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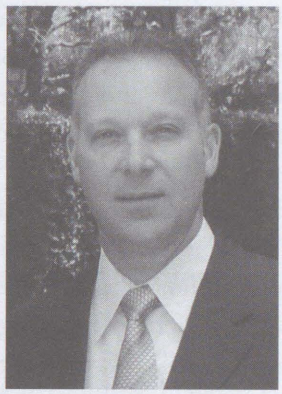

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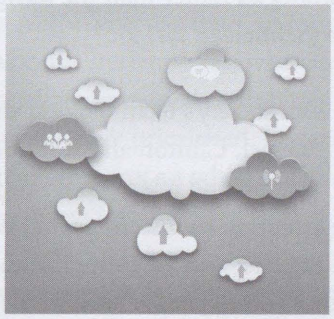

Across international landscapes, K-12 students are expected to possess an orientation toward learning that is mediated by pervasive digital devices (World Internet Project, 2013). Skills in digital media literacies and information and communication technologies (ICTs; this and other technology terms can be found in the glossary at the end of this article) are necessary for students to navigate the educational resources that are quickly moving to online and digital formats by publishers (e.g., Pearson), course management systems (e.g., Blackboard or Canvas), or open-access platforms (e.g., Google). A survey by the Pew Research Center (2016) found 77% of U.S. adults owned a Smartphone. Along these lines, a Digital Future Project (2013) survey found that 83% of American households had broadband Internet. These trends indicate digital forms of communication are becoming ubiquitous in U.S. society, resulting in the same trends transferring to U.S. schools. In fact, technology innovation adoption is either assumed or required across state standards, learned societies, and within the general public milieu (Bennett, Maton, & Kervin, 2008; Straub, 2009).

The Digital Divide Between Home and School

Non-use of technology, or teachers' and students' inability to adopt particular technology innovations, is considered a "failure" within adoption-diffusion theories (Straub, 2009). Yet, many technology adoption models have not accurately accounted for the multiplicity of factors involved in the contexts of schools such as the availability of equipment, level of professional training, ease of use of the device, dispositions of teachers, dispositions of students, relevance to the curriculum, and, of course, the amount of time focused on testing coupled with accountability systems. As Straub (2009) noted, "by ignoring teachers' possible preferences for an innovation, this model [adoption-diffusion models] sells teachers short by portraying them as resistant luddites" (p. 636), when, in fact, one type of digital device does not fit all, and teachers have instructional styles and personal preferences for technology use as well.

In addition to the fact that teachers have personal preferences for using technology, out-of-school technologies, such as Smartphones, do not necessarily transfer to school contexts due to safety, security, and compatibility issues. Therefore, home devices are not necessarily school devices. As a result, many factors have converged

to create a well-documented digital divide for students and teachers (Hutchison & Reinking, 2011; Warschauer, 2003; Warschauer & Matuchniak, 2010).

The "Ideal" Solution

To combat the digital divide, technology integration experts suggest several key factors may bridge the gap between the pervasive use of technology in society and the limited use of technology in schools: (1) develop dispositions and competencies, (2) give students the same devices, and (3) allow for a new learning ecology.

Develop Dispositions and Competencies

Without question, the future of education is based on technological advances that shrink time and space (Zhao, 2010). Technology advances mean that the devices will always change in response to the marketplace. Therefore, if the equipment is going to constantly shift, then it is important to build teachers' dispositions toward and competencies with learning instructional technology strategies rather than the navigation of specific tools (Schneider, 2015).

To coincide with society's technological shifts, Jenkins, Purushotma, Weigel, Clinton and Robison (2009) recommend "schools and afterschool programs must devote more attention to fostering what we call the new media literacies: a set of cultural competencies and social skills that young people need in the new media landscape" (p. 4). The new media literacies include skills such as playing, performing, multitasking, and negotiating. These media-friendly skills increase the potential for successful technology use.

Give Every Student the Same Device

Beyond cultural competencies or dispositions, 1:1 initiatives are often viewed as the gold standard among Instructional Technology (IT) departments, administrative leaders, and learned societies (Demski, 2012; Hutchison & Reinking, 2011). As Spires, Wiebe, Young, Hollegrands, and Lee (2012) state, "The key feature that differentiates 1:1 instructional contexts is the simple fact that *all* students and teachers have access to a mobile learning technology device and the Internet" (p. 233). When all students have the same equipment and the same access, it is assumed that the teacher can spend less time on accommodating multiple devices and more time focused on instructional integration and applications. The same device should create a more consistent context for learning.

Allow for a New Learning Ecology

Equity principles are embedded in 1:1 programs in which all students have access to the same type of devices.

> The constant access to tools and rich information in the 1:1 classroom can create what we refer to as the *new learning ecology*, in which information and ideas are abundant, in flux, and constantly evolving. Destabilization of information and knowledge is a critical factor within the contemporary learning environment, creating opportunities for new ways for students to be engaged and educated (Spires et al., 2012, p. 234).

For the most part, a new learning ecology, in which "information and ideas are abundant, in flux, and constantly evolving," is portrayed as a good problem to have. The flow of ideas and endless opportunities for engaged learning seem to result in desired outcomes with regard to technology use and instructional integration.

The Reality

Even though ideal solutions serve as a model for ideal situations, most schools operate as a destabilized environment, one in which the shifting marketplace and new technology tools dictate learning potential. Different tools also create technological, financial, and instructional voids. Shrinking budgets, along with further calls for increased technological competency, often expand the digital divide.

To counter the digital divide, under-funded schools and districts often choose BYOD (Bring Your Own Device) programs (Schaffhauser, 2012) or purchase inexpensive or refurbished devices (Pikar, 2005)—choices that impact the nature and amount of instruction as well as the type of professional development needed for teachers. Schools with limited budgets accept the notion of compromise, understanding that digital constraints can

limit instructional choices. However, what these schools may not realize is that BYOD or selecting inferior products may inadvertently increase the digital divide rather than nullify it.

With extraordinary pressures on schools to integrate technology in a complex context of curricular, budgetary, and societal demands, we documented one school's decision-making process as the administrators and instructors implemented technology initiatives. In particular, we examined how one, well-resourced school pursued a *new learning ecology* when new forms of technology integration required basic philosophical and operational shifts in how students learn, how teachers teach, and how administrators select programs and offer professional development support to meet changing cultural and technological demands.

Technology or the Curriculum: The Underlying Tensions of Digital Decisions

Academy of the Holy Names (AHN) is an independent Catholic school founded in the 1880s with a tradition of excellence and generations of alumni who make it financially possible to provide students and teachers with the most cutting-edge applications of technology. In this regard, the school is financially well-resourced. Seven years ago, the school purchased iPads for every student. In addition, their building features several Collaborative Lab (Collab Lab) spaces with small group stations, specially designed furniture, smart walls, touch tables, and other features to support digitally-mediated instruction and collaboration. The school remodeled their designated technology spaces, which evolved from two desktop computer labs. The labs were gutted and redesigned, and recently relocated to include large class areas, smaller study areas, a private booth for meetings or classes, and other ways for the students and teachers to collaborate and innovate through digital means. The new lab spaces also include areas with lower tech options for group work and instruction. Admittedly, this school has an abundance of resources and advanced technology integration. What's the problem?

With shared goals of an innovative curriculum supported by state-of-the-art technologies, school leaders have consistently worked to foreground the curriculum, often circumventing, but also acquiescing to, the constraints created by technological tools, digital devices, and infrastructure logistics. Their frustrations led Kent, the school's technology director, to consult with Jenifer, a local university professor, to collaboratively study the problem.

Below, we describe the layered, complex, and competing decisions of the school's instructional and administrative teams by highlighting a series of tensions. These tensions constrained the school's choices and iterative phases of technology adoption, and had corresponding effects on instruction.

Tension 1: Technology or the Curriculum? Flipped Priorities and a New Learning Ecology

Several years ago, Kent led the charge to create a visionary technology plan, develop a tech team (Figure 1), and then equip AHN with resources to support a 21st century education for students. Yet, whereas he previously felt the curriculum guided technology decisions, and curricular needs were prioritized, he sensed a change in the planning process when the school initiated a 1:1 device program.

Kent also recognized a similar shift among other schools and districts with 1:1 devices. For example, when Kent attended the International Society for Technology in Education (ISTE) conference, he noted that other technology directors and school superintendents identified *technology acquisition* as the primary goal rather than *technology as a tool* for enhancing the curriculum. When Kent attended the State Educational Technology Conference, he noticed the "tech experts" discussing infrastructure, bandwidth, and device constraints rather than best practices in curriculum and instruction. Kent recognized that technology plans were increasingly constrained and curricular goals were taking a backseat to technology acquisition. He noticed a lack of attention to digital literacy or disciplinary objectives. He wondered, "What was happening to the field?"

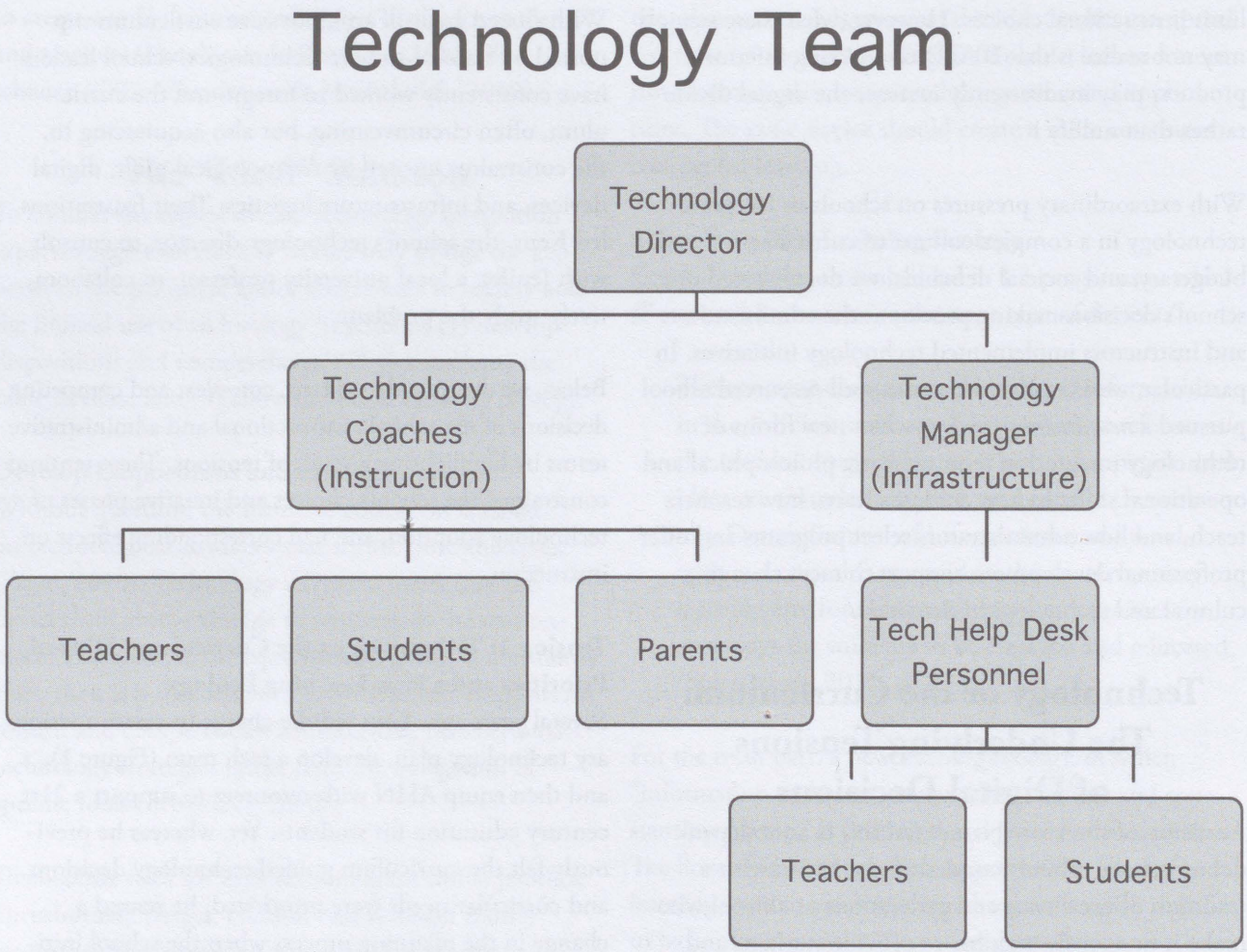

Figure 1. Technology team organizational chart.

Tension 2: Big Business Devices vs. Educational Uses

Historically, the usual culprits that inhibited technology integration, such as budget and hardwire infrastructure, were the known constraints in any school's technology plan. And they still remain, especially in schools with few resources. Yet another potentially destructive constraint has entered the equation—the device. Kent noticed that the coveted devices, and the big businesses that develop and fight over them, are interfering with education goals.

For example, when one of AHN's 5th grade teachers wanted to use iMovie, the school purchased the license. The teacher did not immediately install iMovie and, in the interim, Apple released a new operating system for the iPad. With the new operating system in place, the students could not load iMovie on their iPads because Apple restricted the app to those who had the newest iOS. However, if the students upgraded their operating system, then other apps, such as Notability, stopped working because the apps were not compatible with the iCloud drive. Notability was the primary method for note-taking and homework completion across the entire school; therefore, inaccessibility to Notability was not an option. Also, the students could not use their Spanish ebooks because the Spanish series was not compatible with the Safari app in the new operating system. The teacher, and her students were in a quandary.

AHN's chosen device (iPad) and their selected app (iMovie) derailed the teacher's instructional agenda. This is one example of how schools or districts often lock into proprietary technologies and then they become constrained by all of the associated problems such a decision creates.

These proprietary technologies are manageable in the workplace because large businesses or industries typically purchase one type of computer and train all of their employees to use its proprietary software. However, in *educational* contexts, technology purchases must be more open-ended and responsive to new ideas and adaptive learning. The over-controlled, over-supported, and over-trained practices in business and industry do not apply to educational contexts because teachers and students have different needs depending on grade levels, subject areas, and learner capabilities. As a result, educational technology must have expansive capabilities. Kent explained:

> The remote offices in big businesses don't work for classrooms. We (schools) have more problems by not over-controlling devices, but if we control the device, apps, websites, all of those things, teachers lose the ability to teach. They can't create and invent with the students. Students lose the freedom to learn.

Given all of its resources, AHN experienced continual problems with the devices that are designed for big business and larger markets rather than classrooms. Clearly, budgets are not the only constraint to technology integration.

Tension 3: Is *Any* Tech *Good* Tech?
Which Device Is Best?

With so much focus on access to the tool, Kent and his team found that the device continually constrained instruction. In previous years, any tech was good tech. But Kent sensed a change when he found that he could not prioritize the curriculum over the technology when making decisions. Other factors came into play such as cost, maintenance, network requirements, the features of each device, and compatibility with ebooks, online textbooks, and other instructional resources. As outlined briefly below, Kent identified strengths and weaknesses of each possible choice.

- **BYOD (Bring Your Own Device):** BYOD is cheap, but it is a technological nightmare. Each device will have issues with compatibility with the curriculum and the teacher must become an all-in-one tech help desk.
- **Microsoft Computers:** PCs are cheaper and usually compatible with educational programs. However, their operating systems require the most maintenance, they are prone to viruses, and the range of configurations require network flexibility.
- **Apple Computers:** Macs have long battery life and access to most programs and ebooks. However, some software programs are still not Mac compatible.
- **iPads:** iPads are cheaper than PCs or Mac laptops. They include readily-available apps tested by Apple, which makes them reliable. iPads are easy to maintain and have well-developed systems to deploy apps and books. However, productivity is limited. Special considerations must be made for data storage, printing, and the network must provide a better signal for the devices to connect well. Plus, not all websites work in the mobile device browser.
- **Google Chromebooks:** Chromebooks are cheap and easy to maintain, but a school must have Internet access and the different versions do not run Windows-based software. Curricular sites must run and be compatible with the Google Chrome web browser. Many schools have or will purchase Chromebooks due to the lower cost, but there are major instructional costs as well.

Given that no device can do it all and no device meets all needs, AHN made choices within constraints. Additionally, if the curriculum could not function as the constant that drove the technology, and, instead, if the technology drove the decisions, then the school would have to develop realistic processes for navigating

school-based priorities and corresponding purchases. This dilemma is our fourth tension: capped potential.

Tension 4: Capped Potential, Work Arounds, and The Decision-Making Process

If the school's curriculum was constrained by the technology, Jenifer asked Kent if AHN's entire process was guided by money. Kent acknowledged the importance of funding, but he felt other factors were more important and took precedence over money.

To understand the factors at play, Kent described AHN's decision-making process using ISTE's essential conditions as a starting point (ISTE, 2015). Then he altered the essential conditions to represent the school's actual order of operations: Concept/Vision, Implementation, Professional Development, and Assessment (Figure 2).

Concept/Vision. Approximately 20 years ago, AHN created its first technology committee (administrators, technology personnel, teachers representing all disciplines, and parents) and they created a five-year plan. As technology innovation sped up, AHN's plan shifted to a three-year cycle. Currently, the school revisits the technology plan every year. The technology plan includes an inventory of current equipment as well as a description of needs, actions, and recommendations. More importantly, the technology plan is shaped by a vision. A key shift occurred in the 2011 plan (p. 1):

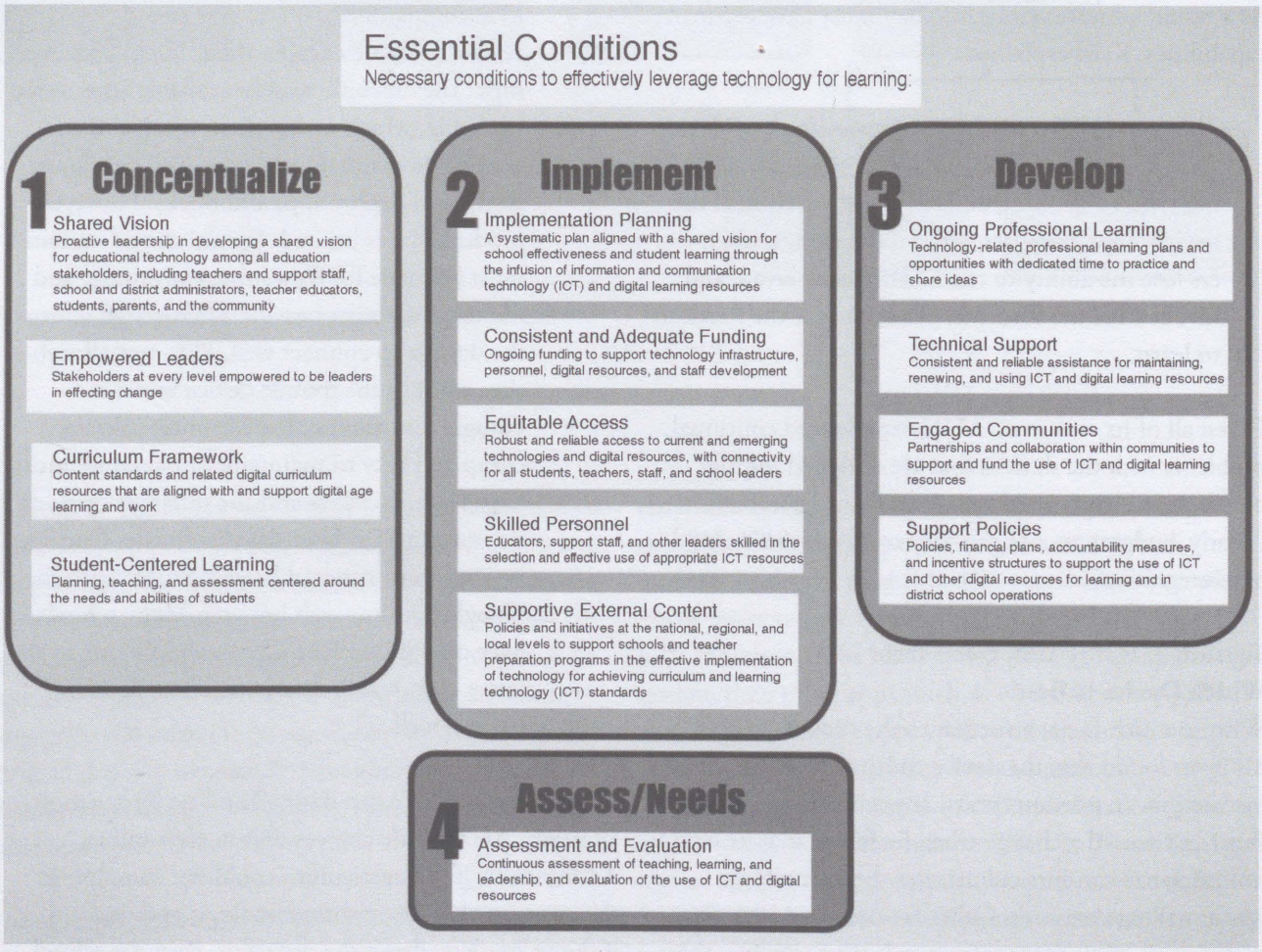

Figure 2. Modified essential conditions for leveraging technology for learning.

> Previously, technology was considered a tool to help educate students. Now, we consider technology an integral part of student and professional life – not just tools, but actually a change agent that is shaping our culture and our way of life. The education system needs to take an active role in helping shape students' access, understanding, and use of technology as a part of their lifelong learning.

AHN's technology committee recognized that technology was changing rapidly, and their school's fundamental capital expense equation was changing as technologies followed the commoditization curve. In other words, technology companies make money when they invent new technologies and they make less money when their inventions become a common item. Therefore, the school had to adjust their budget to allow for price spikes and equipment depreciation. In addition, they made predictions about the future, suggesting software would be a service (rather than a physical product in disk form) and cloud computing would create new paradigms (e.g., email services, editing services, collaboration tools). Only with a strong vision and collaborative effort across faculty, administrators, and stakeholders could they enact a productive technology plan.

Implementation. In the implementation phase, funding enters the equation. In Kent's case, the funding is excellent, in other cases, schools make due or enact gross approximations of technology integration within limited funding models. As Kent points out, "There aren't many resources to help schools figure out what to buy. A lot of the tech companies develop for BYOD, but how does a teacher plan for that? The tech people throw teachers to the wolves and let them figure it out, but it takes away planful choices." Without clear choices for equipment purchases, the school returns to the mission and vision for guidance.

Focus on the mission and vision. Kent attributes AHN's success to their ability to connect their funds to the school's overall mission and vision. The school's technology plan includes specific recommendations for actions, outcomes, and continuous review of effectiveness. The technology plan also includes estimated costs for any purchase or hire. For example, when recommending two full-time Instructional Technology Specialists (coaches), the school finances constrained full and immediate implementation of those hires; however, the intended goal was set and formal plans were enacted in subsequent years.

Conduct research. In addition to keeping with the schools' vision, Kent and his team research the pros and cons of each purchase. They read tech journals and magazines and attend conferences. They are connected to a network of other technology specialists and they visit other schools. They do not make capricious, trendy decisions. Instead, they make thoughtful ones. Although the technology team and planning committee make informed decisions, Kent reflected upon the mistakes they made along the way. Some purchases worked better than others, but none were fatal to the school. In addition, no single individual was blamed because the decisions were made in consultation, within the budget, and with information.

Hire the right personnel. In addition to a vision and careful planning, AHN makes the right personnel decisions. Prior to serving as the technology director, Kent was a Latin and history teacher. Therefore, he understands classroom models and the teachers' instructional needs. He reads the tech literature, monitors the trends, and tests the equipment. He can discuss the pros and cons of each device from the tech side as well as from the instructional side. He can talk to vendors and teachers as well as principals and school boards. Kent also knows his faculty colleagues. He understands their styles, preferences, and capabilities. He can use his own form of predictive analytics to determine implementation success. This type of knowledge is invaluable to AHN because Kent's due diligence and institutional memory saves the school money.

Take a patient path. Kent also takes intellectual risks but follows a patient path. Kent recognizes the continually shifting state of instructional technology and he balances the new with the known and the unknown with uncapped potential. He stated, "I'm noticing the

device is primary and this is a complete contradiction to the way it used to be." With a seismic shift in priorities away from the schools and toward the tech industry and their devices, any tech purchase carries high-stakes repercussions for the curriculum. Funds are used to purchase the equipment, but teachers are key figures in the implementation success.

Professional Development. AHN uses a multifaceted model for professional development that includes small pilot studies, considerate phases of implementation, workshops, and technology coaching. The coaches work with grade-level teams and with individual teachers to support integrated technology instruction. With ongoing professional learning, the teachers create the essential conditions for students' success within the capped constraints of any given device. As Kent explained, "You need curriculum people with tech understanding. You need tech people with curriculum understanding."

In addition, AHN's professional development model includes structures for parents and students. Major shifts in policies (1:1; student ownership) and new purchases (iPads/Mac books) are discussed in town hall forums. The technology team and administrators share information but they also listen to parents as they move forward with each new initiative. In addition, the instructional team scaffolds students throughout the process. The teachers and technology coaches hold information sessions, practice sessions, whole class demonstrations, and individual practice times.

Assessment. Kent explained that needs and performance assessments provide the data they use to determine next steps. By implementing iterative phases of technology adoption, and monitoring corresponding effects on instruction, Kent and his team navigate technological commerce to prioritize digital learning.

AHN's Technology Plan incorporates a continuous review process to ensure that needs are kept current and action plans are appropriate. Evaluations occur routinely and full-school needs assessments inform new action plans. Kent believes this review process is integral to the plan. In order to define the curriculum-based needs, the committee uses surveys, focus groups, and individual interviews with stakeholders. The stakeholder groups include the principals, teachers, students, and parents.

Back to the Future

We offer this school's story as an example of the compromises leadership teams, district administrators, and school boards make as they purchase technology and implement initiatives in the service of curricular goals. Within this particular school context, the vision, as enacted through the school's technology plan, provided stabilization through a tangible, written rationale that served as a guidepost for internal decision-making processes.

Other schools can learn from this process (Figure 3). If the curriculum is not first, and the budget is restrictive, then understanding the elements of a new learning ecology in which technology integration requires a basic philosophical and operational shift will help administrators and teachers select programs and seek professional development to support learning and teaching.

Schools and communities often feel disillusioned because their desire to foster students' untapped potential is connected to devices that create conditions of capped potential. They often do not realize that the device and its surrounding infrastructure (e.g., cost, wires, personnel) limit access more than money.

In summary, no single technology initiative, device, or platform supported the long-term goals of access, competence, and skill required for 21st century literacies for this school. Instead, the stewards of the digital literacy curriculum and agents of technology integration (i.e., administrators and teachers) had to remain flexible, adaptive, and work in concert with one another in anticipation of future digital advances, while also acknowledging the school context and the ways in which students and teachers needed support and training. In other words, the school came to realize that one device (or philosophy) does not fit all.

Tech To-Do: A Checklist for Selecting New Technology for Your School or Classroom

1. Start a technology committee.
   a. A school- or district-level committee should include administrators, technology personnel, teachers representing all disciplines, and parents.
   b. A classroom- or grade-level committee should include colleagues, students, parents, and individuals who are good at making choices within constraints (e.g. librarians).
2. Create a vision for technology use.
   a. Set priorities focused on students' needs, curricular goals, and instructional goals.
3. Build a plan for technology integration.
   a. Include an inventory of current equipment, a description of needs, actions, and recommendations.
4. Figure out what to buy.
   a. Focus on the vision.
   b. Conduct research on various products by reading consumer reviews and talking to other schools or teachers.
   c. Consult with the right personnel; rely on people who understand instructional goals and technology tools.
   d. Conduct a cost/benefit analysis.
   e. Exercise patience. Technology changes daily. Schools and classrooms are not the target audience of these new trends. Therefore, engage in a thoughtful process before purchasing. Remember, home devices (such as phones) are not necessarily school devices, so choose carefully.
5. Assess outcomes.
   a. Use surveys, focus groups, and individual interviews with stakeholders—the administrators, teachers, the students, and the parents.
   b. Engage in a continuous cycle of review of user feedback and student outcomes to determine success and areas to improve.

Figure 3. Process for technology decision making.

For decades, school technology and integration specialists have proclaimed a consistent demand for curricular goals to dictate technology and digital initiatives. However, the rapid pace of technological development, the pervasive use of personal devices, and the lower costs of BYOD initiatives have led to changes in practice and corresponding shifts relative to the relationship between curriculum and technology. Accordingly, instructional spaces are often constrained by technological factors and innovation is bounded by the possibilities of digital devices rather than a teacher's imagination.

The rapid pace of technological development, the pervasive use of personal devices, and the lower costs of BYOD initiatives are tempting. However, when these informed individuals worked through a thoughtful decision-making model, their selections provided the consistency and access necessary to establish the groundwork for a new learning ecology, ensuring that innovation is bounded by a teacher's imagination, not the digital devices.

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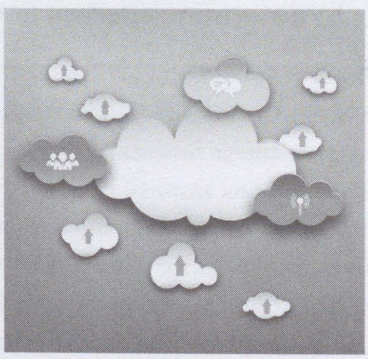


Glossary

1:1 Initiatives—a policy in which every student has a laptop or tablet and all students have the same type and brand of device.

Adoption Diffusion—the ways in which a school adopts communication technologies and distributes those technologies to teachers and students within the system.

BYOD—an acronym for Bring Your Own Device. BYOD is a common policy in which schools allow students to use their personal devices in school.

Capital Expense—the need to determine if the school is spending sufficient money on fixed assets to maintain operations. Capital expenses can be tracked on a trend line.

Cloud Computing—a term used to describe the practice of storing information or data on an Internet-based network rather than storing the information on a local, personal computer.

Collab Lab—a shortened form of Collaboration Lab. These are spaces designed for collaboration using flexible seating, various tools and technology, and other features that support small and large group work.

Commoditization Curve—the lifespan of new technology, from innovative and expensive to common and cheap.

Digital Divide—the social, economic, and learning gap between those who have access to the internet and digital tools and those who have limited or no access to information and communication technologies.

New Learning Ecology—an orientation toward technology integration that is less focused on the device and more focused on the habitat in which technology is used. A new learning ecology focuses on behaviors, processes, and strategies that are embedded in learning communities and human interactions (Brown, 2000).

New Media Literacies—the core cultural competencies and social skills that young people need in our new media landscape (Jenkins, Purushotma, Weigel, Clinton, & Robison, 2009).

Notability—a notetaking and sketching app for the iPad.

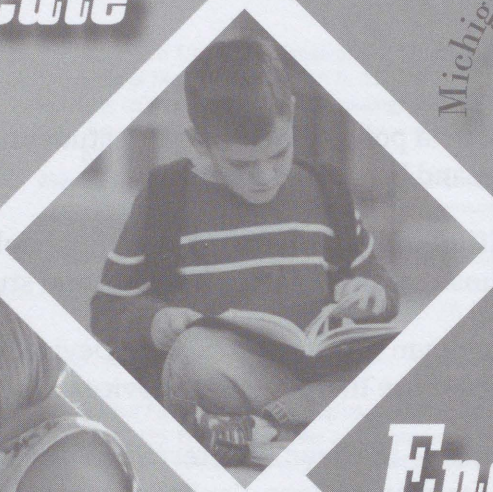
iCloud— cloud computing on a device created by Apple Inc.

ICT—an acronym for Information and Communication Technologies, a term that includes hardware, software, middleware, network storage, etcetera.

iOS—an acronym that represents an Operating System manufactured by Apple Inc.

Proprietary Technologies—software and hardware that uses confidential coding or technical information that limits other company's abilities to manufacture the same type of product, creating a competitive advantage.

Educate



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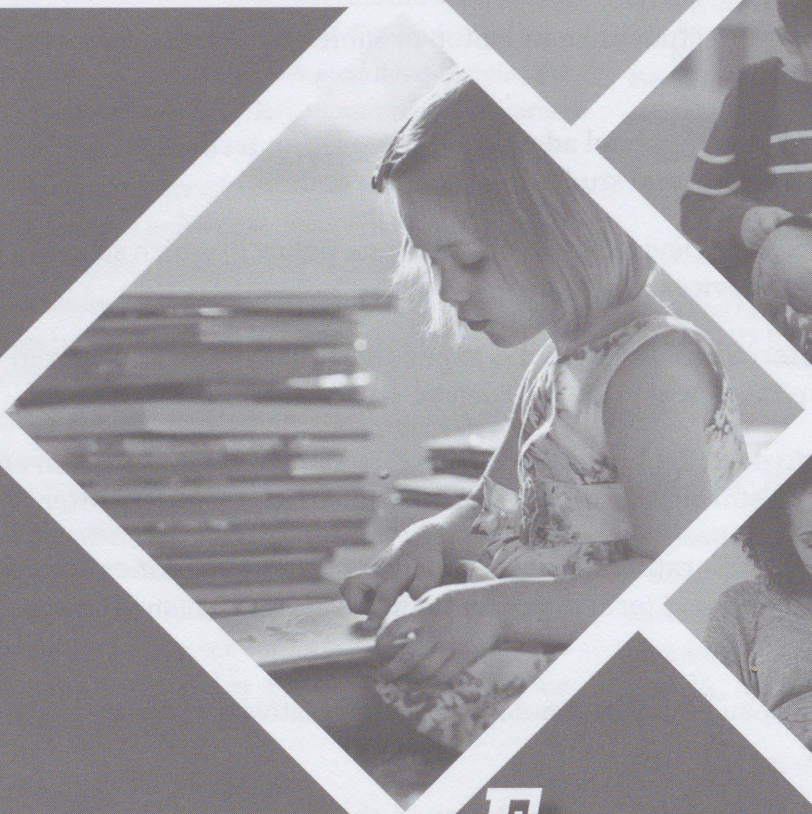

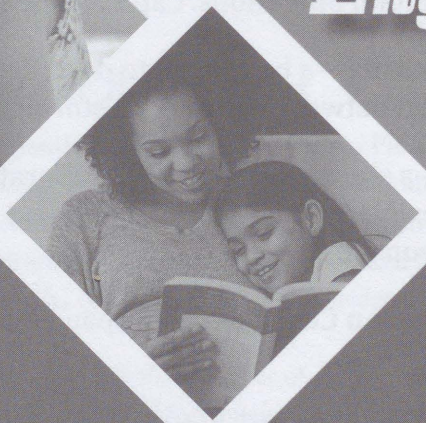

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