Digital Teaching and Learning: Technology-Empowered Pedagogy in American Education

Dr. Sarah K. Anderson, Ph.D.

Mayville State University, USA

Abstract

This research involved a collected case study of use of technology and digital tools by practitioners in an upper-Midwest, American, education cooperative in the areas identified by International Society for Technology in Education (ISTE). This included the knowledge and skills to: (1) facilitate and inspire student learning and creativity, (2) design and develop digital age learning experiences and assessments, (3) model digital age work and learning, (4) promote and model digital citizenship and responsibility, and (5) engage in professional growth and leadership (ISTE, 2014). Exemplars for technology-based pedagogy are described in relation to the ISTE framework and an appendix included for application to practice. Analysis results indicated technology use across all standards and in the format of substitution, augmentation, modification and transformation of teaching. Emergent themes included teacher choice and redefining possibilities through access to devices and technology-rich learning experiences.

Keywords: digital learning, ISTE Standards, teaching with technology

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The proliferation of digital devices and access has inspired a new fear, nomophobia, the fear of being without one's electronic device. There is no doubt, technologies have systemically transformed the way people communicate, educators teach and how students learn in an interconnected culture. Never before has access to information been so wide-spread, and today's learners are flourishing in it. The Pew Research Center found in 2012 that 93% of teens had a computer at home, and 37% had their own smart phone (Madden, Lenhart, Duggan, Cortesi & Gasser, 2013). In a 2014 survey by Pearson on student mobile devices, 75% of high school respondents regularly used cell phones; in addition, 71% of elementary students, 67% of middle school students, and 56% of high school students wanted to use mobile devices more in their classrooms (Pearson, 2014). The power of access benefits students who readily embrace technology. Yet, educators often fall on one side of the digital divide of embrace or reject; both often demonstrate the mistaken emphasis on the presence of technology to carry out the same-old curriculum instead of "why" and "how" technology can transform curriculum or pedagogy (Pahomov, 2014, p. 3).

Technology has changed the most important school factor impacting student outcomes, the effectiveness of the teacher; teacher effectiveness is paramount for positive student outcomes. According to Marzano, Pickering, and Pollock (2001), students in classrooms with the most effective teachers gain about 52 percentile points in their achievement while students with the least effective gained only 14 percentile points (p. 2). Nye, Konstantopoulos and Hedges (2004) findings indicated a student whose teacher is in the 75th percentile in terms of pedagogical competence will outperform a student with a 25th percentile teacher by 14 percentile points in reading and 18 in math. This makes finding/hiring an effective, technology-using teacher critical.

Districts are now using digital tools to gauge teacher potential effectiveness through hiring assessments such as the TeacherInsight Assessment by Gallup. Interview candidates answer questions about philosophy, relationships and instructional approaches, their answers are compared to high-quality teacher responses, and percentile ranking is calculated for predicted potential teaching success. Clearly an effective teacher makes a significant difference in student achievement. Todays' effective teacher is one who embraces technology on behalf of rigorous learning, one who looks at technology not as an end in itself, but towards technology "as a medium for all kinds of learning" (Pahomov, 2014, p. 3).

Technology creates student engagement and learning environments,connecting content with students' interests. It can link students with experts, tutors and peers to extend learning. Technology can function as an equalizer in providing quality education as access is gained by more and more students, and as such, teachers must be able to support students in gaining access to technological benefits. Technology can shift emphasis from content to transfer of skills, allow for constant engagement, increase the student voice, create relevancy by bringing the outside world in, and simplify the work of managing a classroom (Pahomov, 2014). Everyone presently in a teaching role must model and apply technology standards as they design, implement and assess learning experiences. If, "the essence of technology is rapid change" (Council for the Accreditation of Educator Preparation [CAEP], 2013, p. 22), what are teachers currently doing with technology? To examine such a variable and far-reaching topic, this paper is focused on a detailed description of a selected case study to explain how teachers in a defined educational cooperative are using technology to enrich teaching and learning.

The Case Study

The case study approach was chosen to explore interrelationships between technological and educational practices of teachers in a regional upper-Midwest, American, education cooperative. An in-depth understanding of bounded, identifiable cases was desired (Creswell, 2007). The cooperative is a voluntary, state-funded, concerted approach for school districts to utilize resources and meet the needs of students, staff, and communities more efficiently and effectively. It is representative of 20 school districts, nearly 13,000 students and 1300 teachers. The cooperative was selected through purposeful sampling; it demonstrated a perspective of teaching with technology set within a defined context, and with enough information present to portray an in-depth picture of current technology use.

The entire case was guided by the five-standard framework of ISTE, the International Society for Technology in Education (2014). The standards are the system of concepts, assumptions, expectations, beliefs and theories (Maxwell, 2005, p. 33) of what teachers should know and be able to do related to technology. The standards include the knowledge and skills to: (1) facilitate and inspire student learning and creativity, (2) design and develop digital age learning experiences and assessments, (3) model digital age work and learning, (4) promote and model digital citizenship and responsibility, and (5) engage in professional growth and leadership (ISTE, 2014). The ISTE standards explain what the case study research examined: the technology utilization of teachers in the selected education cooperative.

Data collection for this case study included interviews, documents, archival records, direct observation, participant-observations, and physical artifacts, which coincides with Yin's (2003) recommendation of drawing on multiple sources of information. Interviews included two district superintendents, school principals, teacher leaders, and the cooperative's coordinator.

Documents, artifacts and archival records include calendars of professional learning (PL) opportunities, handouts from PL, the professional learning community document archive, teacher-made technology examples, teacher websites, and state media and technology standards. Direct observation was conducted through non-intrusive classroom observation and informal school building visits. Participant-observation was gained through both leading and taking part in cooperative PL sessions and conferences. Appendix A includes a list of digital tools included in the data and described in the narrative (indicated in bold).

Holistic data analysis occurred across all cases using the four-stage framework of Morse (1994). Comprehending the data occurred during collection through pre-established codes of the ISTE standards. Examples of technology use were open coded into the standard they illustrated. Many examples represent multiple uses and were coding according to teacher utilization. This caused enough data to be gathered in order to write a detailed, coherent and rich description (Houghton, Murphy, Shaw & Casey, 2015, p. 10) of the bounded education cooperative case. Data was then synthesized from the multiple sources and reorganized according to patterns within the standards. Theorizing occurred to examine the relationship among the data and tie them together into ISTE concepts (Miles & Huberman, 1994). Finally, the development of cross-case exemplars of technology, themes and interrelationships that capture the nature of technology use in teaching occurred during recontextualizing. This coherent set of themes and relationships of digital teaching and learning are useful for both understanding the subject and application to improve practice.

Using Technology to Inspire Learning and Creativity

According to ISTE standard one (2014), teachers are to facilitate experiences that advance student learning, creativity, and innovation in both face-to-face and virtual environments. School

districts in the educational cooperative most often pursue one-to-one student device initiatives to leverage learning. Research has confirmed progress in academics and student, parent and teacher relationships with such initiatives (Warschauer & Tate, 2015). Local schools have chosen **Chromebooks** or other similar netbook computers for secondary students. For elementary-age students, **Ipads** or other surface-style, tablet devices are most often adopted. These devices utilize touch-screen interfaces which work well with younger children and for individuals with disabilities (p. 61). The third option, the **Bring Your Own Device** or BYOD choice, a lower cost but less reliable option for schools, requires schools to provide devices when parents do not have the means to do so. BYOD options included the use of hand-held devices and cell/smart phones.

With devices available and in use, schools in the cooperative are taking advantage of connectivity. Some even hold virtual school for days when teachers or students cannot get to school (i.e., snow days) (Dobo, 2014). With the utilization of **Google for Education** as a common productivity tool and learning management system, digital classrooms are already established for online lessons and flipped lecture models. Many districts are "Google Schools", that is they have purchased the Google for Education suite of applications to facilitate innovative student learning experiences; the suite includes:

- Google classroom – a learning management system and interactive classroom
- Google hangout – live video conferencing
- Gmail – common email provider
- Google calendar – common calendar system for events, synced with Gmail
- Google drive – cloud-based storage for files
- Google docs – word processing with added editing and collaboration features
- Google forms – a surveying tool to collect and analyze information

- Google sheets – spreadsheets with editing and collaborative features
- Google slides – for creating presentations
- Google sites – website builder

These tools paired with one-to-one student access through multiple devices have allowed teachers to create "connected learning" options, a blend of online networks and tools and in-classroom and out-of-school learning (CAEP, 2013, p. 22).

Teachers have engagd students in exploring issues using various digital tools and resources. Examples include website resources from **Open Library**, the **Library of Congress**, the **U.S. Smithsonian Institute**, **TED: Ideas worth spreading**, **National Geographic**, **PBS Learning Media** the **American Association for the Advancement of Science**, and **Made from History**. Rich Site Summary (RSS – sometimes called Really Simple Syndication) web feeds are utilized for accessing frequently updated information, such as blog entries, news headlines, audio, video from leading news sources (e.g., Reuters, BBC or CNN).

Teachers are also using digital workspace tools to facilitate innovative and collaborative learning experiences. Students and teachers both use **Evernote** to take notes, track tasks, save items found online, clip web articles, capture handwritten notes, and collect photos. Evernote has also allowed users to communicate, collaborate, and share in real-time. **Diigo** is a research and knowledge management tool teachers and students have used to bookmark and tag webpages, highlight the webpage and attach virtual "sticky notes". The **ClassPortal** is another way of using a blog or website to promote deep inquiry by creating an online space to inquire about a specific topic or question. They use digital tools to fuel a shared interest and allow for an enduring pursuit of atopic (March, n.d), such as a ClassPortal inquiry into child slave labor created by high school students. The specific utilization of an online platform (e.g., **WordPress**) to create a

ClassPortal takes advantage of readily accessible information and the ability to participate with others from around the world to engage in critical thinking, collaborative team work, problem-solving, learning-to-learn, differentiated instruction, and content master (March, n.d.).

BoomWriter, a Google Education partner, is used for collaborative story writing (including vocabulary building), **HSTRY** is used to create interactive timelines and promote collaboration and engagement in the classroom, and **lino** is used to post memos, to-do lists, ideas, and photos anywhere on an online web canvas. Similarly, educators are using **Stormboard** and **Stoodle** as real-time sticky note/virtual whiteboards, to brainstorm, organize, and prioritize ideas with others. **Thinglink** is a digital tool teachers have used to turn images into interactive graphics with "hot spots" on specific parts of the image to launch multimedia. **Zaption**, an interactive video platform, allows teachers to turn videos into interactive experiences by adding images, text, and questions to existing online or personal videos. Teachers also use **Google Lit Trips** to create engaging and relevant literary experiences for students. In a 3-dimensional way, readers are placed "inside the story" by marking the happenings of characters on the surface of Google Earth. At each location along the character's journey, there are "placemarks" containing resources such as media, discussion starters, and links to supplementary information about real world references made in the story.

Digital tools also offer innovative alternatives for students to demonstrate what they know. Students in classrooms of the education cooperative use presentation options such as **Prezi**, **ShowMe**, **SoundCloud**, **Shadow Puppet Edu**, **Seesaw**, **Animoto**, **Replay**, and **Explain Everything**. Additionally, teachers and students use **Aurasma** augmented reality to change images, objects, and places into interactive experiences through graphics, animation, video, audio, and 3D content. A specific classroom example is to attach video book talks to the cover

images of the book using augmented reality functions. A further option for demonstrating learning is **Notability**; students combine handwriting, images and typing in a digital note-taking format, but can also receive linked verbal and written comments.

These are some of the methods teachers in this case study use digital tools to advance student creativity. Using these methods engages learners in all of the ISTE standards for students: 1) Creativity and innovation, 2) Communication and collaboration, 3) Research and information fluency, 4) Critical thinking, problem solving and decision making, 5) Digital citizenship, and 6) Technology operations and concepts (ISTE, 2014). Many options used to inspire learning also serve the purpose of creating experiences that meet all learners' needs. They reduce barriers, add flexibility, and optimize levels of challenge and support reflected in quality teaching.

Aligning Digital Experiences with Learning Goals

According to ISTE standard two (2014), teachers are to design, develop, and evaluate authentic learning experiences and assessments. They are to incorporate contemporary tools and resources to maximize content learning in a context and technology-enriched environment in order to develop the knowledge, skills, and attitudes of their students. Many of the tools to inspire creativity also support teachers to address this goal.

The foundation of designing digital learning experiences for teachers in this study begins with setting and communicating learning goals, defining what students will know or be able to do. This is established in the comprehensive framework for effective instruction all districts in the cooperative follow, *The Art and Science of Teaching* (Marzano, 2007). The framework is articulated in the form of ten design questions, the first of which includes, "What will I do to establish and communicate learning goals…?" (p. 7). Focusing on learning goals by identifying

desired results first, and then designing technology-rich learning experiences, keeps the focus on the end result, not the technology itself. This is backwards design defined (Wiggins & McTighe, 2005). A clear vision of desired results shapes teacher choice of methods and materials (p. 14).

Teachers in this study are required to have daily learning goals planned, visible and articulated; this keeps the emphasis on learning targets, which are often inclusive, even if not explicitly, of digital objectives. Teachers employ technology to teach using research-based instructional methods that affect student achievement. For teachers in this study, in the context of the *Art & Science* framework (Marzano, 2007), these learning experiences include those proven to positively effect percentile point gains on student achievement tests (Marzano, Pickering, & Pollock, 2001): identifying similarities and differences (45% gain), summarizing and note-taking (34%), reinforcing effort and providing recognition (29%), assigning homework and providing practice (28%), nonlinguistic representation (27%), cooperative learning (27%), setting objectives and providing feedback (23%), generating and testing hypotheses (23%), and cues, questions and advanced organizers (22%). Choice of technology use is guided by the ability of the tool to carry out these effective strategies and engage students in a variety of levels of cognitive work (Bloom, 1956) during the learning experience.

Educators are also innovating their classrooms through **Gamification**, the application of game mechanics and design to the classroom to engage and motivate students. To do so, teachers are making progress monitoring towards learning goals visible, adding player control (i.e., student choice), providing immediate feedback-often through digital assessment tools, giving opportunities for collaborative problem solving, scaffolding learning through increasing levels of cognitive work, integrating a mastery learning approach (leveling up), and making sure students have a social connection. Teacher Chris Aviles demonstrated classroom Gamification of his New

Jersey classroom for teachers in the education cooperative during a summer Tech Day training opportunity conducted via Google hangout.

Using Technology to Differentiate Instruction

Teachers use digital tools to offer multiple means of learning information, multiple means of demonstrate learning and multiple means of engagement; this is universal design for learning (Turnbull, Turnbull, Wehmeyer, & Shogren, 2013, p. 35). Often one digital tool facilitates all three differentiation concepts, and many inspire creativity as well. This coincides with ISTE standard two (2014), which calls teachers to customize and personalize learning activities to address students' diverse learning styles, working strategies, and abilities using digital tools and resources; the teacher must be adept at providing, "effective options to fit instruction with differing student needs" (CAEP, 2013, p. 22).

To differentiate instruction for gifted students, in this case study teachers have accessed Massive Open Online Courses (MOOC's) hosted by institutions such as MIT and Harvard through **edX**. These courses, on a myriad of topics, are made available, without charge, to anyone, anywhere, anytime. Teachers have used them to extend the curriculum and allow for acceleration in an autonomous learner model. **Khan Academy** is used to deliver free micro-lectures and match students'own learning pace; it is used by teachers for both advanced students and those who need lessons re-taught. Online courses have also been used through Khan Academy. **E-books** are used by teachers to differentiate literacy instruction through features such as built in dictionaries, audio support, larger font, color contrasting, translation, note-taking tools, and text-to-speech options (Larson, 2015). **Subtext** has provided a place for teachers and students to have digital book discussions and interact with the text by adding questions, text, highlights to ebooks, websites and other texts (such as blogs). It is incorporated automatically

into district-level reading intervention programs such as **Accelerated Reader**. **Mindplay** virtual reading coach is an online reading program teachers also have used to improve literacy. Students with diverse skills and instructional needs are provided customized lesson plans; the student receives only the lessons required to fill in gaps in skills.

Interactive white boards, such as **Promethean**, are used by teachers to integrate student response into lessons, readily accommodate different learning styles, and create engaging, multisensory instruction**.** For written text, **Booktrack**, a reading "soundtrack", is used by teachers to increase comprehension and engagement through contextual sounds. By using **Newsela**, teachers have an entire class read the same current event article, but at a level right for each student. With archives of over 1000 articles, 5-reading levels, new articles every day and quizzes, students build reading comprehension with relevant nonfiction. Teachers also use **Google translate** to translate text and webpages for students who are English Language Learners and **Duolingo** is a blended language learning platform teachers have used to give students personalized instruction, feedback and practice in another language.

A math tool called **Desmos** is used by teachers as an online graphic calculator, and they also access the Desmos math inquiry activity repository; classes have used the repository to explore math topics such as statics and expressions in a more creative and applicable way. For example, the "Tile Pile" activity can be used to challenge students to develop ratio skills and the concept of proportionality by analyzing the work of others, making inferences and correcting errors. The **PhotoMath** app is used by teachers and student to solve mathematical problems. By using the camera of a mobile device, the app reads the problem and instantly displays the answer in real time. It is used for students to self-correct work or study. If a student is stuck on a problem, the steps button is used to see a full step-by-step solution; this allows for individualized, targeted support that one teacher has difficulty providing for every student.

Students are also using digital tools to express their learning in diverse ways (differentiating the product). Many teachers use student-selected media tools, such as **YouTube**, as a platform for creating a performance for differentiated assessment. **Vocaroo** is a way teachers record and share audio recordings. Students who struggle with writing express content learning verbally; teachers then access recorded answers and provide feedback in an auditory format. Likewise, **Voxer** is a group messaging tool teachers have used to combine voice, text, and photo messages to differentiate presentation of learning.

Technology is essentially the key to creating a differentiated classroom; individual learning variances are challenging to accommodate by one teacher, but technology can customize learning and instruction in accordance with student need. Digital tools can also be utilized to determine what those student needs are through timely and relevant assessment and data analysis

Using Technology to Collect Data and Assess

ISTE (2014) notes that a digital age teacher can formatively and summatively assess students' content and technology skills and use data to inform the teaching process. CAEP reaffirmed there are "powerful new forms of assessments with simulations, gaming, computer adaption and rapid scoring capabilities" (CAEP, 2013, p. 22). Teachers in this case study used a variety of tech-powered tools to do just this. A commonly used tool to collect formative assessment data, **Kahoot**, is a free, game-based pedagogy platform involving real-time feedback, which crosses language barriers, and encourages social learning. Teachers use the tool as a pre-test to measure prior knowledge, as a previewing strategy to stimulate interest in a lesson (i.e., anticipatory set), and also as a review game of knowledge and comprehension skills.

Another well-loved, free tool to visualize student understanding is **Socrative**. Teachers post questions to students during a class, assign quizzes, or use quick question polls, exit tickets and competitive quiz races to gather feedback about student learning. Socrative instantly grades, aggregates and provides visuals of results to help teachers make instructional decisions. **Poll Everywhere** is another live-class response system teachers use to increase student engagement and allow individual student responses. Another similar option is **Quizlet**, which includes online study tools such as flashcards, tests and study games with progress tracking. Teachers upload materials for students to access on their phones, tablets or computers.

Plickers is a student response alternative teachers use without the need for student devices. Teachers quickly check for understanding of big concepts and key skills by asking questions and scanning student response cards with a digital camera. Similar tools being used include **QuickKey**, **ZipGrade** and **GradeCam**. These real-time profiles of individual or group understanding assist teachers in personalizing learning, analyzing instruction and sequencing learning experiences.

Teachers are also using digital tools to formatively assess the "backchannel", similar to a side-conversation, in online interactive spaces that run parallel to spoken remarks. This involves collaborative conversations, parallel discussions, interactive notes, formative assessment, and allows even the quietest student a place to express themselves (Carpenter, 2015). **Padlet** is a backchannel platform teachers use for brainstorming, note-taking, allowing students to express their comments on a shared topic. It is essentially an online piece of paper, except users can add images, videos, documents, or text. Similar backchannel tools include **TodaysMeet**, **Chatzy**, **Ning**; all allow students to take notes together during teaching and include group note taking options.

Teachers also engage digital tools to collect data that informs learning and teaching, particularly in regards to skill acquisition in reading and writing. Many districts use the **Measures of Academic Progress (MAP)** assessment to measure student growth and learning needs and use the data to differentiate instruction. The computerized test is given at the beginning of each school year from grades 2-12; it includes reading, language usage and mathematics. Teachers work together in grade-level or subject-area groups to analyze data and to make decisions on curriculum and instructional improvement and for individual student learning plans.

In this case study, the most commonly used classroom tools for collecting data include **Dynamic Indicators of Basic Early Literacy (DIBLES)** and **AIMSweb**. DIBLES are a short series of assessments, which follow standardized procedures, and assess early literacy skills such as phonemic awareness, accuracy, fluency and comprehension, with the purpose of identifying students who need intervention and to monitor intervention effectiveness. The literacy and math screening tools and assessments are all research-based and available for download through the University of Oregon. The DIBLES Data System is used by schools and faculty in managing results through benchmarking, online scoring, and progress monitoring. AIMSweb is another online system for universal screening, progress monitoring, and data management used with students through grade 12. The system includes curriculum-based measures of reading and math, and also generates reports with actionable data for instructional decisions.

Elementary level teachers are using these systems for universal screenings of all students in the school at the beginning of the year, a check point quarterly or at mid-year, and at the end of the school year as a monitor of growth. Building-level support teams use data to identify students at risk, or those who are not meeting expected outcomes, and to track the impact of

interventions prior to referral for special education services. Special educators use these assessments and systems to monitor progress toward goals in intensive programs on a weekly or bi-weekly basis.

Intervention Central is another well-used source for tools to create assessments, charts to monitor student progress, and it also includes a database of research-based interventions. Teachers use the "featured tools" option to quickly generate probes of student learning for literacy and math. The website includes catalogued strategies, with sources, to help teachers respond to student's academic and behavioral needs. In the area of academic interventions for writing, for example, step-by-step instructions for six different research-based strategies are available.

When teachers engage in the ongoing process of data collection and analysis, they are able to modify instruction and learning tasks to match student skills or a group of students' needs. Differentiated tasks, based on data, allow all students to reach learning objectives and simultaneously improve the educational process. Using technology efficiently and effectively accomplishes this goal for teachers in this educational cooperative.

Digital Age Citizenship and Responsibility

According to CAEP, "Educators must know how to use technologies and how to guide learners to apply them… [and] should know why and how to help their students access and assess critically the quality and relevance of digital academic content" (p. 22). It is the teacher's responsibility to professionally model what work and learning should look like in a global and digital society (ISTE Standard 3); this includes transferring use of technology to new situations, collaborating and communicating in multiple digital media and formats, and doing so in ways that are culturally appropriate, safe, legal, and ethical. ISTE standard four requires teachers to,

"understand local and global societal issues and responsibilities in an evolving digital culture and exhibit legal and ethical behavior in their professional practices" (ISTE, 2014).

The Partnership for 21st Century Learning (2009) defines these skills collectively as information, media and technology literacy: the ability to effectively utilize digital options in an era of overabundance of rapidly-changing information and tools. Specifically, teachers must assist students in accessing quality information efficiently and effectively and chose the most appropriate expressions and interpretations in different environments to research, organize, evaluate and communicate. In general, teachers in this study modeled digital citizenship and responsibility through their own work related to learning experiences, instruction and assessment. They also collaborated with the school librarians, who explicitly taught digital citizenship skills.

In this case study, appropriate digital behavior is most often directly taught by a school librarian, who teaches information literacy, copyright and plagiarism, fair use laws, and internet safety. Teachers then informally model appropriate behaviors and establish classroom activities and performance assessments that allow student to demonstrate these skills. However, assessment of these skills is not typically conducted in a formal way outside of language arts classes. One mode of direct instruction used in schools is the **iSAFE curriculum**. The content includes responsibility and safety issues related to online use, such as when to give out personal information or display frustration or anger online or checking for the security codes when ordering products. It also includes ways predators interact with students, and how the accumulation of small bits of information can result in unexpected identification of an individual. The program follows **ISTE digital citizenship standards**, which include the following nine actions: (1) Advocates for equal digital rights and access for all; (2) Treats others with respect in

online spaces and never cyberbullies; (3) Does not steal or damage others' digital work, identity or property; (4) Makes appropriate decisions when communicating through a variety of digital channels; (5) Uses digital tools to advance their learning and keeps up with changing technologies; (6) Makes responsible online purchasing decisions and protects their payment information; (7) Upholds basic human rights in all digital forums, (8) Protects personal information from outside forces that might cause harm; (9) Proactively limits health risks of technology, from physical to psychological (ISTE, 2014).

One particular way teachers provide learners with a way to use these digital citizenship skills is through **Skype** in the classroom features. Through Skype, classes have taken virtual field trips, played the global guessing game "Mystery Skype" to learn about geography, culture and how people live in other places, or talked with registered guest speaker from around the world. It provides students with a chance to practice online etiquette in a global platform. As a final example, teachers are beginning to focus on sharing student work, which, as a global citizen, requires a different way of expressing learning than previously conceived. One option utilizing the **Book Creator** app allows students to write a collaborative book authored by educators and students from around the world and present their learning.

Teachers frequently use digital tools to safely collaborate and communicate in ways that also increase their own productivity and efficiency. One digital communication tool, **Remind**, is used by teachers to easily and safely send texts or voice messages to parents or students in a way that keeps all phone numbers private, even when sending to an entire class. Other features include chats and one-way announcements. Teachers use Remind when communication needs to occur outside school hours, when activities are changed or canceled, and in particular for extracurricular activities such as sports and music. Some teachers are also choosing to use

Edmodo, a blended learning platform that allows students, parents and teachers to share content and documents, access homework, conduct online voting, and view school notices; it functions similarly to a social media, but in a closed and protected environment. It functions as **Google Classroom** does in the Google for Education suite of applications; for schools without Google for Education, this is an often chosen option.

A frequently used tool of primary level teachers in particular is **Class Dojo**, a classroom behavior management and communication tool. Student profiles are represented by self-created, monster-like avatars; teacher then give positive and negative points (dojos) during the week through their computer, tablet or smart phone. Parents receive weekly updates and class photos, check behavior points at any time, and send and receive messages with the teacher.

To meet this standard of digital citizenship, educator's and other school professionals, model, and teach safe, legal, and ethical use of information and technology, model etiquette and responsible social interactions, provide equitable access to technology to all learners, and do so in a way that develops cultural understanding and global awareness.

Professional Growth & Leadership

If teachers must know "how to use digital and interactive technologies for efficiently and effectively achieving specific learning goals" (CAEP, 2013, p. 22), then they need to start somewhere-preferably somewhere manageable. And just like their students, teachers' levels of proficiency related to technology differ greatly, which is why the ISTE standards call for engagement in professional growth. Standard five states (ISTE, 2014) teachers should continuously improve their use of digital tools and resources, participate in collaborative exploration of tech applications, demonstrate leadership in infusing research-based technologies, and contribute to the effectiveness of the profession.

In this case study, teachers have been challenged to create their own personal learning networks for sharing and discovery by **EduTechND**, learning specialist who focus on improving the educational process through technology. This challenge includes leveraging the power of social media, such as **Facebook**, **Twitter, Pinterest** and **Instagram** to follow the work of individuals and organizations that can provide teachers with resources. Teachers are following local and national IT coordinators, teachers, principals, industry specialists and universities. EduTech itself leads #EdChat live via Twitter weekly across states; teachers engage in a chat session focused on a particular discussion topic and share resources and tips with each other. Another well-used resource includes the facebook page, blog and twitter feed **Free Tech for Teachers**. Teachers access weekly blog posts with ideas on how to use a variety of digital tools in their classroom and a critique of their usefulness in an actual classroom.

Teachers are also using **YouTube Crash Course**, **Google communities** and **TED Ed** videos and podcasts for their own learning. Additionally, **Teach for Google** offers a library of short courses, strategies, instruction in best practices and training for the use of Google apps for education. As a more formal option, the education cooperative also provides professional development for continuing education through the state **Teacher Center Network**. The network includes nine Teacher Centers across the state, two of which are located in the cooperative region. Teachers are accessing staff development programs, resource materials, distance learning, graduate credit classes, workshops on various topics teacher exchange/visitation, curriculum enhancement, technology, and guest speakers, all of which provide options for professional learning.

Another well-used source for professional growth is the website of the **IRIS Center**, a U.S. Department of Education (DOE) Office of Special Education center situated at Vanderbilt

and Claremont Universities. Their charge is supporting the preparation of educators to improve outcomes for students with disabilities. Teachers access resources, research, and self-paced, online training modules, case studies, activities, and video vignettes, along with options for earning a certificate for professional development hours. Another DOE sponsored organization, the Institute for Education Sciences, runs the **Regional Educational Laboratory Program** (REL). Ten RELs serve constituents by bringing up to date research and proven practices into school improvement efforts. For schools in this education cooperative, REL Central: Marzano Research located in Denver, Colorado is the provider of applied research, development, dissemination, and training and technical assistance. One exemplary district in this case study has partnered with Marzano Research to become a high reliability school, defined as one in which all students learn the content and skills they need for success in college, careers, and beyond. Professional development, training, and school improvement efforts are structured around this framework and supported by the REL in both digital and traditional learning formats.

Teachers also access resources for professional growth through the global organization ASCD, the **Association for Supervision and Curriculum Development**. Members keep current in their field through the monthly journal, *Educational Leadership,* online resources, books and publications, online and blended professional development sessions, and daily briefs delivered directly to email. Educational leaders such as the education cooperative director, district principals, superintendents and instructional coaches also work with **Learning Forward** to advance professional practice. This most often takes the form of an annual state conference, but other opportunities such as online courses and webinars are also offered for collaborative professional learning.

Through these formats, teachers in this exemplar continuously improve professional practice and model lifelong learning habits to their students. Personal learning networks connect educators across states and around the world, and contribute to the effectiveness, vitality, and growth of teachers in this cooperative. This results in the end goal of improved student learning.

Discussion of Case-Based Themes

Through data collection and analysis, key words and processes generated related themes of teacher technology use. These include the overall observations of choices and redefining possibilities. This case study, while limited to a particular education cooperative, is revealing in that it recognizes the reality of teachers working within a digitally-infused local, national and global context.

Choices

Since "the essence of technology is rapid change" (CAEP, 2013, p. 22), teachers are challenged to constantly remain current, but not simply because, "it is fashionable or progressive to say and do such things" (Wiggins & McTighe, 2011, p. 104). Teaching with technology can be overwhelming in regards to access, choices and professional learning options. Guidance in choosing which digital tools are worth using and important to model is most certainly needed. Teachers in this study used multiple platforms for the same function. For example, a power point to accompany a lecture was replaced with a Prezi or Keynote, or the backchannel monitored through Padlet, TodaysMeet, Chatzy, or Ning. With in-depth knowledge of a few tools, fundamentally changing pedagogy through digital learning experiences may occur more quickly; this mimics the consistent mantra of depth versus breath. In an environment of too many options, McTighe and March (2015) recommended teachers, "use a few high-leverage digital tools to enhance acquisition, meaning making, and transfer goals" (p. 36). Being really good at using a

small collection of favorite tools to accomplish most tasks will make a teacher effective at leveraging technology. Ferlazzo (2015), provided criteria to guide teachers in choosing tech tools for classroom use. The tool: (1)"Will add value to my students' learning experiences-a value that's not available through using less techy resources or methods", (2)"Will be easily used by my students-and by me-within two minutes of "playing around" with it", and (3)"Is available free or at a very low cost" (p. 67). A further consideration may also ask, does it allow student to pursue their own interests?

For teachers just starting to blend technology into their classrooms, Tucker (2013) also offered a few suggestions. First, find a "gateway" technology; discover a piece of technology that helps answer a persistent problem in the classroom and learn to use it really well (p. 57). Also, try weaving student-centered activities in class with work completed online. Daccord and Reich (2015) recommended teachers view technological professional learning in two categories, "someday" and "Monday" (p. 23). Monday experiences provide teachers with small steps they can try in the classroom right away. Someday professional learning requires a deeper commitment to change, substantial planning and research in order to transform teaching and learning. Both are needed to help educators design, develop, and infuse digital learning to impact student achievement.

The digital reconceptualization of Blooms Taxonomy (1956) supports teachers to infuse technology in a way the remains true to learning goals and levels of cognitive work. Blooms original taxonomy defined levels of intellectual behavior and served to promote use of higher forms of thinking; taxonomy action verbs identify measurable results related to knowledge, comprehension, application, analysis, synthesis and evaluation. Blooms Digital Taxonomy (Churches, 2007) expands the original to include sharing as a supplementary higher order skill

and adds functional levels of technology use with examples of digital tools and activities. This expanded framework may serve to assist teachers in choosing technology integration in a way that supports their already defined planning process. As Wiggins & McTighe (2011) stated about backwards design, "If your goal is student understanding and transfer, then you need to employ instructional methods aligned with these goals" (p. 104). Likewise, if the goal is to create responsible digital citizens who acquire desired results, make meaning and transfer learning in the future, then teachers must employ digital age learning methods and resources aligned with these goals. Prensky (2013) reminds educators that technology isn't about 'stuff', it's actually about a new way of thinking that keeps learning first, learning defined by a desire to learn more.

Redefining Possibilities

Within this case study, access to a digital device in the school is essentially a non-issue. Students have access to a variety of devices and can often choose which type of device with which to interface, as do teachers. A Project Tomorrow survey found 78% of middle school students surveyed check their grades with their cell phone, 69% use it for taking notes, 64% use it to access online textbooks, 56% use it to help complete papers and do homework, and 47% state it helps them learn about school activities (Nielsen & Webb, 2015, p. 70). As Richardson (2013) stated, there is "near ubiquitous courses and coursework, with teachers, tutors and technologies that let learners of any age learn whatever they want, whenever and wherever they desire" (p. 10). However, in a BYOD model, equity of devices and capacities does remain a barrier to improved access. Teachers must consider their assignments in relation to home internet connection. For learners with no online connection in the home, educators need to plan outside of school assignments which do not require connectivity. But teachers must also work with

students to raise awareness of what technology and access is available to them and to help them find ways to get connected.

With devices in students' hands, access has shifted from considering the device and online connectivity, to accessing technology-rich learning experiences. This is a pedagogical challenge because technology has changed everything schools have been; with an abundance of content, knowledge, and educators available outside the school walls, teachers cannot limit learning to a set of standards within the walls. The reality remains that the current educational system was not necessarily built for the deep, passionate learning computers and access elicit. Yet, to prepare students for life and work in a society permeated with technology, they need practice working this way in school (Krist, 2013).

Technology-rich learning experiences are "more than just vehicles for delivering the traditional curriculum more effectively" (Richardson, 2013, p. 12), they address the needs of learners in novel ways. Experiences should be truly participatory in real-world contexts, connected with learners outside the individual school, and involve conversation, creation and publication of genuine, meaningful and beautiful work (p. 12). There should be a shift from teacher to student control and from forced to authentic sharing of outcomes. Often this takes shape as digitally enriched problem-based learning or an inquiry model; students develop feasible and creative solutions to real-world challenges, and present solutions to an audience beyond the classroom. Transferability of skills across disciplines and integration of 21st Century Themes (i.e., global awareness, entrepreneurial literacy, civic literacy, health literacy and environmental literacy) is a hallmark of this kind of work (Partnership for 21st Century Learning, 2009). Digital tools currently used in this case study demonstrate teachers are prepared to make this next jump to more effective design of learning experiences. As Marzano (2007)

stated, “effective teaching is a dynamic mixture of expertise in a vast array of instructional strategies combined with a profound understanding of effect.” (p. 5). Proficiency in digital tools has started to change teaching; now enhanced pedagogy is poised to positively effect student access to higher-quality learning experiences.

In his research on effective pedagogy, Marzano (2007) identified three highly interdependent components: use of effective instructional strategies, use of effective management strategies, and use of effective classroom curriculum design strategies. Essentially teachers in this case study are using technology, to varying extents, in all of these areas, and use in one most certainly impacts the other. Therefore, teaching practices should look decided different with technology, and in this case study, they mostly do not. Often the difficulty in doing so is teacher proficiency with the tools of technology, but there are pockets of excellence and professional learning communities in which teachers find support and encouragement to try new things.

According to CAEP (2013), current possibilities for digital learning are “insufficiently exploited” (p. 22). In this case study, a context to define current practice and identify desired improvement is useful. Puentedura (2009) framed this progression of changing pedagogy of digital teaching in the SAMR model of technology integration. First, teachers enhance their practice by *substituting* tools directly with no functional change or *augmenting* practices with technology. Then, teachers transform instruction through *modifying* student tasks/products, and *redefining*/reinventing learning through creation of new practices.

In this case study, teachers are working within all levels of the SAMR framework. They are certainly enhancing their pedagogy through substitution and augmentation. For example, using an ebook instead of a hard-copy version of a book, and using Subtext to highlight and

annotate instead of highlighters and underlining. Another example is using an interactive white board for projection only. Augmentation, or improvement of tasks, was documented through the use of Google for Education applications to share and submit classwork, and utilizing open resource databases for research. Task redesign, modification, was evident in the use of collaborative writing/creation tools, and visually/media enhanced products. Most often, redefined teaching included project-based learning with added real-life application. It involved students and teachers being the creator, not just the user. This was evident through concepts such as gamifiction and the class portal, augmented reality, backchannel tracking, and integration of massive open online courses to differentiate. These options were not previously possible without technology advancements and demonstrate redefinition of teaching.

Teachers might further their integration process at the transformational level by accessing resources of the Partnership for 21st Century Learning. The Partnership developed a series of digital literacy maps illustrating the intersection possible between these skills and core academic subjects including English, mathematics, science and social studies and. The maps provide concrete examples of how digital literacy can be integrated into effective teaching by subject area. Educators can also access 21st Century Skills Maps for specific content areas and project management for learning along with illustrations from exemplar schools.

Another option to encourage movement towards transformation is to explicitly observe, assess and provide feedback to teachers on their methods related to technology. ISTE provides a free classroom observation rubric, downloaded from their website, to record aspects of integration. These various aspects examine the teacher' role during instruction (facilitator versus lecturer), activities in which students are engaged (such as discussions or watching presentations), and the kinds of technologies that were used. The rubric offers a list of 28 tools to

record use of, and allows the observer to evaluate whether the technology was essential or not needed in the lesson, and also if the activities helped students to meet ISTE standards for students. This work is a process that allows best practices to drive significant technology use in the classroom.

Conclusion

So where are teachers in the process of empowering their pedagogy with technology? In this case study, teachers use many digital tools for substitution of current materials and to augment a task by improving it with technology. Teachers overall have demonstrated some steps towards curriculum redesign with a desire for new, innovative performance tasks that require transfer. They understand pedagogy needs to be effective; they have a desire to modify or redefine their methods, to make education the vehicle for social progress, well-being, and impartiality that many aspire for it to be. A recommendation for future research is to conduct a qualitative inquiry using individual interviews and focus groups to query teachers further about the implications of technology on their teaching. Further, an analysis of classroom observations using the ISTE classroom observation rubric could yield more in-depth results on teaching effectiveness and student outcomes.

In their recent research, Levin and Schrum (2013) identified commonalities among districts exemplifying learned-centered technology integration. These include: clear vision of technology integration, strong and distributed leadership, curriculum revision to promote 21st century skills, ongoing differentiated professional learning, focus on a collaborative school culture, sustainable funding sources, good tech support, and strong partnerships with families, universities and community businesses (p. 53). Schools may further progress towards a culture of technology-rich teaching by self-evaluating and attending to these key components. McTighe

and March (2015) asked, "…is more technology the answer? Will the newest digital tool really show us the way?" (p. 36). Even though it underlies everything we do, technology is positively the means, not the end, to learning. Students need to do the thinking and teachers the effective teaching.

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Appendix A

Frequently Used Online Resources

Using Technology to Inspire Learning and Creativity

- Google for Education https://www.google.com/edu/
- Open Library https://openlibrary.org/
- Library of Congress www.loc.gov
- U.S. Smithsonian Institute www.si.edu
- TED: Ideas worth spreading www.ted.com
- National Geographic www.environment.nationalgeographic.com
- PBS Learning Media http://www.pbslearningmedia.org/
- American Association for the Advancement of Science http://sciencenetlinks.com
- Made from History http://madefrom.com/history/referenced/last-100-years/
- Evernote www.evernote.com
- Diigo www.diigo.com
- ClassPortal http://tommarch.com/strategies/classportals/ and http://ihscslnews.org/
- WordPress www.wordpress.com
- BoomWriter www.boomwriter.com/
- HSTRY www.hstry.co/
- lino http://en.linoit.com/
- Stormboard www.stormboard.com/
- Stoodle www.stoodle.ck12.org/
- Thinglink www.thinglink.com/
- Zaption www.zaption.com/
- Google Lit Trips http://www.googlelittrips.com/GoogleLit/Home.html
- Prezi www.prezi.com
- ShowMe www.showme.com
- SoundCloud www.soundcloud.com
- Shadow Puppet Edu www.get-puppet.co
- Seesaw www.seesaw.me
- Animoto www.Animoto.com
- Replay www.replayapp.com
- Explain Everything www.morriscooke.com.applications-ios/explain-everything-2
- Aurasma www.aurasma.com
- Notability www.ginegerlabs.com
- Gamification https://sites.google.com/site/sagacitylearning/home

Using Technology to Differentiate Instruction

- edX https://www.edx.org/

- Khan Academy https://www.khanacademy.org/
- ebooks http://www.ebooks.com/
- Subtext https://www.renaissance.com/products/subtext
- Accelerated Reader http://www.renaissance.com/products/accelerated-reader
- Mindplay http://mindplay.com/
- Promethean active board http://www.prometheanplanet.com/en-us/
- Booktrack https://www.booktrack.com/content/
- Newsela https://newsela.com/
- Google translate https://translate.google.com/
- Duolingo https://en.duolingo.com/
- Desmos https://www.desmos.com/
- PhotoMath https://photomath.net/en/
- YouTube https://www.youtube.com/
- Vocaroo http://vocaroo.com/
- Voxer http://www.voxer.com/

Using Technology to Collect Data and Assess

- Kahoot https://kahoot.it/
- Socrative http://www.socrative.com/
- Poll Everywhere https://www.polleverywhere.com/
- Quizlet https://quizlet.com/
- Plickers https://www.plickers.com/
- QuickKey http://get.quickkeyapp.com/
- ZipGrade http://www.zipgrade.com/
- GradeCam http://gradecam.com/
- Padlet https://padlet.com/
- TodaysMeet https://todaysmeet.com/
- Chatzy http://www.chatzy.org/
- Ning http://www.ning.com/
- NWEA Measures of Academic Progress https://www.nwea.org/
- DIBLES https://dibels.uoregon.edu/
- AIMSweb http://www.aimsweb.com/
- Intervention Central http://www.interventioncentral.org/

Professionalism in a Digital Age

- ISTE Elements of Digital Citizenship http://www.iste.org/docs/excerpts/DIGCI2-excerpt.pdf
- Skype http://www.skype.com/en/
- iSAFE http://www.isafe.org/
- Skype http://www.skype.com

- Book Creator https://itunes.apple.com/us/app/book-creator-for-ipad-create/id442378070?mt=8
- Remind www.remind.com
- Edmodo https://www.edmodo.com/
- Google Classroom https://www.google.com/edu/products/productivity-tools/
- Class Dojo https://www.classdojo.com/
- EduTech North Dakota http://www.edutech.nodak.edu/
- EduTech Norway http://edtechnorge.no/
- Facebook https://www.facebook.com/msudivisionofeducation
- Twitter https://twitter.com/
- Pinterest https://www.pinterest.com/
- Instagram https://instagram.com/
- Free Tech For Teachers http://www.freetech4teachers.com/
- YouTube Crash Course https://www.youtube.com/user/crashcourse
- Google Communities https://www.google.com/+/learnmore/communities/
- TED Ed http://ed.ted.com/
- Teach for Google https://www.teachforgoogle.com/
- Teacher Center Network http://www2.edutech.nodak.edu/tcn/
- IRIS Center http://iris.peabody.vanderbilt.edu/
- IES Regional Education Laboratory Program http://ies.ed.gov/ncee/edlabs/
- Association for Supervision and Curriculum Development (ASCD) http://www.ascd.org/
- Learning Forward http://learningforward.org/

Other Frequently Used Online Resources

- International Society for Technology in Education (ISTE) http://www.iste.org/
- P21 Partnership for 21st Century Learning http://www.p21.org/
- Purdue Online Writing Lab http://owl.english.purdue.edu/
- No Fear Shakespeare http://nfs.sparknotes.com/
- Teacher and Learning with the New York Times http://learning.blogs.nytimes.com/
- U.S. Energy Information Administration www.eia.gov
- Environmental Protection Agency www.epa.gov
- Yale National Initiative: Curricular Resources http://teachers.yale.edu/units/index.php
- Center for Disease Control and Prevention www.cdc.gov
- National Institutes of Health www.nih.gov/science/education.htm
- Purple Math www.purplemath.com
- University of Colorado Boulder PhET Interactive Simulations www.phet.colorado.edu
- Creative Commons http://creativecommons.org/
- Association for Supervision and Curriculum Development http://www.ascd.org/Default.aspx
- The Public Domain Review http://publicdomainreview.org/
- LibriVox https://librivox.org/