http://www.portal.state.pa.us/portal/server.pt/community/enrollment/7407/public_school_enrollment_reports/620541

Peppler, K., & Bender, S. (2013). *Maker Movement spreads innovation one project at a time. Phi Delta Kappan, 95*(3), 22-27.

Sprout Fund. (n.d.). *SMALLab learning at Elizabeth Forward Middle School. Pittsburgh's creativity & learning innovation ecosystem*. Retrieved on May 7, 2014, from http://www.efsd.net/departments.cfm?subpage=8402

The YOUMedia Network. (n.d.). *About*. Retrieved on July 11, 2014, from http://www.youmedia.org/youmedia-network

Todd, D.M. (2014, January 22). *Elizabeth Forward recognized for high-tech efforts. Pittsburgh Post-Gazette*. Retrieved on May 8, 2014, from http://www.post-gazette.com/news/education/2014/01/23/Elizabeth-Forward-schools-recognized-for-high-tech-efforts/stories/201401230200

Whipple, A. (2012). *SMALLab turns classroom on its head at Elizabeth Forward Middle School*. Remake Learning. Retrieved on August 12, 2014, from http://remakelearning.org/blog/2012/09/28/smallab-at-elizabeth-forward-middle-school

CASE STUDY

Mobile County Public Schools catalyze 21st century skills through Bring Your Own Device (BYOD) initiative

MOBILE COUNTY PUBLIC SCHOOLS CATALYZE 21ST CENTURY SKILLS THROUGH BRING YOUR OWN DEVICE (BYOD) INITIATIVE

First graders sprawl across a colorful carpet, some sitting cross-legged, others comfortably lying on their backs.[1] This isn't free time, however. Instead they are reading on assorted devices through an app called Big Universe, an online library of e-books organized by interest and level. In a nearby classroom, 4th graders confer in small groups to answer questions about a fashion show by searching for information online using an array of Kindles, tablets, and smartphones.[2]

These scenes are increasingly common as a result of a district-wide effort to infuse technology into the Mobile County Public School System (MCPSS) in Alabama. This case study explores digital learning, which signifies any type of instruction that uses technology to enhance students' education,[3] within Mobile County's public schools, with a focus on its recent Bring Your Own Device (BYOD) initiative. BYOD facilitates blended learning – referring to a combination of face-to-face and online instruction[4] - to impart 21st century skills, such as critical thinking, creativity, communication, and collaboration.[5] The case study opens with an overview of MCPSS's planning and implementation process, and subsequently describes professional development opportunities, changes to the curriculum, instruction, and assessment, technology and hardware needs, and budget and resources. The profile concludes with an examination of plans to scale BYOD and reflections from district leaders on their ongoing efforts to use technology to improve public education.

Planning and implementation

Stretching across more than 1,644 square miles of urban, suburban, and rural areas in southwestern Alabama (similar in size to Rhode Island), MCPSS is the state's largest school district.[6,7] Almost 60,000 students attend 90 elementary, middle, and high schools, including 10 National Blue Ribbon Schools, a prominent U.S. Department of Education award that honors both high academic performance and the closing of achievement gaps.[8,9] The student population is highly diverse; 50 percent are black, 44 percent white, 2 percent Asian Pacific, and 4 percent other.[10] A large proportion is low-income: over 70 percent are eligible for free or reduced-price lunch,[11] and 97 percent of schools are Title I-funded based on their high level of socioeconomic disadvantage.[12]

In 2006 MCPSS increased its commitment to harnessing technology's ever-evolving capabilities in order to better engage students and equip them with 21st century skills for college and career. The district actively involved principals in a visioning process that charted a course to redefine student and teacher roles. According to Executive Manager of Information Technology David Akridge, the district engendered trust by following through on its word. "The principals saw that the [IT] department was going to do what we said we were going to do," Akridge explained. Collaboration among school leaders and the district's information technology services signaled a meaningful shift from the traditional silos separating schools and administration.

As a first step, the district projected costs for outfitting classrooms with various technology resources, such as interactive white boards, clicker response systems, and document cameras, as well as laptops for teachers. MCPSS incrementally added resources to design 21st century classrooms in five schools, matching district funds to school-level fiscal sources such as Title I funding. All core content classrooms are now equipped with white boards (installation in the last set of schools was finished this past summer) and teacher laptops.

Recognizing that technologies were rapidly evolving, including becoming more mobile, MCPSS continued to explore ways to innovate. MCPSS chose a BYOD model that was feasible given its limited resources. According to Michele White, the district's instructional technology coordinator who was named a 2013 Marbury Technology Innovation Award finalist,[13] even if the district could afford initially to purchase laptops, tablets, or smartphones for every student, a 1:1 initiative (when a state, district, or school leases or

purchases enough devices so every student has one) was unsustainable long-term. Additionally, BYOD addresses the district's high level of diversity, allowing schools to adapt the initiative as appropriate, rather than having a "one-size-fits-all" model imposed on them. "What works in one school isn't going to work everywhere else," Akridge noted.

Six schools volunteered to launch this model during 2012-13. In 2013-14, 19 additional schools — including elementary, middle, and high schools — participated, and others are introducing the initiative during the 2014-15 academic year. While the district encourages the use of tablets, each school establishes its own guidelines regarding which devices it permits: some allow cell phones, while others only accept devices with at least a seven-inch screen. One issue is differing capabilities. Students can use their cell phone for simple research or to answer a basic assessment, but not for more complex learning tasks, such as designing multimedia projects. In schools that permit phones, teachers address this challenge by having students work in small groups with a bigger device. Somewhat surprisingly, although the vast majority of schools are Title I, approximately 75 percent of students have their own mobile phone, tablet, or laptop. Students who either don't have their own or aren't allowed to bring it to school for whatever reason use one of the school's. Devices must be OS X or Android compatible to ensure consistency across platforms.

Professional learning

The instructional and information technology teams facilitate schools' BYOD planning and implementation processes. Planning for BYOD involves trainings with both principals and teachers on topics such as devising school policies (for example, how will the school handle a device breaking or being stolen?), coordinating parent meetings (to address any concerns and inform families about appropriate devices to send to school), and scheduling roll-out dates. Returning to their schools, principals then work with their staff to develop buy-in for the initiative.

Systematic planning and staff training are critical to the initiative's success, according to White. "All schools can implement [BYOD]," White said. "It's a matter of whether they're ready to. The teacher has to understand what resources [he/she] wants to use and to preview them." During implementation, the information technology team connects all students to the network, and technology resource staff members are on hand to offer help as necessary. The district has also built capacity by training technology support staff at each school.

White and her team also provide ongoing professional development opportunities on topics such as digital citizenship and responsible Internet use, as well as strategies for integrating 21st century skills into the curriculum. For example, the district is working to prepare teachers to implement effective platforms for student projects that incorporate rich digital content, such as animation, videos, and blogs.

During the summer of 2014, professional learning ventured online - a welcome change in such a large geographic district where teachers previously may have had to spend half a day travelling to attend. Greater access to these programs was especially important because teachers have had to shift from the traditional "sage on the stage" role into a facilitator. Many teachers have been steeped in traditional pedagogy for years, even decades. Dr. Pamela Moore, one of five technology resource staff members who works in the district's information technology services and is responsible for training educators on digital tools, observes that teachers swiftly adapt: "[The tools] become part of what they do as a teacher... just a tool that they use like a pencil or ink pen." "[Teachers] are motivated to make this change because they know [technology] will reach their children," White added.

Curriculum, instruction, and assessment

MCPSS adopted the Alabama College and Career Standards (a modification of the Common Core State Standards)[14] to align

its curriculum with 21st century skills. These standards were established as part of the Alabama State Board of Education's PLAN 2020, introduced in 2013 after receiving a No Child Left Behind waiver from the Department of Education.[15] The new benchmarks reflect the national focus on raising the high school graduation rate and better preparing students for college and career.[16] The plan also sets "differentiated annual objectives" for academic growth according to subgroups (such as race, special education, limited English, and socioeconomic status) – though all students are expected to attain 100 percent proficiency long-term.[17]

As part of aligning with the new standards, the district is transforming its curriculum to focus on 21st century skills.[18] "We're creating thinkers. ... We need to put [these skills] into practice in a technologically-rich classroom," White explained. Technology is considered a key lever for promoting this type of deeper learning. The district is training teachers to design project-based learning opportunities in which students use their mobile devices to collaborate on group presentations and produce multimedia content. Application will vary according to grade level. Seventh graders, for instance, might apply communication and collaboration skills by exploring the concept of the human impact on natural resources and presenting their findings in public service announcements that they design in teams using digital technologies.[19]According to Akridge and White, this dynamic, technology-enabled approach will prepare students for college and career. "Mobile devices are with [students] every moment of the day... we allow them to bring [devices] into the classroom and use as a learning tool and prepare them for what their lives will be like outside of high school," Akridge said.

In addition to facilitating the acquisition of 21st century skills, digital devices help move students towards "anytime, anyplace" education. Students can utilize their devices to learn beyond the end of the school day, as well as to access resources based on their learning needs. Although students' online connectivity at home varies (many rural areas in the county still have dial-up as the only option), they are able to download resources at school, allowing them to work on assignments at home and repost them at school.

Digital tools additionally serve to engage and empower students through relevant, real-world learning, which expands young people's options, according to Moore. Video conferencing equipment, for instance, makes virtual visits to NASA possible, enabling science class discussions with astronauts to hear firsthand accounts about outer space that enliven curricular content.

Technology is also taking data and assessment in new directions, facilitating learning tailored to students' varying abilities. Students demonstrate their understanding by using their phones, tablets, or other devices to respond to real-time assessments. "Teachers love being able to utilize devices because they are able to get that information immediately and see what direction they need to take the lesson. If certain students [are ready] to go ahead or [require] a little more help, [teachers] can address [those needs]," Moore said. Summative assessments – completed at the end of a course to measure student performance[20] - are moving online too. Last spring, MCPSS was the first district to pilot a new state online summative assessment in all 3-8th grade schools. In the future, the district hopes to administer these tests on student devices.

Technology and hardware

Sufficient infrastructure was essential to technology deployment. Akridge and team initially developed a five-year infrastructure plan, but because they fostered such positive relationships with schools, the plan was complete in only three years. Key components involved connecting schools to wireless, installing a network security system, equipping campuses with video conferencing capability, mounting white boards in classrooms, and installing digital signage in the form of monitors in building lobbies, cafeterias, libraries, and hallways. MCPSS would like to further extend video conferencing in order to outfit the entire school system with equipment to facilitate "a world of collaborative learning" across different classrooms within a school, district, or multiple districts, according to Akridge.

Increased traffic generated by BYOD and web-based applications has required greater bandwidth. The district has accordingly upgraded its bandwidth over the past several years and continues to closely monitor it. Wireless connectivity represents another area of growing demand, and the district is working to install wireless access points within all classrooms. "We need to look five years ahead of time ... [and] keep the district going forward to make sure we don't fall behind," Akridge said.

Budget and resources

Although MCPSS faces steep budget cuts,[21] the district benefits enormously from the E-rate program, which has helped fund both broadband and wireless connectivity. (The district is eligible for significant discounts on internal connection support because of its Title I designation.) Akridge anticipates that the next round of E-rate funding will allow the district to install the remaining wireless connections needed for ubiquitous access in every classroom. Federal stimulus money and local taxes have also supported technology, and the district is working to identify sources to address other needs, such as replacing 6,600 digital devices recently removed from the network because Microsoft no longer supports them.

Measurable outcomes

Although schools' BYOD initiatives are still relatively new, progress is already apparent. According to White, elementary schools that have implemented technology now rank among the highest performing in the system, and a BYOD high school, which has also enhanced literacy supports, "made a turnaround" and is now number four out of 90 schools in the district in both math and reading. The use of technology-rich resources is considered to have contributed to schools' improvement by engaging and motivating students. MCPSS is optimistic that these promising trends will continue, and even accelerate, as the initiatives mature.

Looking forward and lessons learned

MCPSS aspires to have a majority of schools launch BYOD by the end of the 2014-15 academic year, and will continue to encourage schools to launch the initiative by offering planning and implementation guidance, as well as ongoing support. The district also plans to address the lukewarm interest from some urban and secondary schools regarding adopting the initiative. According to Akridge, parents in urban areas have concerns about their children's safety when transporting devices to and from school. MCPSS plans to reach out to families to discuss the issue. To expand participation among secondary schools, the system has hired a technology resource staff member who has worked at one of the high schools and who can help overcome their reticence and generate greater interest.

When reflecting on lessons learned, the district's instructional and information technology teams collectively underscore the importance of strategic planning and incremental implementation. "We had a plan, vision, and strategy and we stuck to it," Akridge said. He also noted the critical need for school buy-in among principals and administrators and the "trust factor" in order to advance digital learning goals.

ENDNOTES

[1] Phillips, 2013a.

[2] Ibid.

[3] Alliance for Excellent Education, n.d.

[4] Christensen, Horn, & Staker, 2013.

[5] Partnership for 21st Century Skills, n.d.

[6] Mobile County Board of Education, 2013.

[7] Alabama Department of Archives and History, n.d.

[8] Mobile County Public School System, 2013.

[9] U.S. Department of Education, n.d.

[10] Ibid.

[11] Mobile County Board of Education, 2013.

[12] Ibid.

[13] Alabama State Department of Education, 2013.

[14] Alabama State Board of Education, n.d.

[15] Belanger, 2013.

[16] Alabama State Department of Education, n.d.

[17] Bice, 2013.

[18] National Education Association, n.d.

[19] Mobile County Public School System, 2009.

[20] Andrade, Huff, & Brooke, 2012.

[21] Mobile County Board of Education, 2013.

REFERENCES

Alabama Department of Archive and History. (n.d.) *Alabama counties: Mobile County*. Retrieved on June 26, 2014, from www.archives.state.al.us/counties/mobile.html

Alabama State Board of Education. (2013). *PLAN 2020*. Retrieved on June 26, 2014, from https://web.alsde.edu/Home/General/PLAN_2020.aspx

Alabama State Department of Education. Accountability Reporting System. *2012-2013 cohort graduation rate (all students rate only)*. Retrieved on June 25, 2014, from http://www03.alsde.edu/accountability/preaccountability.asp

Alabama State Department of Education. (2013). *Tenth annual Marbury Technology Innovation Award winners announced*. Retrieved on June 26, 2014, from https://www.alsde.edu/sec/comm/Pages/Awards.aspx

Alliance for Excellent Education. (n.d.). *Digital learning*. Retrieved on August 17, 2014, from http://all4ed.org/issues/digital-learning/

Andrade, H., Huff, K., & Brooke, G. (2012). *Assessing learning*. Students at the Center, Teaching and learning in the era of the Common Core. Teaching and learning in the era of the common core. A Jobs for the Future Project.

Belanger, E. (2013, June 21). AL.com. *Alabama quits No Child Left Behind, adopts new plan to improve graduation rates*. Retrieved on June 26, 2014, from http://blog.al.com/wire/2013/06/alabama_quits_no_child_left_be.html

Bice, T. (2013, July 5). *Press-Register/AL.com*. Individualized goal setting a key part of Alabama's new public education plan (Opinion from Dr. Tommy Bice). Retrieved on June 26, 2014, from www.al.com/opinion/index.ssf/2013/07/individualized_goal_setting_a.html

Christensen, C. M., Horn, M. B., & Staker, H. (2013). *Is K-12 blended learning distruptive? An introduction to the theory of hybrids*. Clayton Christensen Institute for Disruptive Innovation.

Mobile County Board of Education. (2013). *Alabama technology plan: Transform 2020*. Retrieved on May 3, 2014, from http://www.mcpss.com/?DivisionID=2145&ToggleSideNav=ShowAll

Mobile County Public School System. (2013). *Fast facts*. Retrieved on June 25, 2014, from http://www.mcpss.com/?PN=AboutUs

Mobile County Public School System. (2009). *MCPSS 2009 technology education curriculum*. Retrieved on July 16, 2014, from http://www.mcpss.com

Partnership for 21st Century Skills. (n.d.). *Framework for 21st Century Learning*. Retrieved on April 29, 2014, from http://www.p21.org/about-us/p21-framework

Phillips, R.H. (2013, March 7a). 4 questions about technology in Mobile County's public schools. *Press-Register/AL.com*. Retrieved on June 26, 2014, from http://blog.al.com/live/2013/03/4_questions_about_technology_i.html

Phillips, R.H. (2013, March 7b). More Mobile County students using technology through BYOD, Bring Your Own Device. Press-Register/AL.com. Retrieved on June 26, 2014, from http://blog.al.com/live/2013/03/more_mobile_county_students_on.html

U.S. Department of Education. (n.d.). Programs. *National Blue Ribbon Schools Program*. Retrieved on July 31, 2014, from http://www2.ed.gov/programs/nclbbrs/eligibility.html

CASE STUDY

Lewisville Independent School District pioneers “the right device for the right time”

LEWISVILLE INDEPENDENT SCHOOL DISTRICT PIONEERS "THE RIGHT DEVICE FOR THE RIGHT TIME"

Middle school students work intently in small groups on a science lesson about the human heart. Some research its intricate processes, searching for 3D images to illustrate how it pumps blood using various apps on their district-purchased iPads. Others insert multimedia content into a Prezi or PowerPoint presentation on a class-issued laptop or create videos on their tablets. Students also look up unfamiliar vocabulary words on their smart phones, and receive an alert from their teacher about an upcoming class trip.[1]

The class is part of a pioneering digital learning - referring to any instructional practice that uses technology to enhance students' education[2] - initiative developed by Texas's Lewisville Independent School District (LISD) called 1:X™, which signifies one student to many devices. The district has implemented the initiative through blended learning, a method that delivers both face-to-face and online instruction.[3] This technology-enhanced educational environment enables students to choose a variety of tools to demonstrate their understanding. The flexible approach is considered to facilitate deeper learning – a process in which students acquire knowledge that can be transferred or applied to new topics.[4]

This profile spotlights LISD's trailblazing efforts to redesign public education through technology-powered classrooms that seek to strengthen student learning and prepare young people for college and career. LISD uses multiple digital tools to foster students' thinking and deepen their understanding of curricular content. The case study opens with an introduction to the district's planning and implementation process, which carefully considered the student perspective and a variety of technologies. It covers key elements related to professional learning, curriculum, instruction, and assessment, technology and hardware, and budget and resources. Finally, the profile offers advice from the district to other school leaders, including the importance of clear and regular communication.

Planning and implementation

Located approximately 25 miles northwest of Dallas, the 127-square mile area that makes up LISD experienced rapid growth before the Great Recession stalled development.[5] LISD's enrollment is now steady around 52,500,[6] making it one of the country's 100 largest districts. It contains 66 schools, including six National Blue Ribbon Schools of Excellence, a renowned U.S. Department of Education award that honors both high academic performance and the closing of achievement gaps.[7,8] About 50 percent of the system's students are white, 27 percent Latino, 11 percent Asian, and 9 percent black; 30 percent are low-income.[9]

In 2011 Superintendent Stephen Waddell spearheaded a collaborative year-long process, engaging 5,000 students, parents, staff, and community members in summits, focus groups, and an online survey to create a district-wide strategic design that was approved the next year.[10] This diverse group of stakeholders developed new core beliefs, a vision, a mission, and goals. A focus on using technology in the classroom emerged during discussions in which students described, "having to power down," according to Karen Permetti, LISD's chief communications officer. "The superintendent took that phrase to heart. [We] want to power them up, not power down." Among the design's central goals is to "engage learners through the use of technological tools to access, create and share content as well as collaborate with other learners throughout the world."[11] The strategic design aligns with a broader state effort to transform public education called the Texas High Performance Schools Consortium; LISD was one of the 22 districts invited to join in 2012.[12] The Consortium aims to strengthen student learning through the use of high-priority standards, multiple assessments, local accountability, and technology.[13]

LEWISVILLE INDEPENDENT SCHOOL DISTRICT PIONEERS "THE RIGHT DEVICE FOR THE RIGHT TIME"

In order to advance the strategic design goals, LISD's Director of Educational Technology Jerram Froese and his team conducted extensive research and visited several districts to explore technology integration initiatives firsthand. Their efforts led LISD to develop the 1:X™ initiative. 1:X™ encompasses elements of both 1:1 and BYOD initiatives by supplying iPads to students – the primary device used in classrooms - and permitting them to use their personal devices. iPads were chosen based on their versatility, user-friendliness, and the ability to access resources regardless of online access at home. The initiative also supplements these resources with laptops for classroom use.

According to Froese, 1:X™ evolved from a recognition of the importance of "the right device for the right work." He continued, "[It] was important not to just provide a tablet, but [also] access to check out more powerful laptops. They can flow between devices." Students choose tools based on what they are designing for a class assignment: a laptop is useful for collaborative projects that might involve building a website, or creating an iBook or video, while an iPad is helpful for capturing individual students' work (such as recording a video) that can then be incorporated into a group project on the laptop.

In addition to their desire to equip students with access to multiple devices to facilitate their class work and prepare them for similar experiences after they graduate, Froese's team conceived 1:X™ as a powerful model for capturing and developing students' thinking. 1:X™ draws on a research-based concept called visible thinking, which suggests that displaying and documenting cognitive processes through speaking, writing, and drawing, among other techniques, can optimize learning.[14,15] LISD uses technology to promote this approach in the classroom by augmenting existing tools. Rather than serving as a device to mainly deliver content, the iPad was chosen for its capability to capture students' learning processes. According to Froese, whether or not students are using technology to complete a project, they can use their devices to record, share, present, and reflect on their experiences. In this way, the district expects that technology can help foster students' thinking and reinforce their understanding of academic content.

LISD piloted the initiative at three schools during spring 2013, distributing iPads to elementary, middle, and high school students and their teachers and five laptops to each classroom, as well as allowing students in those schools to bring in their own technology. The district permits students to keep the iPads during the summer in order to help prevent learning loss. During the 2013-2014 academic year, the district launched 1:X™ at another five schools, covering grades 1-12. The eight total schools were selected based on their instructional technological readiness, infrastructure, and need. In conjunction with these pilots, LISD implemented a "rollout" of the 1:X™ initiative district-wide in 4, 7, 9, and 10th grades. This incremental approach helped ensure that the devices were evenly distributed across elementary, middle and high schools, that the district had the capacity to effectively train schools on implementing the initiative, and that it would be able to upgrade the devices as necessary, according to Froese.

Another important focus has been to prepare families for the initiative. LISD has made a concerted effort to communicate with families about 1:X™'s purpose. Froese explained that addressing parents' concerns represents a vital need in order to "bridge that gap" that arises when families might be unclear or dubious about whether their children are actually utilizing their devices for educational purposes. Schools also host their own trainings for parents, including a regular "Appy Hour" specifically to learn about digital devices in the classroom. Videos offer another valuable resource (produced by both the district and parents themselves) on myriad topics, such as tips for talking to children about screen time expectations at home.

Professional learning

The district offers numerous in-person and online trainings for teachers and staff, reviewing topics such as deployment, safety, instructional use, and device configuration. According to Froese, providing teachers with laptops and iPads is imperative in order to effectively integrate these tools into the curriculum. During the summer, teachers can further augment their skills by participating in professional learning courses and by attending xCamp, a short series that extends beyond basic use of technology tools to focus on designing lessons that use technology. The district hopes teachers will transfer this knowledge to colleagues. Though professional learning is often challenging, Froese believes that the district's diverse training options offer the necessary breadth and depth to support teachers.

Curriculum, instruction, and assessment

The changes at 1:X™ schools go far beyond cool gadgets scattered throughout classrooms. According to Froese, 1:X™ is helping to shape flexible learning environments, marked by an inherently different use of time, greater student choice, and authentic learning opportunities. These components all stem from the central goals of the district's strategic redesign.

Pedagogical shifts have restructured instructional time; instead of delivering a traditional lecture, teachers become facilitators as students participate in projects and use digital devices to produce media-rich content. This approach gives teachers increased time to confer with to individual students and small groups. According to Froese, this pedagogical style also reveals students' thinking processes through the visible thinking approach described earlier, which can help teachers assess their comprehension. "With the right device, students can capture drawing, hands-on learning, and many other learning experiences in the classroom with photos and/or video. They can annotate what they did and explain their thinking ... in ways that allow teachers to understand what kids know," Froese explained.

A 2nd grade assignment exemplifies this technology-enhanced learning process.[16] Students picked a person of interest to interview in their community, developed questions, and utilized a camera app on their iPads to record videos of the interview. (They were accompanied by a parent.) In one interview, a young boy asked a cobbler questions in Spanish, while another student spoke with a staff member at the YMCA. Back at school, their teacher provided feedback on their videos. Students then used the Google Earth app to identify the location of where their interview had occurred and worked together to create a physical map of their town. They were assisted with uploading their interviews onto the map through the use of QR codes, which they can then scan with their iPads to watch their peers' videos. The lesson concluded with students writing a reflection about their experience.

The reconfigured learning environment also allows students to pursue topics aligned with their interests, delve into real-world issues, and choose technology tools to generate and share content. For example, an elementary school student researching Babe Ruth as part of a state-required unit on historical figures used technology to deepen his learning about other topics that he found meaningful, such as Jackie Robinson, Martin Luther King, Jr., and the civil rights movement, and produced a multimedia project to demonstrate his knowledge. "What he was supposed to learn was in this box, but what he learned was so much more," said Permetti, noting how technology helped to engage the student and facilitate his ability to control his own learning.

Technology and hardware

LISD has built comprehensive infrastructure in its effort to anticipate the growing role of technology within the classroom, according to Patrick Johnson, manager of network and technical services. A switch toward cloud-based computing fueled demand for greater bandwidth, resulting in a large upgrade in capacity over a five-year period.[17]

LEWISVILLE INDEPENDENT SCHOOL DISTRICT PIONEERS "THE RIGHT DEVICE FOR THE RIGHT TIME"

More recently, the technology department embarked on a nearly year-long process to add even more broadband and almost 4,600 wireless access points in order to accommodate the 1:X™ initiative.[18] The department also implemented an "agnostic" management system, which supports multiple platforms including PC, Apple, and Android devices.

Another important project involved installing a robust filtering system to block inappropriate online content, which applies different levels of filters according to elementary, middle, and high school levels. When an upgrade to the devices inadvertently removed some of the software, the district responded immediately and contacted Apple and its content filter provider to resolve the issue. According to Froese, the current filtering system is extremely secure and functions regardless of whether devices are located at school or home.

Budget and resources

In 2008 the community passed a multi-million dollar bond to support capital projects and technology.[19] This bond has served as a major funding source for LISD's infrastructure and technology needs. In addition to helping to upgrade the network's broadband and wireless capacity, the bond covered the cost of purchasing nearly 35,000 iPads for the initial deployment in the eight pilot schools and the select grade levels district-wide and helped fund other costs including training, staff, and laptops. The district has also paid for professional development, hiring of support staff, and laptops by redirecting funding from the general operating and instructional materials budget. E-rate has helped to support wireless connectivity at some of the district's more disadvantaged schools. LISD has proposed that in the future, the cost of digital devices be added to the general operating budget in order to help sustain 1:X™. According to Froese, technology represents such a critical student need that it should be considered as essential as air conditioning, an item in the current operating budget. The district has also implemented substantial cost-saving measures; for example, LISD established an in-house deployment center to prepare devices for distribution - producing an initial savings of $940,000[20] - and relocated storage from an internal network to cloud-based computing via Google Apps for Education.

Measurable outcomes

LISD has employed data-driven decision-making to guide technology deployment from the beginning. The instructional technology team first tracked the number of devices in use at its pilot schools, finding that students were accessing their devices for instructional activities about half of the time during class, and that their devices were in close proximity more than 85 percent of the time. "How quickly that happened at our model campuses [pilot schools] was a huge indicator for the success in what we were doing," he said. Once it was clear the technology tools were being integrated into the classroom, LISD expanded the initiative to other schools.

While disentangling 1:X™ effects on student outcomes from other factors is difficult, Froese and team are continuing to examine multiple indicators in order to identify promising trends. They have employed a robust data analysis product called BrightBytes to facilitate this process by triangulating student and teacher survey data with other sources. The instructional technology team also recently led a device evaluation that included teachers, students, and administrators; it ranked the iPad above other devices based on criteria related to instructional effectiveness, among other factors.[21] Additionally, the team is carefully monitoring 1st through 3rd grade student outcomes to see the effects of digital devices on younger children.

Looking forward and lessons learned

Long-term, the district plans to extend 1:X™ in grades 4-12 by 2016 through a continuous rollout every year in select grades (students use the same iPad when they are promoted to the next grade level and keep the device for four years at which point the district will replace it). According to Froese, once the evaluation of the pilot schools is completed, the district will better be able to assess 1:X™'s effectiveness on younger children. Depending on the results, LISD may then expand the initiative K-12 district-wide.

Reflecting on lessons so far, Froese began with seemingly simple advice: clear communication is crucial. "You can't communicate enough [and] you can't provide enough resources for your community and parents," he emphasized. "We're not just transforming and reimagining the education model. We're also working to help our community to understand what we're doing." Froese also underscored a lesson shared with him and his team during their information-gathering visits to other districts: addressing infrastructure needs is "absolutely critical." Finally, he recommended that districts prioritize evaluation from the start. In this way, districts can make evidence-based decisions on issues such as the most effective device to deploy and whether to scale the initiative.

ENDNOTES

[1] Herold, 2013.

[2] Alliance for Excellent Education, n.d.

[3] Christensen, Horn, & Staker, 2013.

[4] National Research Council, 2012.

[5] City of Lewisville, n.d.; Lewisville Independent School District, n.d.a,b.

[6] Lewisville Independent School District, n.d.a.

[7] Ibid.

[8] U.S. Department of Education, n.d.

[9] Texas Education Agency, 2013.

[10] Lewisville Independent School District, n.d.c.

[11] Ibid.

[12] Lewisville Independent School District, 2012.

[13] Texas High Performance Schools Consortium, n.d.

[14] Ritchhart & Perkins, 2008.

[15] Harvard Graduate School of Education, n.d.

[16] Lewisville Independent School District, 2014.

[17] Lewisville Independent School District, 2013.

[18] Ibid.

[19] Lewisville Independent School District, n.d.b.

[20] Lewisville Independent School District, 2013.

[21] Lewisville Independent School District, n.d.d, n.d.e.

REFERENCES

Alliance for Excellent Education. (n.d.). *Digital learning*. Retrieved on August 17, 2014, from http://all4ed.org/issues/digital-learning/

Christensen, C. M., Horn, M. B., & Staker, H. (2013). *Is K-12 blended learning disruptive? An introduction to the theory of hybrids*. Clayton Christensen Institute for Disruptive Innovation.

City of Lewisville. (2014). *About us*. Retrieved on June 29, 2014, from http://www.cityoflewisville.com/index.aspx?page=2

Harvard Graduate School of Education. (n.d.). *Visible thinking*. Retrieved on August 15, 2014, from http://www.pz.gse.harvard.edu/visible_thinking.php

Herold, B. (2013, October 2). *'1:X' computing aims to tailor digital tools to learning tasks. Education Week*. Retrieved on May 10, 2014, from http://www.edweek.org/ew/articles/2013/10/02/06el-1x.h33.html

Lewisville Independent School District. (n.d.a). *About us*. Retrieved on May 9, 2014, from http://www.lisd.net/apps/pages/index.jsp?uREC_ID=118450&type=d&pREC_ID=231210

Lewisville Independent School District. (n.d.b). *Thank you*. Retrieved on June 29, 2014, from http://www.lisd.net/thankyou/readmore.html

Lewisville Independent School District. (n.d.c).*Strategic design*. Retrieved on August 12, 2014, from http://www.lisd.net/apps/pages/index.jsp?uREC_ID=157261&type=d

Lewisville Independent School District. (n.d.d). *Instructional technology*. Retrieved on July 25, 2014, from http://tech.lisd.net/apps/pages/index.jsp?uREC_ID=167854&type=d&pREC_ID=551252

Lewisville Independent School District. (n.d.e). *Device Eval Rubric*. Retrieved on August 13, 2014, from http://tech.lisd.net/apps/pages/index.jsp?uREC_ID=167854&type=d&pREC_ID=551252

Lewisville Independent School District. (2014). *Writing, mapping, communicating: 2nd grade awesomeness*. Retrieved on August 15, 2014, from http://1tox.lisd.net/

Lewisville Independent School District. (2013). *Infographic*. Board presentation.

Lewisville Independent School District. (2012). LISD accepted into Texas Schools Consortium. *LISD buzz*. Retrieved on July 1, 2014, from http://www.lisd.net/apps/news/show_news.jsp?REC_ID=268011&id=0

National Research Council. (2012). *Education for Life and Work: Developing Transferable Knowledge and Skills in the 21st Century*. Committee on Defining Deeper Learning and 21st Century Skills, J.W. Pellegrino and M.L. Hilton, Editors. Board on Testing and Assessment and Board on Science Education, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.

Ritchhart, R., & Perkins, D. (2008). Making thinking visible. *Educational Leadership*, 65(5), p. 57-61.

Texas Education Agency. (2013). *Snapshot 2013, district detail search*. Retrieved on May 9, 2014, from http://ritter.tea.state.tx.us/perfreport/snapshot/2013/district.srch.html

Texas High Performance Schools Consortium. (n.d.). *Consortium overview*. Retrieved on May 14, 2014, from http://texashpsc.org/

CASE STUDY

San Jose Unified tackles the opportunity gap through school redesign

SAN JOSE UNIFIED TACKLES THE OPPORTUNITY GAP THROUGH SCHOOL REDESIGN

Located near high-tech companies such as IBM, Cisco Systems, and eBay, the San José Unified School District (SJUSD) lies at Silicon Valley's intersection of bold ideas and innovation.[1] This urban district is seeking to exemplify the region's inventive spirit by using cutting-edge concepts to redesign teaching and learning.[2] Its efforts include developing a competitive grant program that enables schools to apply for planning and implementation grants to develop transformative ideas aligned with the specific needs of their students. While implementation is still gearing up, the district is already attracting attention: In 2013 it was one of eight districts selected to join Digital Promise's League of Innovative Schools, a national coalition of public school systems dedicated to digital innovation to bolster student success.[3]

This case study examines how SJUSD is employing novel approaches such as digital learning – referring to any instructional practice that uses technology to enhance students' education[4] - to address academic disparities and to prepare young people for college and career. It discusses the district's planning and implementation of its grant program, which already shows early evidence of increasing student engagement. Additionally, it covers essential elements related to the areas of professional learning, curriculum, instruction, and assessment, technology and hardware, and budget and resources. Finally, the case study describes SJSUD's plans to scale innovations, and concludes with lessons offered to other school district leaders, such as the importance of an inclusive planning and decision-making process, assessing school readiness, and cultivating creative ways to improve teaching and learning.

Planning and implementation

San José is the state's 3rd largest city, and the country's 10th largest, and is home to a highly heterogeneous population.[5] A system of 42 schools and 33,000 students, the district mirrors the surrounding diversity: a majority are Latino; a quarter are white, 13 percent are Asian, and 3 percent are African American.[6] Approximately a quarter of students are English Language Learners, and nearly half are socioeconomically disadvantaged.[7]

Although SJUSD has raised academic achievement over the past decade and become the first district in the state to require a rigorous college-prep curriculum, persistent skill or achievement gaps remain.[8] According to the district, this gap reflects a broader opportunity gap in which students have disparate access to quality instruction and other resources important to their development, such as academic supports and advanced classes.[9] Latino and low-income students are especially affected by these differences; however, a majority of students lack proficiency in 21st century skills such as critical thinking and problem solving, creative thinking, communication, collaboration, global citizenship, and digital literacy.[10]

To address these challenges, SJUSD set out to transform the traditional education system to prepare students for the ever-evolving 21st century landscape. In 2011 Superintendent Vincent Matthew enlisted more than 3,500 stakeholders, including teachers, students, community members, local businesses, and district staff, to participate in meetings and complete surveys in a nearly year-long planning process. According to Jason Willis, assistant superintendent for community engagement and accountability, this collaborative experience engendered strong stakeholder buy-in since participants had an opportunity to contribute their perspectives.

The collective effort culminated in Opportunity21, the district's 2012-17 strategic plan. Guiding the plan were two imperatives: closing the opportunity gap and ensuring that all students possess 21st century skills.

SAN JOSE UNIFIED TACKLES THE OPPORTUNITY GAP THROUGH SCHOOL REDESIGN

Technology plays a fundamental role in realizing this mission. "Most broadly, our plan speaks to 21st century skills, and part of that definition is digital literacy," explained Willis, noting the significance of these competencies for student success in college and career. Beyond equipping youth with vital skills for their future, technology serves to customize learning according to students' abilities. "We see technology as a tool that teachers can use to further differentiate [instruction] in their classrooms and help kids accelerate or to intervene with students in ways that are useful and effective," Willis said.

Opportunity21 aims to achieve the following core objectives:

- High-quality academics
- Broader community and family supports
- Research-based accountability and support
- High-quality staff
- Aligned resources/efficient operations[11]

Each objective delineates concrete strategies. For instance, delivering high-quality academics includes five strategies: creating an educational system that ensures opportunities and successes for all students, accelerating and enriching education for every student, implementing a systematic instructional framework, instituting a comprehensive assessment system that drives instruction, and integrating a rigorous and relevant 21st century curriculum.

SJUSD concluded that providing a system that offers opportunity to all required a dramatic redesign. "We know as a system that half of our kids check out of the learning experience very early in their school careers. The goal is to rethink how learning happens so we don't lose those kids," said Rupa Gupta, the district's project manager for strategic projects, who is overseeing the redesign grant program. For example, a striking 55 percent of middle school and 70 percent of high school students in the district don't look forward to class and don't believe classes are taught in an interesting way.[12]

A renegotiated union contract offered an exceptional opening for implementing the district's vision. A contract provision called a "site flexibility agreement" allows more variation in structuring the school day. For instance, schools might deploy block schedules rather than traditional 50-minute periods, allowing more chances for deeper learning and real-time assessment.[13] At least 75 percent of staff must approve a new proposal, ensuring that an initiative is strongly supported.[14]

The district began implementation of Opportunity21 by devising a process for reshaping the learning environment. The central office considered different approaches, including proposing two to three models for schools to choose from, or having each school present a concept and the district would select the best option among them, which schools would then implement. However, SJSUD realized that identifying one effective model for all schools wasn't feasible due to their diversity. Principals offered similar feedback. The district decided to start anew. Gupta enlisted key stakeholders to participate in a redesign planning committee of teachers and administrators representing different grade levels and low- and high-poverty schools, as well as union and board leaders.

Recognizing that staff buy-in was crucial to success, the committee established a Request for Proposals (RFP) grant process to enable schools to develop concepts appropriate to their situations. "[We] recognized that we needed to centrally let go. ... The folks closest to students come up with ideas the most relevant to students," Gupta said.

The RFP process involves several steps. First, a school submits a letter of intent, which receives a blind review from the committee, who then provide feedback. Those schools considered ready to advance to the next stage are invited to submit a full proposal for a one-year planning grant. These proposals are vetted according to a detailed rubric; main indicators include the level of demonstrated need, alignment with the district's mission, theory of action, staff buy-in, expected transformative effect on students' and teachers' educational experience, and evaluation plan, among others.[15]

If a planning grant is awarded, school staff must vote at the end of the year on whether they would like to proceed with the next stage.

Both the redesign committee and external reviewers, who include staff from Stanford University and The Cities for Education Entrepreneurship Trust (CEE-Trust), a national nonprofit focused on urban education reform, provide feedback to another committee comprised of key leaders from the district, the state and local teachers' unions, and the Board of Education, which makes the final decision. If a school obtains a favorable decision, it will receive additional funding to support implementation.

During 2012-13, 23 schools completed letters of intent and nine were invited to submit full proposals. That year, five schools were awarded one-year $100,000 planning grants for the 2013-14 academic year to fund development and piloting phases. Two of the five – Burnett Middle School and Lincoln High School - are advancing to the implementation stage after being awarded a total of $1.3 million last spring.[16] Burnett Middle School has received another $200,000 from external funders.[17] Additionally, a high school received a planning grant for the 2014-15 academic year. Burnett Middle School is implementing blended learning – a hybrid of face-to-face and online instruction[18] - in core content areas, while Lincoln High School is using technology to facilitate interdisciplinary project-based learning.

Professional learning

SJUSD leads a series of trainings for planning grant recipients, covering topics from developing a theory of action and data collection to project management tools. Additionally, each school continuing on to implementation works closely with an external thought partner to train teachers in the school site's redesign concept. For example, the Buck Institute for Education, a nonprofit that supports districts, schools, and teachers in integrating project-based learning, is conducting staff development at Lincoln High School.

Curriculum and instruction

While the Burnett and Lincoln redesigns differ, they share the goal of delivering more rigorous and personalized teaching and learning to enhance opportunities for all students, an essential element of the strategic plan. The redesigns use the increased flexibility afforded by the union contract to restructure instructional time. Technology acts as a powerful lever to help students acquire critical 21st century competencies, and to enable self-paced and collaborative learning.

Burnett Middle School, which is among one of the lowest income schools in the district, is reshaping the school day through blended learning. It has directed a large portion of its grant to purchasing mobile devices, such as iPads and Chromebooks, that facilitate personalized learning. While students don't receive their own device, every classroom has its own cart containing an array of these digital resources for student use. An illustrative example of how blended learning is poised to transform the learning and teaching experience is last year's Algebra class pilot. The teacher restructured instructional time, using digital devices to tailor assignments to students' abilities and learning styles. Students practiced content at different stations in the classroom while their teacher offered guidance to both individual children and small groups. "Having kids being able to work at their own pace gets rid of teaching to the middle and allows us to meet individual learning needs so that students aren't either bored because they already get it or overwhelmed so they check out," Gupta described. The teacher also developed formative assessments - used to determine students' understanding of material during class[19] - for students to demonstrate mastery of core concepts. During the 2014-15 academic year, the school is employing a new tool that will enable teachers to monitor students' progress on a daily basis, greatly facilitating their ability to customize instruction to individual needs.

In addition, Burnett is introducing what it refers to as "criterion-based grading." This model will allow teachers to assess student performance based on a rubric rather than letter grades to measure content mastery and proficiency in 21st century skills. Students might exhibit their critical thinking and problem-solving skills through application of content to an unfamiliar situation. "Before kids could get away with doing ok on some quizzes and continue plodding through the system. Now it's much more dynamic [and involves] the other skills [students] need to develop," Gupta explained.

Lincoln High School, an academic, visual, and performing arts magnet school that has earned numerous accolades,[20] is targeting its redesign toward project-based learning. Technology will help the school develop interdisciplinary, inquiry-based projects to enhance student ownership of learning, build 21st century skills and application of knowledge, and prepare young people for college and career. For example, English, biology, and geography teachers piloted a project last year in which students explored the concept of beauty through these disciplines and then demonstrated their learning through producing a product such as a website, magazine, video, or short story. This pilot fostered 21st century skills by having students evaluate and provide feedback, participate in collaborative teams, and create and present rich multimedia content.

Technology and hardware

Over the last several years, SJSUD has developed its infrastructure to support 21st century learning. The vast majority of schools have high-speed Internet access and wireless access points in each classroom. In the coming years, the district hopes to convert from traditional textbooks to electronic tablet versions (pending funding availability), which will likely require enhanced bandwidth and wireless connectivity.

Budget and resources

While E-rate supports basic Internet access, local bond measures represent the major fiscal source for addressing the district's infrastructure needs, including broadband and wireless connectivity. For example, a local bond measure approved in 2012-13 is projected to produce $290 million over seven years to fund capital projects and technology.[21]

District budget reserves support the planning and implementation grants for school redesign. Local foundations have also contributed monetary support. After the initial two- to three-year investment, schools are expected to maintain the initiative on their own (though they can apply for district funding to replace old devices), and are evaluated on their capacity to do so during the grant proposal process. According to Gupta, schools will be able to sustain the initiatives since, after teachers are well-trained in the model, they won't have to continue to pay external thought partners.

Measurable outcomes

The district has already obtained some preliminary positive results from pilot projects. Burnett Middle School student surveys and focus groups indicated encouraging progress related to greater student ownership of learning and increased 21st century skills as a result of integrating technology into the classroom. Early data found that blended learning facilitated one-on-one teacher support for 20 percent more students, and that criterion-based grading boosted student ownership of learning by 15 percent.[22]At Lincoln High School, initial data reported that a majority of students believe that project-based learning emphasizes the use of 21st century skills more than traditional instruction.[23] To track long-term outcomes, the grant program requires that schools monitor their redesigns by collecting and analyzing student data during the course of their redesign. Schools will then use the data to evaluate key performance measures.

Looking forward and lessons learned

SJUSD envisions that all schools will eventually embark on redesign, though realizes that time frames and strategies will vary. Teams of teachers and principals can visit the redesign sites to see the work on the ground. School staff can also participate in webinars led by principals at the redesign sites who share their practices and experiences, which are systematically documented, as mandated by the grant guidelines. Willis expects more schools to apply for grants as they witness the exciting work happening around them. “Being able to create examples in the backyard is very real for people. They know the school’s struggles and dynamics. If they are able to see that it’s possible, [it will] create some inspiration and meaningfulness for other schools that didn’t exist previously,” he said. Additionally, the district will continue to spur bold redesign concepts through a brand new innovation team supported through recent grant funding.

When reflecting on lessons thus far, Gupta highlights the significance of thoughtfully engaging a team of diverse stakeholders to both develop the process and make decisions, which helps to “demonstrate that we’re all in this together.” She also underscores a need to assess school site readiness, marked by a foundation of strong leadership and staff support coupled with openness and trust. Finally, devising creative strategies to encourage schools to think differently is a critical facet for transformation, which SJSUD is doing through the aforementioned innovation team, as well as through facilitating site visits to charter schools that are implementing creative approaches to teaching and learning.

ENDNOTES

[1] City of San Jose, 2013.

[2] Ibid.

[3] Digital Promise, n.d, San José Unified School District, 2013.

[4] Alliance for Excellent Education, n.d.

[5] City of San Jose, 2013.

[6] California Department of Education, 2013-2014.

[7] Ibid.

[8] San José Unified School District, 2012.

[9] ibid.

[10] Ibid.

[10] San José Unified School District, 2012.

[12] San José Unified School District, 2013a.

[13] Rosen, 2013.

[14] San José Unified School District, 2013b.

[15] San José Unified School District, 2013a.

[16] Digital Promise, n.d.

[17] ibid.

[18] Christensen, Horn, & Staker, 2013.

[19] Andrade, Huff, & Brooke, 2012.

[20] Lincoln High School, n.d.

[21] San José Unified School District, 2012-2013.

[22] San José Unified School District, 2013-2014.

[23] Ibid.

REFERENCES

Alliance for Excellent Education. (n.d.). *Digital learning*. Retrieved on August 17, 2014, from http://all4ed.org/issues/digital-learning/

Andrade, H., Huff, K., & Brooke, G. (2012). *Assessing learning*. Students at the Center, Teaching and learning in the era of the Common Core. Teaching and learning in the era of the common core. A Jobs for the Future Project.

California Department of Education. (2013-2014). *Enrollment by ethnicity for 2013-2014, district enrollment by ethnicity. Primary enrollment*. Retrieved on May 20, 2014, from http://dq.cde.ca.gov/dataquest/

California Department of Education. (2013-2014). *Enrollment by ethnicity for 2013-2014, district enrollment by ethnicity. English learners*. Retrieved on May 20, 2014, from http://dq.cde.ca.gov/dataquest/

California Department of Education. (2013-2014). *Enrollment by ethnicity for 2013-2014, district enrollment by ethnicity. Socioeconomically disadvantaged*. Retrieved on May 20, 2014, from http://dq.cde.ca.gov/dataquest/

California Department of Education. (2013-2014). *Enrollment by ethnicity for 2013-2014,school enrollment by ethnicity. Peter Burnett Middle. Socioeconomically disadvantaged*. Retrieved on May 20, 2014, from http://dq.cde.ca.gov/dataquest/

Christensen, C. M., Horn, M. B., & Staker, H. (2013). *Is K-12 blended learning distruptive? An introduction to the theory of hybrids*. Clayton Christensen Institute for Disruptive Innovation.

City of San José. (2013). *City fact sheet brochure*. Retrieved on June 29, 2014, from http://www.sanJoséca.gov/Index.aspx?NID=109

Digital Promise. (n.d.) *League of innovative schools*. Retrieved on June 29, 2014, from http://www.digitalpromise.org/league

Lincoln High School. (n.d.). *About us*. Retrieved on July 15, 2014. From http://sjusd.org/lincoln/school-information/about-us/

Rosen, C. (2013, June 19). Three San José Unified schools will spend next year re-imagining the school day. *San José Mercury News*. Retrieved on June 29, 2014, from http://www.mercurynews.com/san-José-neighborhoods/ci_23497389/three-san-José-unified-schools-will-spend-next

San José Unified School District. (2013-2014). *Opportunity21 2013-2014 annual report*. Retrieved on August 7, 2014, from http://www.San José Unified.org/opportunity21-annual-reports

San José Unified School District, & Digital Promise. (2013). *San José Unified School District accepted into League of Innovative Schools, joins National Network of Pioneering School Districts*. Retrieved on June 29, 2014, from http://www.sjusd.org/news-events/2013-sjusd-news/

San José Unified School District. (2013a). *Opportunity21: Strategy 1.1 transformational redesign*. Request for proposal. Internal document.

San José Unified School District. (2013b). *San José Unified School District and San Jose Teachers Union 2013-2016*. Internal document.

San José Unified School District. (2012-2013). *Opportunity21 2012-2013 annual report*. Retrieved on May 20, 2014, from http://www.San José Unified.org/opportunity21-annual-report

San José Unified School District. (2012). *Technology plan*. Retrieved on May 20, 2014, from http://www.San José Unified.org/community/technology-plan/

San José Unified School District. (2012). *Opportunity21. Preparing all students for the 21st century. San José Unified School District 2012-2017 strategic plan*. Retrieved on May 20, 2014, from http://www.San José Unified.org/opportunity21/

CASE STUDY

Students chart their own course in West Allis-West Milwaukee School District

STUDENTS CHART THEIR OWN COURSE IN WEST ALLIS-WEST MILWAUKEE SCHOOL DISTRICT

Just three years ago, classrooms in the West Allis-West Milwaukee School District (WAWM) in Wisconsin looked like those in most other public school systems across the country. Desks were lined up in rows, all facing the blackboard.[1] Now more and more classrooms are filled with beanbag chairs, bouncy balls, arm chairs, and sofas for individual work, tables and seats for small groups, and space on the carpet for learning activities.[2]

Redesigning the physical layout marked only the beginning of deeper change. Using district-issued tablets, students participate in a form of digital learning – signifying any type of instruction that uses technology to enhance education[3] – named blended learning, a hybrid of online and face-to-face instruction,[4] and pursue personalized learning paths aligned with their unique interests and skills. Some classrooms have extended the model even further, combining multiple grades in what WAWM calls Next Generation Learning (NxGL).

Last year the district hosted over 430 site visits from people eager to see an educational environment so innovative that it has garnered accolades such as being named a Follett First Look District, an Apple Distinguished Schools Program, and a Partnership for 21st Century Skills (P21) Exemplar School Program.[5] WAWM is also recognized for its excellence in education, and two of its 17 schools have received National Blue Ribbons, a prestigious U.S. Department of Education award for high academic performance and the closing of achievement gaps.[6] The Wisconsin Department of Public Instruction has honored the system with the Promise Schools of Recognition 39 times.[7]

This case study examines the key features in WAWM's journey towards digital learning, in which teachers use technology to empower youth to chart their own educational pathways and personalize learning by developing strong relationships with students that enable them to customize the curriculum, instruction, and assessments according to individual learning styles, strengths, interests, and motivations.[8] It begins with an overview of the district's planning and implementation process, which unfolded within a regional effort to reshape public education, and addresses in subsequent sections professional learning, technology and hardware, and budget and resources. The profile then describes the district's future plans to expand NxGL, and concludes with key recommendations for guiding other efforts to improve public education, including using a systemic approach and experimenting with different digital technologies.

Planning and implementation

WAWM is the 12th largest district in Wisconsin, enrolling nearly 10,000 students in 17 elementary, intermediate, and high schools.[9] A majority of students are white and a total of one-third are Latino or black.[10] The district serves a large proportion of socioeconomically disadvantaged students: almost 60 percent are eligible for free and reduced-price lunch.[11]

Confronted with numerous challenges, including fiscal shortfalls and an evolving economy requiring a new set of skills, Superintendent Ken Wachholz was one of many school district leaders across the state who recognized the need to transform the current public education system.[12] The Great Recession significantly disrupted Wisconsin's economy, and school district leaders knew that they needed to equip students with 21st century skills to compete in the increasingly global labor market.[13]

In 2009 superintendents from across Southeastern Wisconsin came together to develop a vision, recommendations, and strategies for revamping the education system.[14] The collaborative process occurred as part of the superintendents' role as members of an advisory committee of the Cooperative Educational Service Agency #1 (CESA #1), a state-authorized entity

that offers consulting, leadership support, and direct services to districts, schools, and teachers.[15] The effort grew into a regional learning community that authored A Regional Call to Action white paper centered on creating and implementing flexible learning environments to address the needs of all students and prepare them for success in college and career.[16] The agency convened symposiums attended by school board members, district administrators, teachers, students, and business and community leaders to discuss and contribute to these innovative ideas.[17]

Personalized learning emerged as the singular model for achieving meaningful transformation based on its capacity to "get learning right the first time – every time,"[18] and an affiliate organization was established to help facilitate this approach across the region.

Back in West Allis-West Milwaukee, Wachholz brought together district administrators to participate in brainstorming about what transformation would look like in the district and to conceive how to adapt the regional vision of personalized learning. "There was a sense of urgency to change what we're doing in public education to prepare students for college and career," explained Johnna Noll, director of instructional services. After these preliminary conversations, district leaders led sessions to introduce the concept of personalized learning at each school site based on their unwavering belief that the model would benefit all students. This rationale steered WAWM toward seeking systemic transformation rather than offering isolated programs to select students.

Noll next intensively worked with school staff interested in immediately experimenting with this model to develop a vision for personalized learning built on six foundational pillars:

- **College and career readiness**. Academic, technical, employability, and interpersonal skills for success in college or career
- **Student-centered learning environments.** Varied and flexible learning environments
- **Competency based progression.** Students demonstrate deep learning aligned with the Common Core State Standards
- **Student voice in learning.** Students participate in shaping their learning through goal-setting and personalized learning paths
- **21st century skill set.** Students will collaborate, communicate, think critically, and problem solve through the use of creativity, innovation, and technology
- **Family and community partnership.** Foster relationships with parents and community to support students[19]

WAWM recognized from the start of this process that technology could propel personalized learning by enabling students to customize and demonstrate their learning. Digital devices would allow students to use educational apps to complete activities aligned with their personalized learning paths and facilitate the application of 21st century skills, such as such as critical thinking, creativity, communication, and collaboration,[20] by having students work individually and together to produce multimedia projects to show mastery of curricular content.

Implementing a three-year 1:1 computing initiative in order to supply each student with a mobile device represented a natural next step. After researching different tools, the district selected the iPad based on its multifaceted abilities, such as accessing material offline if students didn't have home Internet connectivity. Managed by Digital Learning Coordinator Rachel Schemelin, the 1:1 initiative was rolled out during the 2012-13 academic year. (Nearly all schools are 1:1 and full deployment is planned during the 2014-15 academic year.) Simultaneously, WAWM introduced a Bring Your Own Device (BYOD) initiative, allowing students to use their personal mobile

devices if they preferred those to the iPad. The district implemented 1:1 only after it identified a clear purpose in the personalized learning model, and teachers were trained in this approach.

As it discussed personalized learning, WAWM refined its model into its NxGL classrooms. In NxGL elementary school classrooms, interdisciplinary teams of teachers instruct multi-age cohorts. For example, 1st, 2nd, and 3rd grade teachers collaborate to work with students over a three-year period. In NxGL intermediate and high school classrooms, interdependent teams of core content teachers personalize instruction for a specific grade level rather than multi-age groups. For instance, English Language Arts, math, social studies, and science teachers would work together to integrate learning across subjects for 9th grade students. "NxGL was a way to build structure for personalization," Noll said, adding that the presence of multiple teachers in a classroom maximizes their ability to adapt lessons according to individual students' needs and interests. Similar to the personalized learning model, teachers in the NxGL classrooms use technology to customize content and enable students to progress at their own pace according to their personalized learning paths, while honing 21st century skills and demonstrating their understanding.

Thirty-four elementary school teachers initially launched NxGL, and, by the end of the first year, it proved so popular that a student waiting list had formed. Since then, NxGL has rapidly expanded, and over 220 teachers have already implemented it or are in the process of doing so. Currently, the approach is most widely adopted in the elementary schools with clusters at the intermediate and high school levels.

As part of the planning process, the district updated its policies, practices, and procedures to promote the new approach. For example, the acceptable use policy, which sets rules and expectations regarding accessing computers, the internal network, email, and the Internet, was modified to allow greater flexibility for teachers to utilize Web 2.0 tools without needing to obtain approval from the district first. This change enabled teachers to select resources tailored to each student's interest and ability (one student might have an app to practice fractions, and another one for decimals, for example).

Professional learning

Noll and her instructional services team, including Schemelin and Paula Kaiser, Next Generation Learning/ personalization coordinator and assessment coordinator, provide ample professional development opportunities for teachers in each of the six pillars of personalized learning. Sessions focus on strategies for coaching students to demonstrate depth of knowledge on a proficiency or on how to integrate technology more fully to promote 21st century skills. Teachers create 30-, 60-, and 90-day plans to evolve their instructional practices within the six pillars. WAWM also transformed its media specialist role into a technology integrator position — supervised by Schemelin — to assist teachers with bringing digital resources into the classroom.

During the initial iPad deployment, technology integrators from each school participated in an Apple-led training (included in the district's leasing agreement), and then trained teachers in the product. Currently, technology integrators hold regular in-person "Appy Hour" trainings for teachers, which cover basic use of different apps and examples of how to use them as part of instruction to help students meet learning objectives. During the 2014-15 school year, WAWM is experimenting with supplementing traditional face-to-face trainings with online professional learning opportunities through the iTunes U app. Educators can earn certificates of knowledge and/or implementation upon completion of these "on-demand" courses.

STUDENTS CHART THEIR OWN COURSE IN WEST ALLIS-WEST MILWAUKEE SCHOOL DISTRICT

Curriculum, instruction, and assessment

WAWM is dramatically reconfiguring K-12 instruction to tailor instruction based on students' individual abilities and interests. Starting as early as kindergarten, teachers produce learner profiles based on youths' academic strengths and challenges, learning styles, interests, and postsecondary goals, recognizing that elements will undoubtedly shift over time. This information is incorporated into personalized learning plans (PLPs), which are loaded onto students' iPads or other devices and regularly updated. "The personalized learning plan goals are the foundation for the apps and how the technology is being used," explained Schemelin. Through conferring with teachers, students set goals, identify activities for learning and practicing competencies, and decide appropriate ways to demonstrate proficiencies – all of which is monitored through their digital PLPs. "The use of technology has helped us become more efficient and helped students exercise more control over their learning through managing [their] own productivity and work flow, as well as demonstrate evidence of their learning by curating and remixing information," Noll said in noting the iPad's many benefits.

The school day has also been reshaped: students participate in teacher-facilitated seminars on core academic subjects and then work on both individual and collaborative activities and projects using their digital devices. The restructured environment has made use of time more efficient, since students progress at their own pace and teachers are better able to individualize instruction. For example, students target goals aligned with their PLPs during workshops and confer with their teacher about specific content. This technology-enabled approach helps prevent skill gaps requiring later remediation and promotes student acceleration. Personalized learning also empowers students to take ownership of their education. "We want [students] to be advocates for their own learning and either ask for help or seek out resources to get to the next step," Kaiser said.

Personalized learning has demanded a pedagogical culture shift from teachers and students alike. "We've worked hard to have teachers let go of saying, 'as a student you must do this,'[and, instead, having] a student say, 'this is what I'm interested in, these are some of the standards and proficiencies that I will need, and this is how I want to learn it,'" Noll said. Some students, particularly at the secondary school level, have experienced difficulty adapting to the restructured educational environment. "A 10th grader has 11 years of a school model to unlearn and is used to having people tell them exactly what they need to do to earn an A or a B or a C and what the assignment is and when it's due," she noted.

The district further tailors learning by using technology for both formative and summative assessment. Formative assessment determines students' understanding of material during class and is used to discern their strengths and weaknesses, plan further instruction, and enhance student responsibility and guiding of their learning; summative assessment measures student performance at the end of a course and is used to assign grades, award diplomas, promote or retain students, and identify proficiency levels.[21] Grades K-8 employ proficiency progressions aligned with the Common Core State Standards, and WAWM is currently working to develop proficiency progressions for the high school. According to Noll, these progressions ensure that students advance only once they have exhibited standards-based depths of knowledge. Teachers follow a cyclical approach: they first identify the appropriate standards and give students a pre-assessment. Students are then assigned to seminars according to their level of comprehension. Subsequently, students choose a method for applying and practicing skills, and take a formative assessment to identify additional seminars to enhance their knowledge. Problem- or project-based learning serves as a summative assessment to demonstrate their knowledge.

Technology facilitates this iterative process by capturing students' level of understanding through real-time data, and amplifying student choice through providing greater options for showing evidence of learning.

Problem- and project-based learning opportunities are offered both at schools and in the community. For example, elementary school students recently developed a raised garden, applying diverse skills to calculate the correct square footage for distributing plots equally to multiple teams and researching types of plants. "We try to connect [the standards] back to real-world applications and make it relevant and purposeful to them," Kaiser described.

NxGL classrooms further infuse personalized learning through highly flexible environments in which multi-age cohorts build strong relationships with teachers over the course of two to three years. Multiple teachers have even greater capacity to customize learning because they are able to confer with students during workshops as they participate in activities aligned with their personalized learning paths, while another teacher simultaneously conducts a seminar on core content for a small group. In a personalized learning classroom, a single teacher fulfills both roles. Students explore topics across subjects, identify their interests, and use technology to facilitate their learning. For example, students examine the concept of cause and effect within both a literary text and a historical context, such as the Great Depression. The multidisciplinary unit is assessed according to both English language arts and social studies standards. A student then conducts research on the topic on an iPad in order to identify an essential question of interest, and uses the device to produce and present a final project, such as an iMovie or blog, that demonstrates learning. Digital devices strengthen students' ability to discover and delve deeper into personally meaningful topics, which can enhance their ownership of learning and engagement. Technology also enables youth to acquire and apply important 21st century skills through creating multimedia projects.

At the secondary level, personalized learning and NxGL classrooms have to adhere to state requirements such as earning credits based on a prescribed number of hours. However, the use of a blended instructional format is facilitating more flexible schedules that enable students to engage in online learning outside of the traditional school day. This adaptability helps students participate in real-world opportunities, such as project-based learning in the community, co-ops, and job shadowing.

Technology and hardware

The district's technology department has built infrastructure to support the 1:1 deployment, such as installing a new wireless system to enable robust mobile connectivity for the more than 9,000 digital devices. In addition to expanding wireless access, the district has identified a need for greater bandwidth for video streaming and online assessments, and is currently working to update the network.

Budget and resources

The district was awarded an initial NxGL planning grant from Next Generation Learning Challenges (NGLC), a project jointly managed by EDUCAUSE, the Bill & Melinda Gates Foundation, the League for Innovation[22] in the Community College, the International Association for K-12 Online Learning, and the Council of Chief State School Officers that promotes educational innovation. All other support for this effort, as well as for the 1:1 initiative, has stemmed from reallocating existing funding from other sources, such as redirecting money from desktop computers to lease iPads. WAWM has also capitalized on savings from switching from print to online resources to develop digital platforms, such as a learning management system that enables students to access course materials, assignments, and grades online.[23] E-rate funds the district's basic Internet connection, in addition to helping to support wireless infrastructure.

Measurable outcomes

Within both personalized learning and NxGL classrooms, WAWM reports substantially increased student engagement, which it attributes to connecting learning to students' own interests and motivations. NxGL classrooms also exhibit impressive academic progress. According to an evaluation conducted by the Northwest Evaluation Association, students in NxGL classrooms substantially outperformed their peers in traditional classrooms during 2012-13 on MAP, the state's standardized test.[24] Noll reported that students reflected 185 percent growth - nearly two years of growth within one year - during the first year of implementation. "Success breeds success," she observed. "Most students felt empowered and continued to excel." These remarkable results have sparked interest in the model among other schools.

Looking forward and lessons learned

Success to-date presents both an opportunity and a challenge, according to Noll. Since families of elementary school children enrolled in NxGL desire the same innovative setting in intermediate and high school, the district is working to scale the model more quickly by further investing in staff training for teachers in the upper grades. That expansion requires that proficiency progressions translate into measurable indicators, such as high school grade point average (GPA). "[It's] challenging to be flexible and innovative when there are rigid structures that we need to conform to such as seat-time and attaining Carnegie Units," Noll said. (The Carnegie Unit denotes credits earned at the secondary level based on a certain number of hours.[25])

Above all, Noll emphasizes the importance of embracing personalized learning as an optimal strategy for all students, not only some. This perspective continues to guide WAWM's approach to professional development, preparing every teacher for the pedagogical shift. Although the district has faced obstacles along the way, Noll advises others hitting some rough patches to "stay the course." She also encourages a departure from traditionally long planning processes prior to implementation that can typically span one to two years, and, instead, to experiment with "rapid cycles of innovation" over a 30- day period. This bold approach is essential for implementing technology, which is ever evolving and can lead to resources becoming obsolete.

ENDNOTES

[1] Borsuk, 2013.

[2] Borsuk, 2013; West Allis-West Milwaukee School District, n.d.

[3] Alliance for Excellent Education, n.d.

[4] Christensen, Horn, & Staker, 2013.

[5] Wachholz, 2013.

[6] U.S. Department of Education, n.d.

[7] Wachholz, 2013; West Allis-West Milwaukee School District, n.d.

[8] Yonewaza, McClure, & Jones, 2012.

[9] West Allis-West Milwaukee School District, n.d.

[10] Wisconsin Information System for Education, 2013.

[11] Ibid.

[12] Cooperative Educational Service Agency #1, 2010.

[13] Ibid.

[14] Ibid.

[15] Cooperative Educational Service Agency, #1, n.d.

[16] ibid.

[17] Cooperative Educational Service Agency, #1, 2011.

[18] Ibid, p. 3.

[19] West Allis-West Milwaukee School District, n.d.

[20] Partnership for 21st Century Skills, n.d.

[21] Andrade, Huff, & Brooke, 2012.

[22] Next Generation Learning Challenges, n.d.

[23] Ash, 2013.

[24] Northwest Evaluation Association, 2014.

[25] U.S. Department of Education, n.d.

REFERENCES

Alliance for Excellent Education. (n.d.). *Digital learning*. Retrieved on August 17, 2014, from http://all4ed.org/issues/digital-learning/

Andrade, H., Huff, K., & Brooke, G. (2012). *Assessing learning*. Students at the Center, Teaching and learning in the era of the Common Core. Teaching and learning in the era of the common core. A Jobs for the Future Project.

Ash, K. (2013, June 11). How to choose the right learning management system. *Education Week*. Retrieved on August 28, 2014, from http://www.edweek.org/dd/articles/2013/06/12/03lms-evaluation.h06.html

Borsuk, A. J. (2013, February 9). Individualized program showing signs of success in West Allis-West Milwaukee schools. *Milwaukee Wisconsin Journal Sentinel*. Retrieved on June 28, 2014, from http://www.jsonline.com/news/education/individualized-program-showing-signs-of-success-in-west-alliswest-milwaukee-schools-168n6o2-190543901.html

Center for Promise. (2014). *Don't call them dropouts*. Washington, DC: America's Promise Alliance.

Christensen, C. M., Horn, M. B., & Staker, H. (2013). *Is K-12 blended learning distruptive? An introduction to the theory of hybrids*. Clayton Christensen Institute for Disruptive Innovation.

Cooperative Educational Service Agency #1. (n.d.). *About us*. Retrieved on August 5, 2014, from http://www.cesa1.k12.wi.us/about/

Cooperative Educational Service Agency #1. (2011). *Public education transformation: Powered by regional networks*. Pewaukee, WI: Report.

Cooperative Educational Service Agency #1. (2010). *Transforming public education: A regional call to action*. Pewaukee, WI: White paper.

Next Generation Learning Challenges. (n.d.). *About*. Retrieved on August 1, 2014, from http://nextgenlearning.org/learn-about-us

Northwest Evaluation Association. (2014). *West Allis-West Milwaukee School District, Using MAP data to support a personalized learning model*. Retrieved on May 10, 2014, from http://www.wawm.k12.wi.us/news/what_s_new/w_a_w_m_participates_in_personalized_learning_case/

Partnership for 21st Century Skills. (n.d.). *Framework for 21st Century Learning*. Retrieved on April 29, 2014, from http://www.p21.org/about-us/p21-framework

U.S. Department of Education. (n.d.). *Structure of the U.S. education system: Credit systems*. Retrieved on July 6, 2014, from http://www2.ed.gov/about/offices/list/ous/international/usnei/us/credits.doc

U.S. Department of Education. (n.d.). *Programs. National Blue Ribbon Schools Program*. Retrieved on July 31, 2014, from http://www2.ed.gov/programs/nclbbrs/eligibility.html

Wachholz, K. (2011). *Superintendent's message*. Retrieved on May 10, 2014, from http://www.wawm.k12.wi.us/news/superintendent_s_newsletters

Wachholz, K. (2013). *Superintendent's message*. Retrieved on May 10, 2014, from http://www.wawm.k12.wi.us/news/superintendent_s_newsletters

West Allis-West Milwaukee School District. (n.d.) *NxGLC video*. Retrieved on May 10, 2014, from http://www.wawm.k12.wi.us/district_information/departments/curriculum_and_instruction/next_generation_learning/nxglc_video/

West Allis-West Milwaukee School District. (n.d.). *Why WAWM?* Retrieved on May 9, 2014, from http://www.wawm.k12.wi.us/district_information/why_w_a_w_m_

Wisconsin Department of Public Instruction. (n.d.). *Academic standards*. Retrieved on May 10, 2014, from http://standards.dpi.wi.gov/

Wisconsin Information System for Education. (2013). *Enrollment (single year)*. Retrieved on May 9, 2014, from http://wisedash.dpi.wi.gov/Dashboard/Page/Home/Topic percent20Area/Enrollment/

Yonezawa, S., McClure, L., & Jones, M. (2012). *Personalization in schools*. The Students at the Center Series. Teaching and learning in the era of the common core. A Jobs for the Future Project.

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