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Slide to Unlock: Creating a Technology-Integrated Environment for Our Students

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SLIDE TO UNLOCK:
CREATING A TECHNOLOGY-INTEGRATED ENVIRONMENT FOR OUR STUDENTS

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NLU Digital Commons Document Origination Statement

This document was created as *one* part of the three-part dissertation requirement of the National Louis University (NLU) Educational Leadership (EDL) Doctoral Program. The National Louis Educational Leadership EdD is a professional practice degree program (Shulman et al., 2006).

For the dissertation requirement, doctoral candidates are required to plan, research, and implement three major projects, one each year, within their school or district with a focus on professional practice. The three projects are:

- Program Evaluation
- Change Leadership Plan
- Policy Advocacy Document

For the **Program Evaluation** candidates are required to identify and evaluate a program or practice within their school or district. The "program" can be a current initiative; a grant project; a common practice; or a movement. Focused on utilization, the evaluation can be formative, summative, or developmental (Patton, 2008). The candidate must demonstrate how the evaluation directly relates to student learning.

In the **Change Leadership Plan** candidates develop a plan that considers organizational possibilities for renewal. The plan for organizational change may be at the building or district level. It must be related to an area in need of improvement, and have a clear target in mind. The candidate must be able to identify noticeable and feasible differences that should exist as a result of the change plan (Wagner et al., 2006).

In the **Policy Advocacy Document** candidates develop and advocate for a policy at the local, state or national level using reflective practice and research as a means for supporting and promoting reforms in education. Policy advocacy dissertations use critical theory to address moral and ethical issues of policy formation and administrative decision making (i.e., what ought to be). The purpose is to develop reflective, humane and social critics, moral leaders, and competent professionals, guided by a critical practical rational model (Browder, 1995).

Works Cited

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Abstract

The focus of this study is to explore how to support teachers in capitalizing on students' technology skills, experiences, and preferences to offer enhanced teaching and learning experiences in school. Using a framework developed by Wagner et al. (2006), technology integration is systemically examined in terms of "4 Cs:" context, culture, conditions, and competencies to construct an "As-Is" picture of a school district based upon current realities. Next, a series of changes are proposed and the 4 Cs are used to describe the "To-Be" picture of the organization at the end of the proposed change journey. The three teachers who participated in this study used a protocol developed by the researcher with over 150 students that allowed the teachers to learn about their students' technology skills, experiences, and preferences both in and outside of school. Information from the survey data was used by the researcher and participating teachers to co-plan technology-integrated projects that matched the students' technology skills, experiences, and preferences. An analysis of the student projects and teacher interview data resulted in a set of eight strategies for educators, Creating a Technology-Integrated Environment for Our Students, presented in two themes. Theme one offers, Provide Technology-Integrated Student Learning Opportunities: (1) engage students by allowing choices; (2) share learning experiences (student-to-student; student-to-teacher); (3) create with digital tools, learn outside of school, and simplify learning experiences; and (4) practice student-centered assessment. Theme two offers, Provide a Technology-Integrated Environment: (5) seek student opinions and match tools with student interests; (6) build capacity in the classroom; (7) provide models for all teachers; and (8) allow students to take the lead.

Preface

Having completed this study in change leadership, two significant leadership lessons were learned, both in the area of instructional leadership. First, this study allowed me to develop and test a personal theory of change within my organization while working with representative teachers and over 150 students. I began with the knowledge from a previous program evaluation that students bring technology skills, experiences, and preferences into the classroom. I developed a personal theory of change that states: When teachers understand the technology skills, experiences, and preferences of their students, intentional strategies can be used in the classroom to increase engagement, differentiate instruction, and personalize learning. I then developed a protocol for teachers to use to learn about their students' technology skills, experiences, and preferences. Working with the teachers, we co-developed a series of lessons and then tested my change theory. Since I was able to with teachers in my own district with whom I had no evaluative relationship, I was allowed to work in a purely instructional leadership capacity. I believe that I further increased my capacity as an instructional leader when the data analysis pointed to two major themes and eight strategies for Creating a Technology-Integrated Environment for Our Students. The two themes are: provide technology-integrated student learning opportunities and provide a technology-integrated environment for students. These themes, along with the eight accompanying strategies, carried beyond this study and were used in my leadership practice as I planned a One-to-One Mobile Learning Initiative to implement a major goal of my district's strategic planning initiative.

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SECTION ONE: INTRODUCTION

Statement of the Problem

Life in the twenty-first century requires the use of technology for communication, collaboration, and functioning in daily life. Although many schools have invested in the infrastructure, devices, and services to deliver curriculum using technology, many students do not experience technology as a seamlessly integrated part of their school day. Further, students have unprecedented access to technology devices and services in their lives outside of school and express interest in using technology in school. Thus, a disconnect exists between the experience of students who have a high level of access, skill, and interest in using technology in their lives and the learning experience that is offered to them in school.

Consider the students who attend The Winnetka Public Schools, an affluent, high-performing school district north of Chicago. These students regularly use technology outside of school in their everyday lives. In quotes from a recent survey administered to students in District 36 (Northern Illinois University Public Opinion Laboratory, 2012), one student suggests, "the classes should have individual laptops, because I always forget my flash drive at my house, and if I had my personal laptop I could access my documents." In the same survey, another student says, "I have heard about schools going with total technology. What that means is we use computers or iPads or stuff like that for everything we learn...I think that would help us get ready for having jobs..." Another student in the survey advocates using their own personal technology in school, "I would allow phones in school. When I need to use my phone, it's to call my mom or for educational purposes like dictionary, translator, or calculator."

Teachers and staff members in the same school district have high access to technology devices, services, and support. One teacher reports in a survey response,

> We have access to a lot of technology. I am not confident that we as staff always use it in ways to complement and enhance our work as much as we could. There is a lot of potential in this area. (Northern Illinois University Public Opinion Laboratory, 2012)

Another teacher in the survey acknowledges, "I believe we need to use technology to help students create, collaborate, and construct." Several teachers responded to the survey suggesting that each student should have technology available to them at all times. One teacher states, "Every student should have a 1 to 1 relationship with technology" (Northern Illinois University Public Opinion Laboratory, 2012).

The disconnect, it seems, is not necessarily a lack of interest, skill, or motivation on the part of teachers. Just because students have access to devices, express high interest in using technology, and demonstrate technology skills, simply using more technology in school may not necessarily ensure better teaching and learning. Meanwhile, teachers are not fully aware of the technology interests, skills, and preferences of their students since student technology use takes place outside of school and district rules do not allow widespread use of personal student technology devices during the school day (Fuller, 2012).

The focus of this research is to explore how to support teachers in capitalizing on students' technology skills, experiences, and preferences to offer enhanced teaching and learning experiences. This multifaceted topic will require adaptive leadership solutions,

described by Heifetz, Linsky, and Grashow (2009) as, "the practice of mobilizing people to tackle tough challenges and thrive" (p. 14). They further explain that

> adaptive leadership is an iterative process involving three key activities: (1) observing events and patterns around you; (2) interpreting what you are observing...; and (3) designing interventions based on the observations and interpretations to address the adaptive challenge you have identified. (p. 32)

Adaptive problems are the antithesis of "technical" problems. Although "technical problems may be very complex and critically important...they have known solutions that can be implemented by current know-how" (Heifetz et al., 2009, p. 20). Leadership problems can have both adaptive and technical aspects. As a Director of Technology I am quite familiar with literal technical problems and, as Heifetz et al. (2009) suggest, many technical problems require a high level of knowledge, skill, and tenacity to solve. However, the issue of integrating technology effectively with teaching and learning is primarily an adaptive leadership issue. Potential technical aspects, such as implementing devices, increasing Internet bandwidth, or adding wireless network access points, pale in comparison to adaptive issues such as providing a differentiated professional development program, changing staff mindsets about the potential uses of student-owned technology, and effecting a culture shift to establish a progressive education technology environment for the twenty-first century.

My assumption is that teachers can use students' technology skills, experiences, and preferences in daily teaching and learning activities in the classroom. As a first step, teachers will need strategies to learn about the technology skills, experiences, and

preferences of their students outside of school. In a school culture that values knowing students well and teaching "the whole child" (Winnetka Public Schools, 1999), the dimension of technology use is one attribute worth exploring as a critical facet of student learning (Fuller, 2012). Teachers and staff can then translate information about what they learn regarding student technology use into teaching and learning scenarios that enhance the delivery of the curriculum.

The framework used to examine this issue is the "4 Cs Diagnostic Tool" described by Wagner et al. (2006). This tool begins with the systemic examination of current context, culture, conditions, and competencies regarding the "challenges and goals of change in schools and districts" (p. 98), the "As-Is" picture of the organization. After considering this current reality, a representation is constructed to illustrate the state of the education system after a change has been implemented. The resulting "To-Be" picture describes the context, culture, conditions, and competencies in the organization at the end of the change journey (see Appendix A).

Rationale

The Winnetka Public Schools has a rich tradition grounded in the roots of progressive education (Winnetka Public Schools, 1999). Carleton Washburne, a former District 36 superintendent and early luminary in the public school progressive education movement, wrote that

> school is only a focal point in education...the child has far more experience and learns far more at home and in the community than in school. Instead of shutting out the world outside, it takes the child into it, and draws it into the school. (Washburne, 1953, p. 15)

This whole child approach to education is an important aspect of the district's progressive education culture to this day.

As the Director of Technology for The Winnetka Public Schools, I focused previous program evaluation research on student uses of technology outside of school. Several findings from this thesis, *Tap the Screen: Technology Integration in Our Students' Lives* (Fuller, 2012), influenced my decision to further study the topic of how student technology skills, experiences, and preferences might positively influence teaching and learning.

Previous research (Fuller, 2012) indicates that teachers and administrators are aware that students have high access to technology at home. In the course of my previous study, some teachers and administrators were able to identify a few students whom they felt were interested in technology, but the adults could not express precisely what the students were doing with the technology (Fuller, 2012, p. 72). While I concluded that school staff were not intentionally disregarding student technology interests and uses, they were nonetheless not considering student technology interests and uses as an aspect of knowing the whole child. I believe that in order to know the whole child in the twenty-first century, educators must consider the technology-enabled pursuits of students to truly know and understand them.

I also suggested that further study is needed to help teachers develop specific protocols for efficiently learning about their students' preferences for technology use both inside and outside of school (Fuller, 2012, p. 72). I identified three dimensions of student technology: skill, use, and interest. In the course of this research, I have reframed these three dimensions to "skills, experiences, and preferences." The term "skills" refers

to a students' ability to perform tasks using technology devices or services. The term "experience" replaces "use" and refers to a students' day-to-day perceptions, understandings, and encounters with technology devices and services. "Preferences" is used in place of "interests" and is meant to imply that a student has made a choice to use one technology device or service over another and that this preference may express an interest in the selected technology. This research identifies specific methods for teachers to learn about the three dimensions of skills, experiences, and preferences; identifies additional possible dimensions; and most importantly, links these dimensions to learning strategies that will help teachers plan and develop activities that promote twenty-first century skills in a progressive education setting.

Another aspect of student technology use that warrants exploration is the growing interest expressed by students to bring their own personal devices to school to use them for learning. The Information Technology (IT) market and educational technology literature refers to this trend as "BYOD" (Bring Your Own Device) (Johnson, Adams, & Cummins, 2012, p. 4). The industry's largest provider of technology infrastructure hardware, Cisco Systems, describes BYOD as, "end users being able to use the computer and communication devices they choose to increase productivity and mobility...BYOD means any device, with any ownership, used anywhere" (Cisco, 2012). Students express interest in using their personal devices for learning because they are familiar with them, they use them in every other aspect of their lives, and the devices are already personalized with the tools and content they prefer (Fuller, 2012). Current school rules in District 36 ban the use of personal mobile phones during the school day.

Winnetka's high socioeconomic status provides a unique opportunity to study the potential to enhance teaching and learning by exploring the ways student technology skills, experiences, and preferences can be used in the classroom. My previous study clearly indicated that the children in this community have high access to technology services and devices. For example, one participant reported that he had access to 17 gaming systems in his home (Fuller, 2012); many of these systems were multipurpose portable devices with educational capabilities. Participants also have high access to devices such as iPad, iPod touch, iPhone, laptop computers, desktop computers, Kindle electronic book readers, and gaming consoles, to name a few (Fuller, 2012). Studying this population with high access to technology devices and services provides an opportunity to draw conclusions about effective choices for teaching and learning in populations with more limited means to acquire technology.

Goals

One goal of this study was to develop ways to "bridge the gap" between the "As-Is" current reality and the "To-Be" vision where teachers capitalize on students' technology skills, experiences, and preferences to offer enhanced teaching and learning opportunities. Through the use of Wagner et al.'s (2006) "4 Cs Diagnostic Tool," the context, culture, conditions, and competencies regarding technology use in The Winnetka Public Schools were examined.

Ultimately, my hope is that teachers will regard the technology-enabled pursuits of their students as an important facet of knowing and teaching the whole child. This study begins with the belief that the skills, experiences, and preferences students bring into the classroom will open additional possibilities for teaching and learning activities

that have remained untapped. My personal theory of change is: When teachers understand the technology skills, experiences, and preferences of their students, intentional strategies can be used in the classroom to increase engagement, differentiate instruction, and personalize learning.

Demographics

The Winnetka Public Schools, District 36, is located sixteen miles north of Chicago, Illinois, on Chicago's North Shore. Since the mid-1950s, The Winnetka Public Schools has identified itself as a national leader in public school progressive education and strives to develop "the whole child" (Washburne, 1952, p. 17). In the progressive education tradition, The Winnetka Public Schools considers "each child to be a whole person who should be developed intellectually, socially, emotionally, and physically" (Winnetka Public Schools, 2012).

The Village of Winnetka's population is 12,187 (U.S. Census Bureau, 2010) and is considered a highly affluent community. In 2011, CNN placed Winnetka in its top-ten listing of "top-earning towns" in the United States citing a median annual family income of $236,222 and a median home price of $990,000 (CNN, 2011). District 36 serves only 0.2% low-income students (Illinois Interactive Report Card, 2013).

The Winnetka Public Schools serves approximately 1,900 children in Kindergarten through Grade 8 (Illinois Interactive Report Card, 2013). The district is comprised of three elementary schools including Crow Island School, Greeley School, and Hubbard Woods School. The Skokie School serves all District 36 students in Grades 5 and 6; Carleton Washburne School serves all District 36 students in Grades 7 and 8. After students complete Grade 8 in The Winnetka Public Schools, they attend the New

Trier Township High School District 203 with campuses in Northfield and Winnetka, Illinois.

The district population of The Winnetka Public Schools is predominantly homogeneous. The Illinois Interactive Report Card (2013) reports that the following ethnicities are served by the district: 92.8% White, 0.1% Black, 1.7% Hispanic, 3.0% Asian, 0.2% American Indian, and 2.3% Multiracial.

The district's progressive values are explicitly stated in the document, *Winnetka: A Community of Learners* (1999). The document includes the statement,

> We are a dynamic community of learners committed to respecting childhood, challenging the intellect, nurturing creativity, fostering reflection, encouraging action, and exploring possibilities for the future. We believe that a developmental, child-centered approach to education is the most effective way to meet the needs of our students and the high level of expectations we set for them. We are guided by a set of beliefs embedded in a culture that honors tradition, reflects on transitions, and makes choices about transformations.

In December 2012, District 36 published updated vision, mission, and values statements as a result of an ongoing strategic planning initiative (see Appendix B). The vision statement reaffirmed the district's commitment to producing citizens well prepared for the future. The mission states that the district "honors the whole child, fosters creativity, inspires lifelong learning, and develops civic responsibility." The updated values reflect ideals that both support the vision and mission and prepare students for life in the twenty-first century.

The Winnetka Public Schools consistently performs well above average on the Illinois Standardized Achievement Test. The percentage of District 36 students who performed in all subjects at the “Meets and Exceeds” level was 97.3% in 2012 (Illinois Interactive Report Card, 2013).

SECTION TWO: ASSESSING THE 4 Cs (AS IS)

Guided by the "4 Cs Diagnostic Tool" framework offered by Wagner et al. (2006), the issue that teachers are not capitalizing on students' technology skills, experiences, and preferences for teaching and learning is systemically examined in this study. The "As-Is" reality of the situation in The Winnetka Public Schools is presented here in terms of current context, culture, conditions, and competencies of the organization. The following "As-Is" account is meant to present the most significant issues that will be further examined through a research methodology for the purpose of proposing a change described in a later "To-Be" scenario.

Context

Wagner et al. (2006) describe context as a set of "skill demands" that must be met by all students "to succeed as providers, learners, and citizens and the particular aspirations, needs, and concerns of the families and community that the school district serves" (p. 103). They go on to say that in "the world of the 2020s, the knowledge economy of the future...will be very different from the world of the 1970s—and even from what we experience today" (p. 103). Wagner has also proposed his own seven "survival skills" for the twenty-first century (Wagner, 2008): critical thinking and problem solving; collaboration across networks and leading by influence; agility and adaptability; initiative and entrepreneurship; effective oral and written communication; accessing and analyzing information; and curiosity and imagination. Considering this selection of skills, the successful integration of technology into everyday life is placed at the forefront of student needs in the twenty-first century. In The Winnetka Public

Schools, the integration of technology into educational practice forms the basis of two current context realities:

- Students have unprecedented access to technology devices and services outside of school and express preferences for using technology in their everyday lives.
- Students have the option for some access to technology devices and services in school.

One conclusion of my previous study is that students have unprecedented access to technology devices and services outside of school (Fuller, 2012). Students further expressed preferences for using the same technology they use in their everyday lives in their learning while at school. Additional support for increasing the amount of technology used in school was presented in a survey conducted as part of strategic planning efforts in the district. Among students in Grades 5–8, 485 students responded to the question, "What technology would you like to use at school?" and 172 reported that they wanted to bring their own devices to school for learning. The top three devices students wanted to use at school included their personal smartphone (including iPhone), personal laptop, and personal iPad (or other tablet) (Northern Illinois University Public Opinion Laboratory, 2012). Further, focus groups conducted during my study last year revealed that students in Grades 3–8 have generally higher access to technology devices and services outside of school than national averages (Fuller, 2012). In contrast, the same students have relatively little access to technology throughout their school day.

In practice, the current policy allowing students to use personal devices for a specific class assignment is one step closer to giving students access to a more

personalized learning experience; however, the district restricts students' Internet access on personal devices, raising other legitimate issues. For practical purposes, disallowing outside Internet connections maintains a level of in-school online student safety, but it also eliminates the ability for students to access information and communicate online. It is currently possible for the district to offer Internet access to the district wireless network for students while maintaining district web filtering from a technical standpoint; however, at this time, published district rules and procedures prohibit students from connecting to the wireless network on their personal devices.

Another issue of context involves published procedures currently in place in the district. Students in The Winnetka Public Schools have the option for some level of access to their personal technology devices and services in school. Rules stated by The Winnetka Public Schools currently ban the use of mobile phones during the school day. For example, the *Carleton Washburne School Parent-Student Handbook* contains the following language:

> The use of a personal cellular telephone disrupts Washburne's educational environment and therefore will not be allowed to be used in school... Cell phones must be turned off and stored in the student's locker from 7:00 a.m. until 4:00 p.m. They must remain in lockers during the instructional day. (Carleton Washburne School, 2012)

However, as of 2012, Carleton Washburne School allowed some use of student-owned devices with the stipulation that Internet may not be accessed from the devices:

> When sanctioned by the teacher and utilized for a specific class assignment, students are permitted to use student-owned electronic

devices in school. Devices that allow access to outside-District Internet services may be used, but the outside service must be turned off. Examples include, but are not limited to:

- E-book readers (such as Kindle) may be used with Internet connectivity turned off.
- iPad, iPhone, and iPod touch may be used with Internet connectivity turned off (set in Airplane mode).
- Other devices (such as smart phones) may be used with Internet connectivity turned off.

Thus, a major context issue in The Winnetka Public Schools is that students may use some of their personal technology, but on a basis that limits connection to the outside world.

Culture

Culture is defined by Wagner et al. (2006) as the "shared values, beliefs, assumptions, expectations, and behaviors related to students and learning, teachers and learning, instructional leadership, and the quality of relationships within and beyond the school" (p. 102). Discussions involving culture are frequent and prevalent in The Winnetka Public Schools and often involve perceptions based in cultural beliefs and practices of the past. The district is currently redefining its progressive education practices to better align to the needs of the twenty-first century. While technology devices and services have been a part of the district's environment for over twenty years, the district is only now considering technology as one of five major "pillars" as culture is being redefined during a strategic planning process. The five pillars include

communication; curriculum, instruction, and assessment; metrics and reporting; operations; and technology (Winnetka Public Schools, 2012b).

Technology in The Winnetka Public Schools is in the process of finding its place in the culture of the district through a multi-layered strategic planning process that includes voices of stakeholder groups consisting of community members, parents, staff, and students. Three current aspects of culture as they relate to capitalizing on students' technology skills, experiences, and preferences include:

- Technology integration of student skills, experiences, and preferences is not fully understood.
- Technology-enabled instructional strategies have lagged behind other instructional strategies.
- The school district considers itself "progressive," but has not updated thinking about technology's role in teaching and learning.

While the culture of The Winnetka Public Schools has included access to technology, technology integration is not practiced by every teacher in a consistent manner across the curriculum. In addition, technology integration based on student skills, experiences, and preferences is not considered, nor is it fully understood, as a way to enhance teaching and learning. While teaching the whole child is both a long-held belief and a frequently discussed ideal among the progressive practices of teachers in this district (Winnetka Public Schools, 1999), the idea of getting to know a student's technology skills, experiences, and preferences has not occurred to all teachers as an area that could potentially enhance teaching and learning in the district (Fuller, 2012).

Concurrently, technology-enabled instructional strategies have lagged behind other instructional strategies. One reason that technology integration has not gained momentum is that elementary schools lack a dedicated building-level position to support technology integration. While The Skokie School (Grades 5–6) and Carleton Washburne School (Grades 7–8) have dedicated Technology Facilitators on staff in the buildings, the buildings serving Grades K–4 do not have this resource. Further, technology integration is not a practice that is specifically evaluated by principals in The Winnetka Public Schools at any grade level. While technology integration is mentioned in the district's vision document, *Winnetka: A Community of Learners* (1999), no formal or informal oversights are currently in place to ensure that technology integration is implemented with regularity or fidelity in the curriculum. Within the past two years, however, the topic of technology integration has been built into the current efforts of district curriculum committees as The Winnetka Public Schools updates curricula to align with the Common Core State Standards.

One of the purposes of the district's current strategic planning efforts is to define the values of the district and either reaffirm or redefine twenty-first century progressive education practice. These efforts have included a district-wide exercise to define a set of values that are practiced by all teachers across all five buildings. The eight drafted values that have resulted from these efforts include reflection; lifelong inquiry; honor the whole child; cultivate civic responsibility; student voice; creativity and innovation; work together; and meaningful, purposeful, and experiential learning (Winnetka Public Schools, 2012c). These values, written by teachers, express the foundational beliefs of teaching and learning in the district. The role of technology has been included in current

strategic planning efforts as one of five major pillars. Further, technology integration has been discussed in current literature as an inexorable part of a twenty-first century learning environment (International Society for Technology in Education, 2007; Ito et al., 2008; Ito et al., 2009; Means, 2010; Partnership for 21st Century Skills, 2012; Rideout, Foehr, & Roberts, 2010; Wagner, 2008) and as a part of the emerging Common Core State Standards initiative (2012a, 2012b).

Conditions

Conditions are described by Wagner et al. (2006) as the "external architecture surrounding student learning, the tangible arrangements of time, space, and resources" (p. 100). The current conditions in this study also extend beyond the boundaries of the school and into the other aspects of the daily lives of our students. Three current conditions include:

- School/district rules limit the use of technology devices and services in school.
- Teachers and staff are not generally aware of student technology interests, skills, and experiences outside of school.
- Parents, community members, students, and staff have expressed interest in being a technology integration leader.
- Teachers have high access to technology devices and services for teaching and learning in and out of school.

As the research for *Tap the Screen: Technology Integration in Our Students' Lives* (Fuller, 2012) was being conducted, I had the opportunity to speak to teachers and administrators about some of the interests expressed by students in focus groups. In

several cases after hearing information related by a student, I would share it with one of their teachers. In each informal exchange, the teacher was unaware of the technology-enabled interests of the student. Examples included numerous students (usually boys) who played video games that required real-time communication and group strategy; a group of Carleton Washburne School students who wrote, filmed, edited, and produced videos weekly for their YouTube channel, complete with digital special effects; a student who completed her homework assignments using a Kindle Fire electronic book reader; and a student who identified himself as a "non-technology user" who regularly used Twitter to communicate with his coach and teammates to participate in his baseball league. The teachers and administrators with whom I shared these stories were surprised by these examples of outside-school technology use, even though they felt that they knew these students well.

An interesting condition that has recently emerged as a result of strategic planning efforts is that parents, community members, students, and some staff members have expressed interest in the district being viewed as a leader in technology integration. While the definition of "technology leader" was not defined in the survey, a general sentiment was conveyed that technology integration is important and that the district needs to move forward in this area. The most prevalent comments that were provided in open-ended responses indicated that the technology used in school should be in support of teaching and learning and not implemented just for "technology's sake" (Northern Illinois University Public Opinion Laboratory, May 2012).

Another condition that was explored in this study was the issue of teacher interest, readiness, and access to technology tools, services, and professional development.

Teachers in The Winnetka Public Schools have high access to technology devices and services for teaching and learning both in and out of school. During the 2011–2012 school year, all district teachers were issued a laptop for anytime, anywhere technology access. All schools have computer labs, laptop carts, an iPad cart, cameras, video cameras, and many other technology devices that can be used for teaching and learning. Further, teachers may participate in both formal and informal professional development activities in or out of the district that are available in a wide variety of formats. A staff survey conducted as part of strategic planning efforts included the question, "Should The Winnetka Public Schools be a leader in the use of technology in the classroom?" Among the staff members who offered an opinion, 75.4% expressed that they wanted the district to be a leader in the use of technology in the classroom (Northern Illinois University Public Opinion Laboratory, 2012).

Competencies

Wagner et al. (2006) describe competencies as "the repertoire of skills and knowledge that influences skills and learning" (p. 98). Teachers in The Winnetka Public Schools already demonstrate a wide range of skills and knowledge in teaching and learning in a progressive education environment. Three competencies that are currently observed include:

- Teachers know students well in most contexts aside from technology.
- Teachers have a wide array of effective instructional strategies already in use.
- Some technology integration is used by teachers, but in a limited manner.

Teachers in The Winnetka Public Schools take the idea of knowing their students seriously. Teachers who participated in a 2012 Summer Institute were asked to contribute to the definition of a set of district values in a series of activities. Teachers reported that,

> Honoring the Whole Child means we...acknowledge who they are in and out of school...uncover and discover strengths and challenges; develop their curiosity and wonder; guide their connections with others and the environment; and ignite their passions. (Winnetka Public Schools, 2012c)

Further, the teachers identified that student learning should be "meaningful, purposeful, and experiential," stating that students should be able to "make personal connections to their learning experiences so students can then reflect upon these experiences and apply them to their lives" (Winnetka Public Schools, 2012). Teachers regularly engage in classroom discussions, assign writing, and facilitate conferencing activities that help them get to know their students. While the topic of student technology interest sometimes arises in discussions about classroom practices, no evidence has been observed that teachers understand the depth of skills and experiences that students already have using technology in their lives. In order to link student technology interests, skills, and experiences to classroom activities, more information is needed to connect outside student technology use to potential instructional situations in school.

Observations of teachers in The Winnetka Public Schools reveal a wide array of effective instructional strategies in use. Strategies prevalent in Winnetka classrooms include project-based, hands-on, and authentic learning experiences. While technology integration is not absent from instruction, it is not an integral part of the design and planning of instruction, and technology is not used consistently across the curriculum or

across grade levels. While teachers have a wide variety of technology hardware, software, and professional development available, there is currently no targeted program in place to make sure student technology integration experiences are delivered consistently. Teachers who are interested in technology integration tend to use it more frequently than others, but the possibility currently exists that a student could have little or no in-school technology integration in daily learning experiences.

Finally, technology integration is being used by many teachers in The Winnetka Public Schools, but in a limited manner. Technology integration tends to occur during project-based learning experiences that last for one to several days at widely varying frequencies from days to weeks (or even months) between projects. Because The Winnetka Public Schools has not implemented a one-to-one technology environment where students have access to a technology device at all times during the school day, teachers must depend on the availability of computer lab times or check out a limited number of mobile laptop or iPad carts to use in the classroom. This limited availability, along with the fact that not all teachers regularly integrate technology into their teaching, results in uneven experiences for students.

The "As-Is" picture of the technology integration situation in The Winnetka Public Schools described here represents the most significant matters related to the issue that teachers are not currently capitalizing on students' technology skills, experiences, and preferences in teaching and learning contexts. The framework provided by Wagner et al. (2006) illuminates the current situation in terms of context, culture, conditions, and competencies in the organization. The next section offers a research methodology designed to collect specific information to begin to bring about a series of changes in

which teachers make a concerted effort to learn more about each student's technology skills, experiences, and preferences for the purpose of applying the information to enhance instruction and improve the teaching and learning process.

SECTION THREE: RESEARCH METHODOLOGY

Teachers in The Winnetka Public Schools take great pride in knowing, teaching, and honoring the whole child by getting to know students well as both learners and individuals. My previous study, *Tap the Screen: Technology Integration in Our Students' Lives* (Fuller, 2012), found that in general, teachers were not aware of their students' technology skills, experiences, and preferences in which they engaged outside of school. Although technology was shown to be seamlessly integrated into the daily lives of students outside of school, these technology pursuits were not being used to enhance teaching and learning. Along with parents, community members, and students, district staff have expressed an interest in becoming leaders in the area of technology integration. At this time, teachers do not fully understand how the technology skills, experiences, and preferences of students might best be used in the classroom. This study used a two-tier research approach to assist teachers in efficiently learning about student technology use and then helped teachers apply this information to lesson design to inform the differentiation of instruction.

Research Design

A two-tier research design that included three steps in each tier was used to gather information. The intent of the design was to both collect baseline information from the students at the beginning of a technology integration experience and then provide information at the end of the technology integration experience that allowed teachers to correlate students' technology skills, experiences, and preferences to inform lesson designs involving technology integration. One major assumption was that certain

technology skills, experiences, and preferences brought into the classroom by students could be capitalized upon by teachers to increase student learning.

The three dimensions explored in this research—student technology skills, experiences, and preferences—relate to the core practices of curriculum differentiation. Tomlinson and Imbeau (2010) explain,

> At the core of the classroom practice of differentiation is the modification of four curriculum-related elements—content, process, product, and affect—which are based on three categories of student need and variance—readiness, interest, and learning profile. (p. 15)

By intentionally gaining further understanding of these dimensions, a teacher is able to better modify the curriculum-related elements of process, product, and affect. If teachers know and understand their students in terms of the three dimensions of student technology skills, experiences, and preferences, teachers will have additional information to allow them to change their instructional practices to better differentiate instruction to increase student learning.

The first tier of the process allowed teachers to efficiently assess students' technology skills, experiences, and preferences in three steps. The second tier used a set of three steps to yield data from the teacher's perspective about the student learning that occurred as a result of planning using prior knowledge of students' technology skills, experiences, and preferences.

Tier One Data Gathering

During tier one data gathering, I:

1. Identified teachers interested in completing a technology-integrated project in their subject area. The purpose of the technology integration used for the projects in this study was to enhance the curriculum being taught. Using technology for "technology's sake" was not the purpose of this study; rather, the technology integration needed to serve to enhance the learning.
2. Worked with teachers to administer a survey to students in advance of the project to learn about students' personal technology skills, experiences, and preferences. The survey was based upon the focus group questioning protocol developed in my previous study (Fuller, 2012). This survey was designed to gather information quickly and efficiently while providing the teacher with information to potentially differentiate student learning. The student survey was co-developed with the teachers to inform the content of the project and match the developmental levels of the students.
3. Collaborated with each teacher to interpret the findings of the student survey.

Google Forms was used to gather survey data during Tier One. Google Forms is a feature of Google Apps for Education, a suite of "web-based...documents for collaborative study" (Google Apps for Education, 2012). Google Forms provides a method to create and administer template-based surveys that organize responses into a linked Google spreadsheet (Google Forms, 2012).

Survey prompts that were included in tier one data collection were derived from the focus group protocols from my previous study (Fuller, 2012). The first part of the

survey asked students to report about the technology devices to which they had access at home. The second part of the survey asked students to identify their gaming preferences including gaming devices and favorite games. The third part of the survey asked students about the videos they like to watch and create. Finally, students were asked about their favorite past school projects (see Appendix C).

Tier Two Data Gathering

During tier two data gathering, I:

1. Co-planned the details of the technology-integrated project with the teachers using the findings of the student survey:
    - Made purposeful decisions about differentiating instruction for the project, based upon responses from the student survey.
    - Involved students in making decisions about what technology to use to satisfy the learning objectives of the project.
2. Asked students to complete the technology-integrated project. Upon completion of the assignment, the teachers assessed the success of the technology integration based upon the learning that was demonstrated by the students when completing the project. My assumption was that each project would have different learning outcomes and that the technology integration selected with prior knowledge of the students' technology skills, experiences, and preferences would enhance the learning outcomes in a meaningful and positive way.
3. Compared data from the initial student technology use surveys (see Appendix C) to the completed lesson process and project assessments. The analysis sought to find

patterns among the data collected from the student surveys and the choices made by students and teachers in the technology-integrated lessons.

Analyzing and Reporting

The final step in the process was to interview the teachers after the project was completed and assessed. The interviews focused upon how planning, completing, and assessing the technology-integrated project using prior knowledge of students' technology skills, experiences, and preferences affected the teaching and learning experience. Patterns, relationships, and other findings are reported to allow teachers to make more informed decisions in the future regarding the benefits of discovering the dimensions of the whole child and how knowing about students' technology skills, experiences, and preferences serves to enhance teaching and learning in the twenty-first century. Information from this final analysis was drawn from teacher interview transcripts and coded using methods described by Saldaña (2009).

Participants

The key participants in this study included three teachers of students in Grades 5–6. The number of students who participated in the technology integration experiences was dependent upon the class sizes of the selected teachers. Over 150 students in eight classes participated in the study. An effort was made to select teachers who represented different subject areas in Grades 5–6. This study was conducted at The Skokie School, a school in The Winnetka Public Schools District 36 serving all Winnetka students in Grades 5–6.

Teachers who were planning upcoming technology integration projects were selected. Informal meetings with teachers in advance of the study explained the nature of

the research and made certain that the teachers wished to work collaboratively on this experience.

Data Collection Techniques

The types of data gathered included quantitative and qualitative student survey data and qualitative teacher interview data. Surveys and interviews were conducted in the school setting.

The data collected during the tier two process included teacher interview data and field notes. Interviews were conducted to focus upon how planning, completing, and assessing the technology-integrated project using prior knowledge of students' technology skills, experiences, and preferences affected the teaching and learning experience. The teachers were encouraged to share information about all aspects of the process and products of the individual learners and groups. The teachers were also asked to share their observations about their own roles in facilitating the technology-integrated project.

The data were captured and assembled using digital audio recordings of the teacher interviews, preparing transcripts, and then coding the responses for patterns using spreadsheets. Student-created digital artifacts were consulted during tier two data gathering including viewing work in progress and viewing completed project files at the end of the assignments.

Data Analysis Techniques

Coding methods were adapted from Saldaña (2009) to analyze the qualitative data from the student surveys and teacher interviews. The student survey data and interview transcripts were coded in multiple cycles. *"In vivo"* coding (e.g., "from the actual

language found”) was used to analyze student fill-in survey responses. In addition, attribute coding was used to capture basic participant information, structural coding was used to reveal patterns from the content of responses following the interview questions, and holistic coding established the themes and issues raised by participants. After combining coded student survey data and coded teacher interview data, pattern coding was used to identify overall themes.

SECTION FOUR: RELEVANT LITERATURE

When considering issues related to bringing about change in the ways teachers integrate technology into their teaching, researchers discuss topics such as instructional strategies (Ertmer & Ottenbreit-Leftwich, 2010; Levin & Wadmany, 2008; Windschitl & Sahl, 2002); professional development methods (Means, 2010); student technology uses (Arnone, Small, Chauncey, & McKenna, 2011; Ito et al., 2008); and predictions of student needs in the twenty-first century (Frand, 2000; Nagel, 2009). While many of these approaches serve to inform educational leaders of current trends, few of these ideas incorporate the notion that our students are bringing technology skills, experiences, and preferences into the classroom that could be used to inform instruction.

Researchers in change leadership address educational technology needs in terms of structural issues such as policy development (Heifetz, Grashow, & Linsky, 2009), organizational capacity building (Fullan, 2008), and the transformative continuum of technology integration (Puentedura, 2012). This review of relevant literature examines three primary change leadership perspectives: teacher instructional methods in technology-rich environments; student learning experiences and preferences; and educational technology change leadership to bridge the 4 Cs.

Teacher Instructional Methods in Technology-Rich Environments

Over 20 years of research is available related to the various aspects of technology use in classrooms beginning with the early seminal example of the Apple Classrooms of Tomorrow (ACOT) research spanning 1985–1995 that "identified effective models for teaching and learning with technology, developing the professional lives of teachers, and diffusing innovation" (Apple, 2008, p. 3). In 2001 Marc Prensky (2001a, 2001b)

suggested a widening gap between "digital natives"—our students born into a world with the Internet—and "digital immigrants"—adults (including teachers) who must make the choice to learn about and use Internet-age technologies. In the present day, technology is considered so integrated into our daily lives that educational technology standards organizations such as the International Society for Technology in Education (2007) and the Partnership for 21st Century Skills (2012) advocate that technology should not be treated as a separate subject, but infused seamlessly into all subject areas. The Common Core State Standards for English Language Arts and Mathematics explicitly state that technology is to be embedded into the new standards. The Common Core State Standards for English Language Arts state:

> Just as media and technology are integrated in school and life in the twenty-first century, skills related to media use (both critical analysis and production of media) are integrated throughout the standards. (Common Core State Standards Initiative, 2012a)

The Common Core State Standards for Mathematics state: "When making mathematical models, technology is valuable for varying assumptions, exploring consequences, and comparing predictions with data" (Common Core State Standards Initiative, 2012b). Thus, the Common Core State Standards acknowledge that technology is "integrated in school and life" and embed its use into teaching and learning.

As part of a study that examines technology implementation practices leading to student learning gains, Means (2010) provides an extensive list of "Recommended School-Level Instructional Technology Practices" based on research ranging from 1994–2005. The list cites over 70 studies in four categories: schoolwide coherence, teacher

training, technology access, and support for technology use. Means states in the first paragraph of her study that "Teachers and students use technology more frequently outside of school than they do during class time" (p. 285). However, her point regarding teacher or student technology use outside of school is not considered as a possible effort "to use technology as a lever for education change" (p. 287). She concludes that,

> Only by defining, measuring, and analyzing implementation variables and context along with student outcomes (Means & Penuel, 2005) can we gain the understanding that will support the implementation of technology-supported interventions in a way that optimizes student learning. (Means, 2010, p. 305).

Adding the variables of exploring existing student technology skills, experiences, and preferences may serve as important considerations when optimizing student learning.

During a two-year study, Windschitl and Sahl (2002) observed that middle school teachers tended to shift their instructional methods to more constructivist pedagogy as they taught students in a one-to-one[1] laptop environment. The researchers report that

> the influence of ubiquitous technology on instructional decisions was mediated in substantial ways by teachers' interconnected belief systems about learners in that particular school, about what constituted good teaching within the context of the institutional culture, and about the role of the technology in the lives of students. (p. 201)

Although Windschitl and Sahl state that "the role of the technology in the lives of students" was a factor, their findings relate only to the in-school use of technology. Neither the discussion provided by the teachers in the study nor the findings of the

researchers acknowledge that out-of-school technology uses might have influenced the outcomes of the study. Furthermore, in a discussion regarding how teachers might better collaborate with each other and how students make sense of technology integration experiences, Windschitl and Sahl state that "the role of the teacher must necessarily shift when technological resources and technology-competent students are present" (p. 202). Again, the researchers do not acknowledge that student technology competencies may have developed outside of school through the students' own skills, experiences, and preferences.

Levin and Wadmany (2008) followed the classroom technology use of teachers of Grades 4, 5, and 6 for three years. The researchers provide a list of factors that might negatively affect technology use in school. They report that "Hardy's (1998) review of studies on teacher attitudes revealed that teacher confidence affects the use of technology more than variables such as access to equipment, administrative support, and time" (p. 237). They also report that teachers might experience "feelings of intimidation if they sense students know more than them (Fryer, 2003)" (p. 237). Other potential variables offered by Levin and Wadmany include teacher pedagogical practices, level of resistance to change, and willingness to innovate. Although some teachers might, indeed, experience intimidation when students have more knowledge on a topic, the authors do not suggest the possibility of developing strategies for teachers to capitalize on student knowledge instead of fearing it.

Voogt and Pelgrum (2005) use a case study approach when observing information communication technology (ICT) in schools and found that,

> ...students worked on topics that were meaningful to them because the topics were related to real life, including the students' own experiences. Many of the innovative practices aimed at the realization of new goals that were related to skills that were considered important for lifelong learning in an information society. (p. 172)

The researchers also report that when technology is embedded in practice, they observed complex skills such as "information handling, collaboration, and communication" on the part of students.

Ertmer and Ottenbreit-Leftwich (2010) examined the roles of knowledge, confidence, beliefs, and culture as teachers changed their instructional practices to include more technology integration in their instruction. They advocate that

> It is time to shift our mindsets away from the notion that technology provides a supplemental teaching tool and assume, as with other professions, that technology is essential to successful performance outcomes (i.e., student learning). To put it simply, effective teaching requires effective technology use. (p. 256)

They go on to say that if "teachers are going to prepare their students to be technologically capable, they need to have, at the very least, basic technology skills" (p. 259). Ertmer and Ottenbreit-Leftwich advocate the use of the International Society for Technology in Education's National Educational Technology Standards for Teachers (NETS-T).

Because technology knowledge has been described as a "moving target" for teachers, Ertmer and Ottenbreit-Leftwich (2010) cite researchers Bauer and Kenton

(2005) who indicate that "teacher self-efficacy may be more important than skills and knowledge among teachers who implement technology in their classrooms" (p. 261). While students may be able to use current technology, they are reported to have little knowledge about ways to use technology to facilitate their learning. Ertmer and Ottenbreit-Leftwich (2010) advocate for "best practice" technology integration professional development to increase both teacher knowledge and self-efficacy in technology integration. They suggest four specific professional development ideas:

1. Align experiences with existing pedagogical beliefs and knowledge.
2. Provide examples of other teachers' successes emphasizing student outcomes.
3. Provide support for risk-taking and experimentation.
4. Expand the definition of "good teaching" to include technology integration.

The researchers above who have examined change in the area of technology integration by teachers have noted shifts in teacher roles, pedagogy, self-efficacy, and professional development programs, especially in technology-rich environments. While some researchers have acknowledged that students are bringing technology skills, experiences, and preferences into the classroom, this concept has generally not been incorporated into theories of change regarding educational technology integration.

Student Learning Experiences and Preferences Involving Technology Integration

Through the daily use of technology devices and services outside of school, students are developing their own skills, experiences, and preferences for their own uses, including learning outside of the classroom. An exploration of student learning preferences, new media spaces, peer engagement systems, and the overall connectedness afforded by technology devices and services, provides the foundation for this part of this

literature review regarding possible technology integration opportunities brought into the classroom by our students.

Student technology use outside of school is documented in a MacArthur Foundation study (2008) that suggests that, "youth are navigating complex social and technical worlds by participating online" as they learn "basic social and technical skills that they need to fully participate in contemporary society." Further, "young people are motivated to learn from their peers online," enabled by "new kinds of public spaces for youth to interact and receive feedback from one another." Students are not only participating online on their own outside of school, but they are developing their own social contexts to navigate "new media spaces" (MacArthur Foundation, 2008). The fact that students are self-motivated to use these spaces suggests that teachers might consider exploring these same methods as possible instructional opportunities.

Diaz and Bontenbal (2002) acknowledge that because students have different learning styles, teachers should assess these styles and use the data to help design and implement classroom instruction. The researchers advocate several different tools to assess learning preferences that can be administered in classroom or online learning environments. Diaz and Bontenbal believe that

> If students are to play an important role in learning, the instructor must seek to understand the students and their preferences for learning. Learning is facilitated by helping students to understand their learning preferences and by providing them sufficient opportunities to meet those preferences. (Diaz & Bontenbal, 2002)

While a few learning style assessment examples are provided and compelling data showing student differences are presented, Diaz and Bontenbal offer no examples or resources for teachers to make changes to their pedagogy.

Arnone et al. (2011) contend that students have seemingly endless opportunities to "invoke and exercise their curiosity." In the context of new media environments, the authors describe curiosity as a process that is triggered by a single or multiple stimulus evoked by dynamic media environments; followed by a reaction employing the students' use of new media skills (e.g., multi-tasking, distributed cognition, collective intelligence); and a resolution that, if successful, results in new learning. They describe new media episodes of "resolved curiosity:"

> Group gaming, chat rooms, instant messaging, social networks, virtual worlds and the like, invoke a collaborative curiosity which may reinforce individual curiosity and potentially contribute to sustained interest and engagement at both the group and individual level. (p. 184)

Arnone et al. offer that out-of-school learning contexts provide valuable information about how students pursue their interests and that this type of learning may offer suggestions regarding how to address student motivation problems in classrooms. Finally, the researchers offer that the pervasive nature of new media has major implications on education:

> This view of technology acknowledges what today's students take for granted and expect—technology which merges seamlessly into their work and play. The use of technology in schools ranges along a continuum from

avoidance to total immersion supporting 1:1 computer initiatives, mobile devices, and the use of social networking. (Arnone et al., 2011, p. 190)

In an article by Frand published in 2000, ten attributes are offered that he believes make up the "information-age mindset." Although written over a decade ago in a higher-education context, the attributes now seem well suited to describe not only college-age students, but also students in Grades 5–12:

1. Computers Aren't Technology—young people gravitate to new devices, learn them instinctively, and incorporate them into their lives.
2. Internet Better Than TV—the Internet allows users to engage in information, rather than just passively watch it.
3. Reality No Longer Real—information online must be interpreted in at least two ways: provide author authentication and verify information accuracy.
4. Doing Rather Than Knowing—students will need to regularly interact with complex and sometimes ambiguous information.
5. Nintendo over Logic—students tend to prefer "trial and error" learning (derived from gaming experiences) over didactic learning approaches; a balance is needed.
6. Multitasking Way of Life—students have a wide exposure of information due to constant media bombardment.
7. Typing Rather Than Handwriting—the power of "typing" is in the ability word processing gives to manipulate writing easily.
8. Staying Connected—ubiquitous connectivity has changed concepts of distance and location; communication is anywhere, anytime.

9. Zero Tolerance for Delays—the tolerance for delays among our students in access to information and services will grow increasingly shorter.
10. Consumer/Creator Blurring—there are few distinctions among owners, creators, and users of information.

Frand (2000) concludes that "Our institutions need to expand their primary focus from the internal, on-campus, temporal experience to include the external, global, lifelong experience" (p. 24).

A recent study of university students by Andrews and Tynan (2012) addresses learning preferences among college-age students. They propose that "students are looking for more connected and mobile learning opportunities and that 'loose networks' are playing an increasingly important role in supporting learning." They describe "loose networks" as the systems available online (e.g., texting, Facebook, Twitter) that students "dip in and out of" to engage with their peers. They acknowledge that a gap is emerging between students and teachers and that students "are mobile, connecting in ways in which we do not fully understand."

Julie Evans of Project Tomorrow, a national education nonprofit group that collects data annually to create a vision for twenty-first century learning, reports that a disconnect exists between teachers and students in the area of technology use. In Nagel (2009), Evans reports that students,

> have to power down to go to school, and then, at the end of the school day, they power back up again—a real disconnect in the way students are viewing technology from the adults in their educational lives. (Nagel, 2009)

Specific issues reported by students regarding technology use at school included too many blocked Internet sites, rules that prevent personal technology device use at school, and limits on access to technology during the school day.

These studies of student technology pursuits outside of school reveal that students are both highly motivated to participate in new media cultures and participate regularly. Many elements of Frand's (2000) "information-age mindset" are currently observable outside of school by Grade 5–8 students (MacArthur Foundation, 2008; Nagel, 2009). As our students integrate technology into their daily lives, it is time to consider ways to bring student technology skills, experiences, and preferences into school that can potentially enhance instruction.

Educational Technology Change Leadership to Bridge the 4 Cs

When considering the many aspects of change that affect formal and informal leaders of educational technology, a variety of areas must be examined. In section two, Assessing the 4 Cs (As Is), a current picture was offered regarding technology integration by teachers in The Winnetka Public Schools. Later in section six, A Vision of Success (To Be), a vision of the future for the district will be described. Each section follows Wagner et al.'s (2006) framework and presents the "4 Cs," including context, culture, conditions, and competencies. The end of this study offers a bridging of the As-Is and To-Be scenarios that considers several change leadership theories.

Context is addressed through the consideration of forward-looking planning to prepare for new technology trends (Johnson, Adams, & Cummins, 2012). This section introduces the foundations of research that will inform the strategies and actions for change presented later in this study. Culture is considered through the lenses of effective

foundational professional development (Schmoker, 2011) and the preservation of an organization's successful core practices (Collins, 2006). One aspect of conditions is raised regarding the development of new policy (Heifetz, Grashow, & Linsky, 2009). To explore the area of competencies, three issues are discussed, including shared leadership (Kennedy, Deuel, Nelson, & Slavit, 2011), building capacity within an organization (Fullan, 2008), and technology integration practices described by Puentedura (2012).

Short- and long-term technology planning will be discussed as a context strategy in the final section of this study. Beginning in 2002 the New Media Consortium (NMC) has published an annual report identifying emerging technologies across the globe. NMC results are grouped by the time that each area's impact is expected to occur: near-term horizon (within the next 12 months), mid-term horizon (within two to three years), and far-term horizon (within four to five years). The *NMC Horizon Report: 2012 K–12 Edition* (Johnson, Adams, & Cummins, 2012), examines the technologies that are most likely to impact K–12 education environments over the next five years. According to the *NMC Horizon Report* (2012), within the next 12 months schools should expect mobile devices and apps to be valued as learning tools, and tablet computers (such as the iPad) to offer new learning opportunities, especially as one-to-one computing devices for personalized learning. Within two to three years, schools should expect to encounter game-based learning that will "foster collaboration and engage students deeply in the process of learning." Also, schools are expected to observe the rise of personal learning environments comprised of sets of tools and apps that are compiled by individuals for their own learning. Within four to five years, schools may experience the adoption of "augmented reality" where views of information are layered over the real-world "in ways

that are compellingly intuitive" to learners. At the same time, natural user interfaces are expected to replace the now-standard keyboard/mouse combination with gestures, motions, expressions, voice, speech, and other environmental cues.

As a schools move forward with changes intended to positively impact student achievement, professional development programs will need to be implemented during process. Schmoker (2011) believes that no professional development should ever take place until teachers have put into place a "content-rich curriculum that includes ample amounts of purposeful reading, writing and discussion, and sound lessons." He advocates for teachers to invest time in curriculum development, instructional strategies, and the fundamentals of teaching literacy before a new program is implemented. To promote effective teaching, Schmoker recommends that teachers get time to "develop and practice these new effective lessons" and then "examine the results of each lesson and refine those lessons to make them even more effective." Time to develop and practice new lessons is particularly important in instances where teachers are authoring or adapting projects involving technology integration.

In addition to Schmoker's plan for professional development to positively impact the culture of an organization, Collins (2006) describes culture in more general terms. He defines a "great" organization as one that "makes a distinctive impact and delivers superior performance over a long period." The transformation from "good to great" is a "never-ending journey" of input principles that yield output results to "build the foundations of a great organization." Collins describes four distinct stages: disciplined people, disciplined thought, disciplined action, and building greatness to last. The "Stage 4" principles (building greatness to last) speak to the longevity of an organization and are

not tied to any one specific leader or program. He has observed that great organizations "preserve the core and stimulate progress" by adhering to "core values combined with a willingness to challenge and change everything except those core values."

In a later discussion of conditions, the adaptive leadership topic of policy creation is considered. Heifetz, Grashow, and Linsky (2009) define their key elements of adaptive leadership in seven points. Adaptive leadership mobilizes people to deal with challenges, enables the capacity to thrive, builds on past practices, occurs through experimentation, requires diversity, displaces old ways of doing things, and takes time. The authors focus on connecting organizational change to purpose and acknowledge that "ideological commitments...frequently stand in the way of collective action." They suggest that the shared purpose of educating young people should guide any new policy and suggest that leaders pose the question, "How does this new policy connect to our purpose? How does it help us educate kids?" when considering policy change.

Kennedy, Deuel, Nelson, and Slavit (2011) advocate for teachers and administrators to share leadership responsibilities in school. The authors acknowledge that every educational organization includes both experts and opinion leaders, but that those qualities are not necessarily "comingled;" however, both status and expertise are required in successful shared leadership environments. The authors have identified the following requisites to establish and nurture distributed leadership: identify the staff who hold positions of status and consider the knowledge they bring, anticipate varying levels of collaboration, allow trust to develop over time, and include opportunities to "ask high-level questions and focus on student understanding and achievement." School environments where leadership responsibilities are shared require high-level

conversations about technology integration to maximize the potential of twenty-first century skills.

In a book encouraging leaders to find their organization's purpose, Fullan (2008) shares his six "secrets" of change: love your employees, connect peers with purpose, capacity building prevails, learning is the work, transparency rules, and systems learn. Fullan devotes a chapter to his idea of capacity building within an organization. He states,

> Capacity building concerns competencies, resources, and motivation. Individuals and groups are high in capacity if they possess and continue to develop knowledge and skills, if they attract and use resources (time, ideas, expertise, money) wisely, and if they are committed to putting in the energy to get important things done collectively and continuously (ever learning). (p. 57)

Fullan recommends that organizations find and develop talented employees who are both individually talented and who can develop "cultures of purposeful collaboration" (p. 71).

As teachers work to engage in increasingly transformative technology integration experiences, Puentedura (2012) has created the SAMR model (substitution, augmentation, modification, redefinition) to describe the technology integration continuum. In the two initial stages of "enhancement," teachers begin by engaging in substitution, where technology acts as a direct tool substitute with no functional change. The second stage is augmentation, where technology acts as a direct tool substitute with some functional improvement. The last two steps along the continuum are considered "transformation" stages. In the modification stage, technology allows for significant task redesign within the classroom. In the final redefinition stage, technology allows for the

creation of new tasks that were previously inconceivable. Along with shared leadership and capacity building, Puentedura's transformative technology integration continuum will be discussed as a method to increase competencies in the Strategies and Actions for Change section.

These considerations are presented as educational technology change leadership issues to bridge the 4 Cs of Wagner et al. (2006) and will be further discussed in section seven: Strategies and Actions for Change.

Conclusion

This review presents three leadership perspectives regarding technology integration: teacher instructional methods in technology-rich environments; student learning experiences and preferences; and educational technology change leadership. Each research area explores one facet of the idea that students are bringing technology skills, experiences, and preferences into the classroom. However, no research has been found to date that explores this notion as a primary instructional strategy.

Fullan (2013) offers:

> Integrating technology, pedagogy, and change knowledge is fundamentally liberating. It democratizes learning so that every student learns how to learn for a lifetime of pursuing personal passion, purpose, and fulfillment. Best of all, students learn collaboratively, consolidating connections with others locally and from afar. (p. 4)

While Fullan presents this theoretical framework for merging technology, pedagogy, and change knowledge, this study sets out to explore the idea from the perspectives of students and classroom teachers and offers a set of practical strategies for day-to-day use.

SECTION FIVE: DATA ANALYSIS & INTERPRETATION

This study explores the following theory of change: When teachers understand the technology skills, experiences, and preferences of their students, intentional strategies can be used in the classroom to increase engagement, differentiate instruction, and personalize learning. A two-tier data-gathering process was completed to test this theory. Tier one activities consisted of selecting teachers for the study, surveying students, and interpreting the findings of the survey results to inform the planning of a technology-integrated class project. Administering the student survey and interpreting the survey results were then completed in collaboration with teacher participants. Activities in tier two included co-planning technology-integrated lessons with the participating teachers, gathering field notes while students completed the projects, and analyzing data to find connections among a set of initial student technology use surveys, the lesson completion process, and project assessments. Finally, the teacher participants were interviewed after the student projects were completed to seek patterns, relationships, and other findings regarding student technology skills, experiences, and preferences.

Tier One Teacher Identification

The Skokie School in The Winnetka Public Schools serves all District 36 students in Grades 5 and 6. The school enrollment is 409 students and each grade level is comprised of multiple teams of two teachers each. All students who attend The Skokie School take part in "exploratory" classes in addition to their "core" classes of language arts, math, science, and social studies. The exploratory program emphasizes "exploration, discovery of talents and interests, problem solving, independence, and creativity" (Winnetka Public Schools, 2013). Several teachers at The Skokie School expressed

interest in participating in this study and three were selected: one exploratory teacher of Grade 5 students and two core subject teachers of Grade 6 students.

Mrs. M is an exploratory teacher teaching a year-long course called "Digital Literacy." All Grade 5 students are enrolled in the Digital Literacy course and Mrs. M's students meet every other day for one class period throughout the year. The course focuses upon the creation of digital media projects related to the core curriculum. Many projects allow students to pursue their personal interests. Since students are scheduled along with their regular classroom peers, it is possible to integrate content from core classes into Digital Literacy projects. Previous projects in Digital Literacy have included research projects, writing projects, and presentations. Mrs. M is an experienced teacher who has a long history of successfully integrating technology into her teaching. She was selected as a representative exploratory teacher due to her interest in this study and technology integration in general. Because she works with multiple Grade 5 classes, she was also able to provide a basis for comparison when considering her classes not involved with the study.

Working together, Mrs. M and I selected four Grade 5 classes that would be ready to begin a new Digital Literacy project during the beginning of this study. Parents/guardians of the students in these four classes were contacted for permission to take part in this study. Among the 75 students in these four selected classes, only one did not participate in this study (the student's information was removed from the findings).

Two Grade 6 teachers who were already planning a technology-integrated research project also volunteered to take part in this study. Mr. A and Mr. W, two Grade 6 math/science teachers on different teaching teams, had both successfully integrated

technology into projects in the past and work with two different Grade 6 teams consisting of a total of 81 students. Parents/guardians of the students on these two teams were contacted to grant permission to take part in this study. Among the 81 students in these four classes, one student did not participate in this study (the student's information was removed from the findings). With all teachers selected, the next step was to administer a survey to all of the participating students.

Tier One Student Survey Administration

When creating the questions for the Grade 5 administration of the student technology use survey, the original draft of the questions was written based upon the questioning protocol and responses from my previous study, *Tap the Screen: Technology Integration in Our Students' Lives* (Fuller, 2012). In collaboration with Mrs. M, a few additional questions were added and revised (see questions 14–18 in Appendix C). The choices for all multiple choice questions in the survey were derived from the top answers collected from focus groups in my previous study. The survey was administered using Google Forms, a function of Google Apps for Education that allows surveys to be created, administered, and stored in an online Google Spreadsheet. Grade 5 students responded to the survey during a regular class period using laptops in October 2012. The survey took approximately 20 minutes to administer. The final survey included four sub-sections including technology devices, gaming, online video, and technology in school (see Appendix C). When the survey questions were shared with Grade 6 teachers Mr. A and Mr. W, they decided to use the same survey. The survey was administered to Grade 6 students on iPads during regular class periods in January 2013. Most students completed the survey within 15–20 minutes.

Tier One Student Survey Findings

After all students had completed the survey, the results were downloaded in *Excel* spreadsheets for analysis. Results from multiple choice questions are reported below. Fill-in answers were coded using *"in vivo"* (i.e., "from the actual language found") coding (Saldaña, 2009, p. 74). In many cases, it was necessary to seek further clarification of the *in vivo* responses through online research. For example, responses such as *"MW3," "Modern Warfare," "Call of Duty," "COD,"* and other variants all refer to the same game franchise and are counted as the same response in the results (Activision, 2013). Highlights from the survey findings are reported below.

Students in Grades 5 and 6 have high access to both desktop and laptop computers. Grade 5 students reported that 57.0% have access at home to Mac desktop computers; 31.6% have access to Windows desktop computers; and 11.4% report they have no access to desktop computers or do not know if they have access. Grade 6 students reported that 57.5% have access at home to Mac desktop computers; 24.1% have access to Windows desktop computers; and 18.4% reported they have no access to desktop computers. A few students reported access to both Mac and Windows desktop computers in their homes: 8.9% in Grade 5 and 6.9% in Grade 6. Grade 5 students reported that 62.3% have access at home to Mac laptops; 37.7% have access to Windows laptops; and 18.8% reported they have no access to laptop computers. Grade 6 students reported that 47.7% have access at home to Mac laptops; 29.5% have access to Windows laptops; and 21.6% reported they have no access to laptop computers. A few students reported access to both Mac and Windows laptop computers in their homes: 13.0% in Grade 5 and 21.6% in Grade 6. Among all of these students in Grade 5 and 6, 100%

reported having access to either a desktop, laptop, or both types of computer in their home.

When asked about handheld computers such as iPad or iPod touch devices, most students reported that at least one of these devices is available to them in their homes. Among 75 Grade 5 students, 97 handheld computing devices are available (including 49 iPod touch devices and 49 iPads). Among 81 Grade 6 students, 123 handheld computing devices are available (including 67 iPod touch devices and 54 iPads). Some students reported no handheld computing devices are available to them: 8.0% of Grade 5 students and 2.5% of Grade 6 students.

At the time the survey was administered (2012–2013 school year), Grade 6 is the year when most students in Winnetka report getting their own mobile phones. Among students in Grade 5 in October 2012, 39.7% indicated that they have their own mobile phone, while 54.8% indicated that they did not have their own mobile phone (5.5% did not provide an answer). Among students in Grade 6 in January 2013, 84.0% indicated that they have their own mobile phone, while 14.8% indicated that they do not have their own mobile phone (1.2% provided no answer).

Access to gaming consoles and handheld gaming systems is more prevalent than computer access according to this survey. Among the 75 Grade 5 students who responded to this survey, 99 gaming console systems are reported. The top three systems reported among students in Grade 5 include: Wii (72.0%), Xbox (42.7%); and Playstation (10.7%). Only 4.0% of students in Grade 5 reported having no gaming consoles available to them at home. Among the 81 Grade 6 students who responded to this survey, 118 gaming console systems are reported. The top three systems reported among students in

Grade 6 include: Xbox (66.7%); Wii (59.3%); and Playstation (14.8%). Only 8.6% of students in Grade 6 reported having no gaming consoles available to them at home.

Access to handheld gaming systems is even more widespread than console systems. Among the 75 Grade 5 students who responded to this survey, 141 handheld gaming systems are reported. The top three handheld gaming systems reported among students in Grade 5 include: iPod touch/iPhone (78.7%); iPad (62.7%); and Nintendo (DS, DSi) (42.7%). Only 4.0% of students in Grade 5 reported having no handheld gaming systems available to them at home. Among the 81 Grade 6 students who responded to this survey, 158 handheld gaming systems are reported. The top three handheld gaming systems reported among students in Grade 6 include: iPod touch/iPhone (88.9%); iPad (71.6%); and Nintendo (DS, 3DS, DSi) (25.9%). Only 1.2% of students in Grade 6 reported having no handheld gaming systems available to them at home.

A few notable differences are found among the favorite games reported by students in Grades 5 and 6. The survey asked students to report their favorite five (or less) games for any gaming platform. Well over 100 different games are reported overall. Grade 5 students reported the following list as their top ten list of favorite games:

- *Madden NFL Football* (11, 12, 13) (20)
- *Temple Run* (15)
- *Instagram* (12)
- *Call of Duty* (various versions) (10)
- *Angry Birds* (7)
- *Doodle Jump* (7)
- Mario games (various) (7)

- *NBA* 2K12 (5)
- *NHL* (2K12, 2K13) (5)
- *Wii Sports* (5)

Grade 6 students reported the following list as their top ten list of games:

- *Call of Duty* (various versions) (32)
- *Temple Run* (1, 2) (16)
- *Halo* (3, 4, Reach) (13)
- *Madden NFL* (various versions) (13)
- *NBA* (2k12, 2K13) (13)
- *FIFA* (12, 13) (10)
- Mario games (various) (10)
- *Just Dance* (9)
- *Subway Surfers* (9)
- *Minecraft* (8) [tie]
- *NHL 13* (8) [tie]

Differences in preferred gaming categories are noted between the grade levels. Students in Grade 6 preferred skill and puzzle games (e.g., *Temple Run, Mario* games, *Just Dance*) as the top category, closely followed by first-person shooter and sports games. Sports games topped the list of students in Grade 5, followed by skill and puzzle games, with first-person shooter games at the bottom of the list. In fact, Grade 5 students listed *Instagram* above first-person shooter games, even though *Instagram* (a photo application that allows commenting) is not a game and has a minimum age requirement

of 13 to register and use the service (Instagram, 2013). (No Grade 5 students in this group were 13 years old at the time of this survey.)

When asked about favorite online video categories to watch, both grades responded similarly. The top video genres for Grades 5 and 6 are comedy/funny and music videos. The responses for students in Grade 6 indicated that they enjoy watching specific YouTube comedy sketch shows including "Smosh," and "Tobuscus."

When students were asked, "If you could make videos in school, what kinds would you like to make?" the responses also indicated some variance between the grade levels. Top answers from Grade 5 included comedy/funny, music, and sports videos. Students in Grade 6 responded that they would enjoy making videos in the following categories: movies (including movie trailers), comedy/funny, education (including how-to), and music videos.

Students in Grades 5 and 6 reported similar answers to the question, "What technology do you most enjoy using at school?" Top answers generally included portable devices over stationary technology equipment. The top answers for Grade 5 are: laptop, computer, and iPad (when students answered "computer" in this open-ended question, it was unclear whether they meant desktop or laptop computers). Among the 81 students surveyed in Grade 6, 80 replied that they most enjoy using iPads at school. It is worth noting that in both Grades 5 and 6, several respondents mentioned more than one device in open-ended responses (e.g., 23 Grade 6 students mentioned that they like using both laptops and iPads in school). Students were also asked, "What technology have you used at school that has benefitted your learning the most?" Students in Grade 5 answered "computer" and "laptop" as their top two answers. Students in Grade 6 overwhelmingly

agreed that the iPad had most benefitted their learning, followed by “laptop” and “computer.”

When students were asked to “Describe your favorite school projects that you have completed (with or without technology),” 142 projects were mentioned across both grade levels. Top projects in Grade 5 tended to be projects that students had completed during their elementary school years, likely because the survey was administered during the second month of school. Top projects in Grade 6 were mostly projects that students had completed during the current school year. Grade 5 students indicated that they enjoy the following school projects and experiences: Pioneer Room and Immigration project (day-long role-playing experiences after weeks of class research); Great Brain, Expert Report, and Animal Report (research followed by multimedia presentations); and Camp Edwards and Snake Road (overnight outdoor education experiences). Grade 6 students offered fewer examples (43) including: projects culminating in presentations, creating graphs on iPad, making a music CD, and compiling a book about Egypt following research. While the top Grade 6 examples each include a major technology component, technology is less of a focus in Grade 5 examples.

The final question on the survey regarding school technology use at school was, “If you could design your own school project that uses any kind of technology, what would it be?” Students in Grade 5 provided 19 answer categories, while students in Grade 6 provided 28 ideas. The top response among students in Grade 5 is that they wish to make an app (an application that runs on a handheld computing device), with several students specifying the device running the app as iPhone, iPad, or iPod touch. The next most popular responses included: make a video, movie, or show; learn about, build, or

use technology devices; make a website; make a game (a response similar to “make an app”); make a blog; and create education or how-to content. Students in Grade 6 placed “make a movie” at the top of their list, followed by: create a presentation; use more technology devices; design an object or architectural project; create graphs and charts; make a game or app; produce a documentary or reality show (similar to “make a movie”); conduct online research; and create a science project.

One possible reason that iPad responses were more likely among Grade 6 students was that Mr. A and Mr. W had previously used iPads as part of their classroom instruction. In fact, Mr. A was among the first teachers in this school district to pilot the use of iPads in his classroom (beginning in the school year prior to this study). As a result, all Grade 6 students on both participating teaching teams had used iPads in the classroom prior to this study. Since iPads were fairly new to the school district at the time of this study, it is unlikely that students in Grade 5 had used iPads in school before the survey was administered.

This data analysis was a first step to planning technology-integrated projects with the participating teachers. A meeting was held with each of the participating teachers during which the above findings were presented. As a result of the data presentation, several categories were further analyzed to provide more targeted information for the project-planning steps. The next section discusses tier two technology-integrated lesson co-planning. During this phase, specific information is used to develop new projects based upon the student technology skills, experiences, and preferences that were discovered as a result of the survey data analysis.

Tier Two Technology-Integrated Lesson Co-Planning

The purpose of the tier two technology-integrated lesson co-planning step was to work with the participating teachers to co-plan the details of the technology-integrated projects. The participating teachers and I focused on using the information gathered in the surveys to target the technology skills, experiences, and preferences reported by the students. Co-planning activities resulted in the creation of three separate projects: two projects for the Grade 5 Digital Literacy students and one project for the Grade 6 math/science students. Two Grade 5 Digital Literacy classes engaged in an app design project, two Grade 5 Digital Literacy classes created book trailers, and all four Grade 6 classes engaged in an environmental inquiry project. This section describes each project and connects the survey data results to the lesson plans.

The results of the Grade 5 student technology use surveys indicated that the four selected classes shared many commonalities among responses. However, the response to the question, "If you could design your own school project that uses any kind of technology, what would it be?" yielded a pattern of responses indicating that two classes shared one set of preferences that favored app creation and the two other classes preferred video creation.

The two classes that indicated an interest in app design shared their top two responses as "make an app" (10 total responses). Both classes provided additional related responses such as "make a game" (3 total responses); "programming" (2 total responses); and "make a website" (7 total responses). Among these pursuits, all top responses require logical design, visual literacy, the capability to present ideas, and/or the ability to work collaboratively with others. Using these attributes, Mrs. M and I co-planned a lesson that

allowed students to work individually or in groups of two or three to create an app for a handheld device. The planned lesson included a rubric of all aspects required for the app design project (see Appendix D), an example presentation following all rubric items in presentation format, and a presentation template (using the Apple *Keynote* presentation application). The template includes buttons and interface elements that students can copy and paste into their app designs. The lesson description asks the students to include an app name, icon design, "tag line," the proposed price of the app, and three or more screens showing how the app will work. Students were also asked to write a descriptive paragraph explaining what the app does, who the audience is, and why the app is special. Although the project template provided to students uses iOS[2] devices (as suggested by the student survey), students could also select an alternate device for their app design project if they wished.

The other two Grade 5 classes shared their top student technology use survey responses as "make a video, movie, or show" (12). These classes also shared the following related attributes: "make a blog" (4); "make education or how-to content" (4); and make a presentation (4). These types of projects require planning content that is presented to an audience, pre-writing, pre-planning a script or concept, and possible research. With the preference for video creation in mind, Mrs. M and I co-planned a book trailer video project during which students would create a book trailer about a favorite book from The Skokie School Resource Center (see Appendix E). The lesson description explains that students will make a video of no more than three minutes to persuade others to read a favorite book without giving away the ending. Students were asked to include a storyboard and script, and the video could be created in an application of the students'

choice. Available applications included *iMovie, Animoto, Comic Life,* and others. The students were given as much flexibility as possible in selecting their books and video creation applications.

Other factors addressed by Mrs. M and me during project co-planning incorporated findings from other survey responses. Students in Grade 5 reported that they are frequent users of handheld computing devices outside of school including iPod touch (49) and iPad (46) (both iOS devices that run apps). Students used both laptop and desktop computers to complete their projects, indicated by 68 respondents as the technology that they most enjoyed using at school. Another top response among all four classes to, "If you could design your own school project that uses any kind of technology, what would it be?" was the preference to "learn about, use, or build a hardware device" (11 total responses). Both the app design and book trailer projects allowed interaction with additional hardware devices such as iPod touch, iPad, video cameras, and other devices.

Before co-planning with Grade 6 teachers Mr. A and Mr. W, the technology-integrated project topic had already been identified as an upcoming environmental inquiry; however, the exact details of the project had not been finalized. All Grade 6 students had begun the environmental inquiry project by identifying a specific aspect of environmental study and researching a topic of personal significance. When the Grade 6 survey results were analyzed, clear preferences for both presenting visual information and research were apparent among all four classes.

When considering responses to the survey question, "Describe your favorite school projects that you have completed (with or without technology)," the top four

responses included presenting, researching, and writing. Twenty students responded that they enjoy projects involving presentations and many specifically mentioned that they enjoy using the presentation application *Keynote.* Seventeen research-based projects are mentioned from both the current school year and previous grades. Twelve students indicated that they enjoy creating books that involve writing, page layout, and research, such as a recently completed Egypt book project. Twelve students indicated that they enjoy various writing assignments. Finally, the remaining fourteen students responded that they enjoy projects involving problem solving (e.g., "Problem of the Week") and participating in simulated experiences (e.g., Pioneer Room day in Grade 3). In total, 43 past favorite school projects were identified in a wide variety of areas.

Mr. A and Mr. W decided to allow their students to assist in creating the rubric and criteria for assessing the environmental inquiry project. For this project, the students were asked to select the technology-integrated presentation methods to complete the project with the goal of presenting the information they learned to their peers and teachers. Students selected a primary presentation app and at least one other app to create or adapt media (images, audio, or video) to convey their research and ideas. The student-created rubric included content elements (summary of issue, environmental effects, perspectives of people involved, solutions to problem, personal change, and citations) and project considerations (text, images/video links, digital creation, creativity/aesthetics, and organization) (see Appendix F). Media aspects of the project were assessed in terms of relevance to the topic and quality of the media presented.

Tier Two Technology-Integrated Lesson Process

The four Grade 5 classes spent approximately four weeks completing their projects during their regular Digital Literacy class times meeting every other day. The four Grade 6 classes worked on the technology-integrated presentations for their environmental inquiry projects daily for approximately four weeks. As the projects were being completed, I kept in close contact with the three teachers and regularly visited the classrooms during the process. This section contains some of the observations from my field notes during this process. In addition, I have included some teacher quotations regarding the project completion process.

Each time I visited the two Grade 5 classes engaged in the app design project, students appeared highly engaged with the project and were frequently involved in discussions about possible app features. Many student discussions I overheard were regarding comparisons between the apps they were designing and other similar apps that they already used. A pair of Grade 5 boys I observed was creating an app that would allow users to catalog fish they caught by photo, size, and weight. We had a discussion regarding how the app might be able to access an online fish database to look up the fish using a variety of parameters. Another pair of Grade 5 boys was working to design a "Shirt Maker" app that allowed users to design a custom t-shirt, order it, and have it shipped. At the time, these students were consulting several websites that offered similar services to make sure their pricing was comparable.

Regarding the app design project, Mrs. M frequently commented on the level of collaboration she observed. She said, "with the apps [project], I like collaboration with the groups. They work with each other. There's more collaboration than there is with

other projects." Further, she was impressed by the feedback students received from their peers regarding the features of their proposed apps:

> It was interesting, too, the class, they called them on things. "That's just like so and so!"..."But how is it different from *Instagram?"*... They came back before the period was over and they said, "we figured out a way to make it different from *Instagram."* So I thought their feedback from their peers and the experience that different people have with apps, that really added to the whole experience.

I observed similar engagement with the book trailer projects, including activity among students who were using different techniques to create their movies. Some students were making live-action video recordings in the halls, in other rooms, and in front of the classroom's lighted green screen. Other students were finding images and video footage online that they included in their projects. Many students were using one of several applications or online services to edit their book trailers.

Two Grade 5 girls shared their progress on their book trailer for the book *Divergent* (Roth, 2012). They began by giving me an explanation of the plot: a young girl lives in a dystopian future version of Chicago and is part of a faction in danger of being killed due to her personality traits. The girls explained that they were creating their trailer using found Internet images and text, as opposed to recording original video, because the characters in *Divergent* are all teenagers. Another Grade 5 girl working with a partner described her book, *Dork Diaries* (Russell, 2009), about a girl named Nikki who is struggling to survive middle school while pursuing a love interest and trying to avoid a "mean girl" at school. During my observation, they had just finished using an online

video creation tool called *Animoto.* Neither of the girls had ever used the app before and they selected it because they liked the soundtrack music choices and the "cool backgrounds." Finally, another pair of girls who had read the ghost story *Wait Till Helen Comes* (Hahn, 1986) asked for my assistance in finding "spooky" music for their *Keynote* presentation that they would export as a video with continuous background music. We worked in *GarageBand* to identify several music clips that matched the mood they were seeking.

Mrs. M noticed that the students working on the book trailer project were using multiple applications to complete their projects in order to achieve their desired effects. She noted,

> They get more interested, too, as the time goes on and they see what they can do. They see that if they use an *Animoto,* then "I really don't get to be creative enough, but if I put it into *iMovie,* I can add some more. I can narrate and I can do these different things." I love that they're seeing that they can combine different things.

Since the Grade 6 projects were individual research projects, my observations of these classes revealed engagement of a different type. Each time I entered Grade 6 classrooms, students were spread out all over the room and into the halls, iPads in hand, and Mr. A or Mr. W were usually working with one or two students on some aspect of the project. Mr. A frequently greeted me by calling a student over to show "something cool we discovered about the app" or asking me to help them problem-solve a specific technical issue. In each instance, the particular technical issue posed was quite challenging to solve because multiple students (and the teacher) had already attempted

many possible, and often sophisticated, solutions. Some examples of project-related problem-solving included students importing video into presentations from a variety of sources, exporting media from one app to another, and making app selections based upon the ability to use the data outside of school so the student could continue working at home.

During the projects, Mr. A and Mr. W both commented on the high level of collaborative problem solving and engagement they observed. Regarding problem-solving, Mr. A stated,

> I counted within a minute, five...really good questions from kids about the practicality of stuff, whether it was sending things back and forth from home and school, or how it's going to look, or how we're going to present it. There were just really good questions.

At different times, both Grade 6 teachers commented on student engagement. Mr. W said, "It was amazing the amount of focus in my room," and Mr. A added, "You could hear the electricity buzz." Mr. W also said, "everyday, kids [were] asking, 'Are we going to work on the iPads today? Are we going to work on the project? When are we going to get to that?' A lot of enthusiasm."

Mr. A noted that during an early classroom observation, he was surprised by how many students were using multiple apps to create their presentations. He further observed that, "Students are using apps for the first time as a result of this project and teaching themselves to use the app while they are doing the project."

During project completion, the levels of engagement, collaboration, and problem solving were readily observable. The assessment phases provided an equal level of enthusiasm and focus, observed and reported by the three teachers and me.

In Grade 5, Mrs. M noted that in both the app design and book trailer video groups, students were so excited to show their products that they didn't want to wait until all of their peers had completed their projects before they presented their final products. She noted, "because they were more creative, I think they were more proud of what they did. They want to show it right when they get done."

I attended one of Mr. A's Grade 6 class presentations. Rather than give full-group presentations, each teacher had the students leave the iPad or laptop on which they had created their presentation on their desk. Their peers were asked to view at least ten different presentations in the room and leave unique written comments on a comment sheet next to the device. Since the presentations included audio, video, and/or text, each presentation was a self-contained work that related all of a student's findings on their topic. I observed the same environment described by Mr. W: "It was silent, focused. Forty-five minutes of kids looking at each other's projects and there was not even talking. Switching between desks, they were so focused and interested in each other's stuff." Mr. A agreed and added that the experience was different from past group presentations: "They gave respect by being focused and leaving good comments. In the past sometimes you'd get a hollow comment, like, "I loved it," but allowing them to comment on specifics, I think they respected that."

Having completed both the projects and assessments, the final step in the two-tier process was to compare all data from the initial surveys, teacher interviews, and field notes. The next section provides a description of the findings of the overall analysis.

Tier Two Technology-Integrated Lesson Findings

During the initial design of this study, I had hoped to be able to uncover a substantive list of correlations and connections among the responses from the initial student technology use survey, the completed lesson process, and project assessments. For example, I surmised that perhaps students who reported that they enjoy making music videos outside of school might also choose to create a music video as a school project when given the choice. I had envisioned this type of correlated list being useful to teachers in future lesson planning. However, after extensive analysis of many aspects of the survey data, only a few connections were found. For example, in one series of analyses, I isolated each of the top apps students reported using in their projects and compared those responses to all of their technology use survey responses. Although I did find a few correlations that are reported below, the most significant findings are reported in the later section, Analyzing and Reporting Teacher Interview Data.

The two Grade 5 projects were designed based upon preferences expressed in the student technology use surveys administered at the beginning of the study. The findings in this section address the quality of the student products and the ability of the students to convey their content to their various audiences. Other findings are also referenced from the teacher interviews that were held at the end of the study.

All 36 of the Grade 5 students who completed the app design project used the presentation application *Keynote.* While students had the option to use any application,

all students chose to use the *Keynote* template that was supplied to them by the teacher. Several of the students highly customized their *Keynote* presentations by changing backgrounds, fonts, and slide layout designs.

Since students all used the same application to complete this project, it is likely that this lesson planning decision was a good choice that contributed to the high engagement observed among the students during the project. Further, the templates contained high-quality graphics and actual iOS interface elements that allowed the students to create visuals that appeared polished, professional, and authentic.

It is not surprising that students did not choose to create an app for a device other than an iOS device. Among the 36 students who completed this project, 46 iOS handheld devices (e.g., iPad, iPod touch, iPhone) were reported as being available to students at their homes. For students who reported having no iOS devices available at home, Mrs. M made several iPad and iPod touch devices available in her classroom throughout this project.

Grade 5 students regarded the app design project as a high-status project. Mrs. M observed the project being talked about by Grade 5 students outside of class, "The app project is spreading around the school. They're doing something cool and they want everyone to know that they're doing something cool." Mrs. M also noted that when she surveyed all of her Grade 5 students and asked them to report their all-time favorite Digital Literacy project, over half of the students who answered the survey who had completed the app design project (52.2%) expressed the app design project as their favorite.

Thirty-eight students in Grade 5 participated in the book trailer video project, completed the initial survey, and provided Mrs. M with the names of the applications they selected to complete their projects. Between the two classes that completed the book trailer video project, four individuals and sixteen groups participated, producing a total of 20 book trailer videos.

The top three applications selected by the students included *iMovie* (60.5%), *Keynote* (36.8%), and *Animoto* (18.4%). The *iMovie* application allows students to import original or downloaded video clips or pictures, select the parts of the clips they wish to use, order the clips or pictures, and add effects including transitions, text, soundtracks, and other video and audio (Apple, 2013b). *Keynote* is primarily a presentation application that allows users to add video and audio files to slides, add transitions between slides, and export the presentation as a movie (Apple, 2013c). *Animoto* is an online video editing service that allows users to upload video or pictures from a computer, select a visual style, select music, add text, and then download the video or watch it online (Animoto, 2013). Eight students (21.1%) reported that they used the "Movie Trailers" feature of *iMovie.* This *iMovie* feature allows users to drop video clips and pictures into storyboard-based templates, resulting in a short movie-trailer-style video (Apple, 2013a). Other video applications and techniques used by students included the *Video Star* app for iPad, the *Comic Life* comic creation application for OS X, recording video in front of a green screen to produce special effects, and importing found YouTube clips and web images for use in video productions.

A few correlations were discovered by comparing initial student survey results with the applications selected by the students during the project. Before this project, 16 of

38 (42.1%) students reported that they had not made videos before. Among the 7 students who chose to use *Animoto* for this project, 6 of the 7 (85.7%) reported that they had not made videos before. Thus, *Animoto* is a good recommendation for students with little or no video creation experience. Conversely, 10 of the 14 students who used *Keynote* (71.4%) reported that they had experience making videos before completing this project. Although *Keynote* is not specifically designed as a video creation application, it allows users to export full presentations as videos or use exported *Keynote* content as part of *iMovie* video projects (Apple, 2013c). Thus, *Keynote* is a good recommendation for experienced video editors to create full projects or produce additional content for original video productions.

Almost half of the Grade 5 students who made book trailers (42.1%) used more than one application to complete their book trailer video project. Most of the students using multiple applications (87.5%) used *iMovie* as one of their applications. Similar to the correlation regarding *Keynote* as a video creation tool described above, almost half of the students using multiple applications (43.8%) selected *Keynote* as one of the applications they used to complete their book trailer video project. During this project, students discovered on their own that the *iMovie* and *Keynote* applications could be used complementarily.

Seventy students in Grade 6 completed both the initial survey and a final project survey that asked them to identify the various apps they selected to create their environmental inquiry projects. The top five content creation apps students reported using included *Keynote* for iOS (31), *Book Creator* for iPad (20), *Explain Everything* for iOS (16), *Comic Life* for iOS (12), and *iMovie* for iOS (11). Although a few students used

laptops for all or part of their projects, the vast majority completed their final projects on iPad.

Several apps were pre-loaded on the iPads before the students began their projects based upon responses from the initial student survey and requests from Mr. A and Mr. W. The available apps on the iPads included *Comic Life, Explain Everything, ScreenChomp, SonicPics,* and *Book Creator. Comic Life* for iOS provides users templates for designing comics using "colors, fonts, gradients, balloons, captions, panels and more" (Plasq, 2013). *Explain Everything* is an "easy-to-use design tool that lets you annotate, animate, and narrate explanations and presentations" using the iPad (MorrisCooke, 2013). *ScreenChomp* records touch interactions and audio on an iPad so users can make tutorial videos (TechSmith, 2013). *SonicPics* is an iPad app that turns images into custom slideshow movies with narration that can be shared online (Humble Daisy, 2009). Finally, *Book Creator* allows users to create high-quality electronic books with text and images on the iPad (Red Jumper Studio, 2012).

One interesting finding regarding *Explain Everything* for iOS was that among the 15 students who used the app, 100% of them had responded on the initial student technology use survey by providing examples of videos they would want to make if they could make videos in school. *Explain Everything* was the most popular app for making tutorial-style videos in these projects. Similar apps provided to the students were *ScreenChomp,* used by one student, and *SonicPics,* which was not selected for use in this project.

An unintended finding during the environmental inquiry project was that many students who had previously used the traditional research method of taking notes by hand

on paper index cards instead decided to use note taking apps on the iPad. The iPad apps *Notes Plus* or *Notes* were used by almost half of the participants (44.3%). Referring back to the student technology use survey, some of those students had thought in advance about taking digital research notes. Six of these students (19.4%) specifically mentioned using iPads to take notes when they responded to the open-ended question "What ideas do you have for using your own technology devices for learning?"

Most students reported using several apps to create their final presentation, including the *Safari* web browser and note taking apps (i.e., *Pages* for iOS, *Notes Plus, Notes*). Over one-third of students (37.1%) used two or more content creation apps to complete their projects; students created original media such as audio, video, or custom images in one app and then exported the media into their final presentation. Projects using multiple content creation apps were well reviewed by peers and elicited positive feedback. During the final interview, Mr. A noted,

> [During this project,] using *Keynote* slides to be your opening and closing slides in your *iMovie* or using *Comic Life* to be a part of your *Book Creator,* that's the thing I think kids were excited about and that wasn't part of the lesson plan. That was their own initiative.

Although only a few correlations were found in the tier two technology-integrated lesson findings, some of this information can be used directly by these teachers in future lesson planning. In addition, elements of this learning, such as the apps used and the connections among student interests and specific apps, is likely transferrable outside of this study for use by other teachers and students.

Analyzing and Reporting Teacher Interview Data

The final step for collecting data during this study was to interview the three teachers after the student projects were completed and assessed. The interview questions focused upon how planning, completing, and assessing the technology-integrated project using prior knowledge of students' technology skills, experiences, and preferences affected overall teaching and learning experiences (see Appendix G).

As a result of coding the teacher interviews, twelve distinct attributes for improving teaching and learning in technology-integrated environments were discovered and organized here into two main themes: Enhancing Technology-Integrated Student Learning and Providing a Technology-Integrated Environment. Seven attributes support the theme of Enhancing Technology-Integrated Student Learning theme: engaging students, sharing learning experiences, problem solving, creating with digital tools, learning outside of school, simplifying learning experiences, and practicing student-centered assessment. Five attributes support the theme of Providing a Technology-Integrated Environment: seeking student opinions, providing tools to match student interest, building capacity in the classroom, providing models for teachers, and allowing students to take the lead.

Enhancing Technology-Integrated Student Learning

The theme of Enhancing Technology-Integrated Student Learning includes attributes that affect the learning experiences of students in a technology-integrated environment. These attributes were both observed in classroom visits and reported by all three teachers during the interviews.

The theme of student engagement was the most prevalent to arise during the teacher interviews and was the most easily observable attribute during classroom visits. The issue of student engagement was mentioned eighteen times by teachers during the interview and nearly all of my field notes describe some aspect of student engagement in the activities I was observing. Both Grade 5 and Grade 6 interviews responses included instances when the teachers recall that their students asked them when they would be working on the technology-integrated projects during the day. Also, both interview responses included accounts of students who enthusiastically worked on their projects in school outside of the regular class time. Mrs. M recounted, "[The students] surprised me by wanting to do more... 'Can I work on this at home? Can I come in at lunch? Can I come in in the morning?' I was shocked."

Two types of shared learning experiences were reported in the two interviews: student-to-student and student-to-teacher shared learning. Student-to-student shared learning was discussed by Mr. A and Mr. W in the context of both problem-solving and sharing app features to enhance presentations. Mr. W stated, "There were a lot of students teaching each other how to use the technology, which was cool. A lot of helpers and troubleshooting." Mrs. M discussed student-to-student shared learning in terms of collaboration, "I like collaboration with the groups. They work with each other. There's more collaboration than there is with other projects." Both Mr. A and Mr. W related accounts of students teaching teachers about specific app features or assisting in troubleshooting. Mr. W stated, "I think it was a great opportunity for them to teach me some things. And then at the same time I felt like I got a lot out of it."

Related to the shared learning experiences described above, problem solving was discussed ten times by all three teachers. Mr. W offered,

> I never did hear anyone ever say, "I can't do that." They would work through figuring out if [they] wanted to put a movie in and to put different pictures, or take the comics and put it into a book.

Mr. A and Mr. W mentioned that students would problem-solve using a variety of methods, including trial-and-error, asking their peers for help, asking the teacher for help, and consulting the user guides that were built into the apps. Mrs. M shared an assessment experience where students from other groups helped identify and problem-solve aspects of the app design project for their peers. During my classroom observations, I frequently assisted in various problem-solving issues for all three projects. Finally, Mr. A pointed out that this project also identified areas for system-wide improvement (e.g., sharing data between school and home) for consideration as the district moves forward implementing more one-to-one technology devices.

Although the attribute was only mentioned once, Mr. A eloquently related an important point about creating products with digital tools. In The Winnetka Public Schools, a traditional progressive education environment, students frequently build projects by hand and create physical models and objects. Mr. A expressed during this interview that using digital tools provides a similar experience to using physical-world tools,

> Using this stuff allows kids to almost get back to what it was like when you were an artisan and you're building something with your hands, from

> the ground up. It's not cookie-cutter. It's not answering questions on a sheet of paper. It's truly building something.

The attribute of using technology devices and services to learn outside of school was discussed not only in terms of students working on the three projects that were part of this study, but also in examples of students extending learning that began during the study. All three teachers mentioned that some students made choices to work on their technology-integrated projects at home. For example, Mr. W mentioned that

> There were some kids who went home and downloaded some of the apps that we supplied for them [at school] on their own. And they were able to look at them on their own, after school, or on weekends, and learn more about how to use them and come back and share that information with other kids using the same apps.

Both Mr. A and Mr. W related experiences in which students took ideas learned during the environmental issues project and extended them into other areas. Mr. W shared an electronic book made by a student at home over the weekend about fractions. The Grade 6 girl had purchased her own copy of *Book Creator* on the iTunes Store, installed it on her iPad, and created a how-to book that explained a fraction concept they had recently learned in class. Mr. W explained, "[She] had done it over the weekend and emailed it to me. She said, 'I think maybe some students in our class could use this.'" Mr. A related a similar story about a Grade 6 boy who had purchased and installed a video app called *iMotion HD.* The student had set up the app to take time-lapse photos and documented a snowstorm outside his window at home. Mr. A noted,

> ...excitement that kids come up to me randomly in the mornings and show me how they have used those same apps totally outside of school in venues that they are excited about... I have not ever done anything that has that type of level of excitement as a residual effect.

An attribute discussed four times in the context of the environmental inquiry project was the issue of simplifying learning experiences. The Grade 6 teachers asked their students to research topics using a combination of traditional paper-and-pencil note taking and digital note taking before the students began creating their presentations during this study. Both teachers acknowledged that having access to the web during the project allowed students to more easily access additional or clarifying information. Mr. W stated that students "were able to access any information that they needed to fill in holes pretty easily." Although this observation is not particularly surprising, it does speak to one of the many benefits afforded to students when they are learning in a one-to-one technology device environment.

The final attribute noted as part of the Enhancing Technology-Integrated Student Learning theme is how all three teachers practiced student-centered assessment during the technology-integrated projects. Although each of the three teachers in this study had regularly included students in assessments in the past by involving students in rubric design, conducting peer assessments, or incorporating self-assessments, technology played a major role in the assessments described here. Mr. A and Mr. W acknowledged that peer assessments were more easily performed since each technology-integrated presentation made by students was self-contained and could be easily viewed multiple times by peers. Both teachers related the engagement and focus of their students during

the assessment process and noted that students spent time and care in leaving comments for their peers. Mr. A and Mr. W both spoke about student focus during assessments, while Mrs. M commented that she felt that students were anxious to share their work with peers. Mrs. M further surmised that the creative nature of the two Digital Literacy projects contributed to the pride exhibited by her students. Mr. A also felt that using technology integration transformed the nature of the assessment of this project:

> In the past, we'd probably just give a quiz. We'd probably just learn all the different environmental issues. We'd give a quiz assessing the facts... In this case, you're still making sure as a responsible teacher your kids are learning what they are supposed to be learning, but it's a whole different level.

Just as student learning was positively affected by the technology integration aspects of this project, the teacher interviews also revealed several attributes related to the technology-integrated classroom environment.

Providing a Technology-Integrated Environment

The theme of Providing a Technology-Integrated Environment was expressed during the teacher interviews in terms of five attributes. Each of the following attributes provides a description of some aspect of lesson planning or classroom structure that was useful or notable to the teachers involved in this study.

The topic of seeking student opinions in advance of lesson planning was discussed in both teacher interviews. Both Mrs. M and Mr. W acknowledged that it was helpful to them to know that students were invested in the project even before it began. Mrs. M stated,

> It really made it a much more rich experience. To know what they could do—the people who said they had the experience... I knew who the experts were, and who were engaged in the whole process...before we even started...

Mr. W shared a similar thought: "I think it was interesting just knowing their excitement for the project through the survey. I felt like they were invested in it right from the beginning." Mrs. M also felt that seeking student opinions helped her plan the lessons, citing one survey question as particularly helpful:

> "What school projects have you enjoyed in the past?" I think that really turned out to be the key question... If [students] can be honest with you...then you can design the project around what they enjoy. I think that we've proven that they will do a better job.

After seeking information regarding student technology skills, experiences, and preferences, teachers had a set of information that allowed them to provide tools to match student interest. This idea was discussed thirteen times by all three teachers in the study and the teachers acknowledged that the technology tools allowed the students to produce high-quality work. Mr. A felt that matching technology tools to student interests impacted the entire process:

> I think their ability to communicate to a group what the focus was about of their topic and be able to get all that information and present it in a way that was aesthetically appealing to others and communicated point-on what their topic was about. Technology affected all those parts.

Mrs. M noticed that carefully selecting technology tool options allowed students to create higher quality projects than they had produced in the past. She explained how a group of girls had begun their book trailer project in the *Video Star* app and then moved it to *iMovie* for further enhancement: "There they were in *iMovie* yesterday...working with other kids, helping them figure that out. So again, it wasn't good enough the way it was. And these are the kids that anything is good enough."

The topic of building capacity in the classroom for future technology integration experiences was discussed a total of eleven times by all three teachers during the interviews. Since this study was among the first large-scale technology-integrated projects Mr. W had completed using iPads, he was able to offer a pragmatic observation, "I think it was definitely building capacity for them in a way that, if we were to do another project like this, it would take way less time."

Part of Mrs. M's role is partnering with other teachers to integrate core classroom work with Digital Literacy. She addressed capacity building by saying,

> With all of these things, if we're not integrating it into what we do, it's just not going to be as worthwhile... Teachers will say, "What can we do?" And I'll say, "Well, the kids know how to do this so we can just integrate it into the classes."

Mr. A related his own personal story about how he initially purchased a personal iPad because he "thought it was cool," but soon discovered how he could envision his students using it for learning. He began by saying, "I don't want to add something on top of what we already do, which is a lot, but I definitely want to take what I do and enhance it for kids and their learning." After using iPads with students, he now believes, "If you look

deeply at what these kids did with their projects you'll see genuinely, some really sophisticated thought involved. It does truly enhance their capacity."

Closely related to capacity building is the idea of providing concrete models for all teachers to enhance teaching and learning with twenty-first century tools. Teachers in this study acknowledged that whether their peers are already regularly integrating technology or hesitant to move beyond basic technology use in the classroom, modeling technology is a useful endeavor since it ultimately helps our students. Mr. W stated the importance of allowing teachers to "get their feet wet:"

> The first thing I did with the kids was just using the note taking app to show them how you can take notes—it was kind of just more for getting the technology into their hands and getting comfortable with having a group of kids with 20 iPads, with 20 different things going on. I think slowly, the more comfortable you get with it, the easier it becomes.

Mrs. M explained that she might work with another teacher by starting with a current successful project and then building on it: "I can approach the teachers I think would be receptive and start with them—and then the word gets out. Just like with the apps project with the kids...the possibilities are endless." Mr. W also acknowledged that he encountered a form of professional "peer pressure" from his team teaching partner during the study:

> I think the first thing to do is sharing, sharing some of the stuff that these kids produced...my teaching partner, she's not as comfortable using the iPad, but she's becoming interested because she's seeing this and she's like, "Wow, the posters I'm doing in my room are kind of boring now.

Everybody's doing the same thing. Everybody's got a white poster board. They're doing the same project but it's the same idea." So I think her seeing that made her excited about it.

Finally, the teachers in this study all acknowledged that students are capable of taking the lead in some aspects of technology integration and that a teacher need not be an expert in using every app used by students. During the interview, I asked both Mr. A and Mr. W if they felt they were proficient using all of the apps that the students used in their environmental inquiry presentations. Without hesitation they answered, "Nope," "Not at all." It was further apparent during classroom observations that the main point of all activities was for students to demonstrate their learning about a topic, not to demonstrate their skills using technology. Mr. A explained, "At the end of the day, you want to make sure that kids learned what they learned and that's always important to us." The learning environments created by these three teachers all clearly allowed students the freedom to learn in their own ways using tools that interested them while their teachers facilitated the process. Mr. A also emphatically stated that he genuinely enjoys this style of teaching and learning: "Enjoy learning with your kids. Very few times are we allowed to do that. Enjoy learning with your kids. It depends on your personality, I guess, but I enjoy learning with my kids."

Synopsis

Analyzing and interpreting the data for this study consisted of a two-tier process. The tier one process resulted in a partnership among three teachers, eight classes of students in Grades 5 and 6, and a set of survey data regarding student technology skills, experiences, and preferences. The tier two process began by considering the student

survey data and led to the creation of three technology-integrated projects tailored to the technology skills, experiences, and preferences of the students involved in this study. As students completed these projects, classrooms were visited and field notes were compiled. Finally, the three participating teachers engaged in an interview to discuss the outcomes of the three technology-integrated lessons. Overall, the study yielded a few connections and correlations among the initial student technology surveys and the many choices offered to students during the completion of the projects. However, the most significant learning was derived from the insights shared by the teachers during the final interviews. The analysis of the teacher interview data is organized into the two overarching themes of Enhancing Technology-Integrated Student Learning and Providing a Technology-Integrated Environment. Between the two themes, twelve attributes are offered that not only inform future technology integration for those involved with this study, but also lead to the Strategies and Actions for Change discussed in section seven.

SECTION SIX: A VISION OF SUCCESS (TO BE)

Having analyzed and reported the "As-Is" scenario in The Winnetka Public Schools following the "4 Cs Diagnostic Tool" framework (Wagner et al., 2006), and having conducted and reported on the research with teachers in the school district, the following "To-Be" picture shows "a systemic and dynamic vision of the future" for technology integration in the district. Following the framework of Wagner et al. (2006), context, culture, conditions, and competencies will be used to paint this picture. The "As-Is" scenario defined the issue as teachers not capitalizing on students' technology skills, experiences, and preferences for teaching and learning. In this "To-Be" vision, teachers use students' technology skills, experiences, and preferences to enhance teaching and learning and transform the practice of progressive education.

Context

The "As-Is" account of context related that some students in The Winnetka Public Schools use their personal technology devices in school, but limitations are imposed that negatively affect potential teaching and learning opportunities. This "To-Be" scenario specifically addresses Wagner et al.'s (2006) "skill demands" for the success of our students as learners and citizens and prepares students with the needs of the "knowledge economy" of the 2020s (p. 103). In the future that is "To Be," the following two conditions are addressed:

- Students have appropriate access in and out of school to technology devices and services for teaching and learning.

- Twenty-first century skills are used regularly in classrooms to provide authentic experiences communicating, collaborating, and completing day-to-day activities.

In the To-Be scenario of the future, students have access to technology-delivered services and tools to create an environment to support teaching and learning. This access is realized from a variety of different sources and requires revising policies, rewriting procedures for accessing technology services and devices, and updating the physical network infrastructure of the school district. For every student to have access to a technology device, several options have been offered to the parents of this affluent community. Some options include: the school district provides a device to each student using a deferred payment over time; the school district makes devices available at school that are district-owned; parents purchase their own devices for their children to use in school; and students bring and use the devices they already own.

Since technology changes quickly, specific device models are not specified; instead, a set of features needed for everyday learning activities is provided to families. Some example "standard" features include that a device must be able to connect to the Internet, capture still photos, record video, record audio, and create documents on district-provided learning management systems. Since students are accessing the Internet with devices not owned by the school district, the school board policy has been revised and procedures allow student-owned devices to access the network. A major advantage to allowing outside devices on the district network is that the district web filtering system is extended to student-owned devices. Students benefit from increased connection speeds and availability of Internet-delivered services, while the web filter provides a level of

Internet safety. Finally, district infrastructure has been updated through the addition of wireless access points throughout all buildings and Internet bandwidth (available data capacity) has been increased to meet the demands of the added student-owned devices.

Another important issue of context in the To-Be future is that technology is used for communication, collaboration, and functioning in the classroom in the same ways it is used in daily life. Students' skills, experiences, and preferences in technology help teachers successfully integrate technology into teaching and learning activities. Teachers use their knowledge to allow students to demonstrate twenty-first century skills, such as Wagner's (2008) seven "survival skills" for the twenty-first century. These skills include critical thinking and problem solving; collaboration across networks and leading by influence; agility and adaptability; initiative and entrepreneurship; effective oral and written communication; accessing and analyzing information; and curiosity and imagination (Wagner, 2008).

Culture

Wagner et al. (2006) define culture as the "shared values, beliefs, assumptions, expectations, and behaviors related to students and learning, teachers and learning, instructional leadership, and the quality of relationships within and beyond the school" (p. 102). The efforts related to strategic planning in The Winnetka Public Schools allowed opportunities for teachers to reevaluate values, beliefs, assumptions, expectations, and behaviors while considering progressive education practiced in the district. When technology was identified as one of five major "pillars," along with communication; curriculum, instruction, and assessment; metrics and reporting; and

operations (Winnetka Public Schools, 2012b), the district started down the path of realizing some of the aspects of the "To-Be" future:

- Teachers understand how student technology skills, experiences, and preferences relate to teaching and learning strategies.
- Technology-enabled instructional strategies are used regularly.
- The district has redefined progressive education and considers technology integration and other twenty-first century skills as "progressive practices."

As teachers learn more about their students' skills, experiences, and preferences using technology in and out of school, they develop a better understanding about how these attributes relate to teaching and learning strategies. Learning about student technology attributes has become less of a novelty and more of a commonplace activity that is valued among other ways teachers get to know their students. In addition to the correlations discovered in this study, more patterns have become apparent and new connections are made over time as technology use among students and teachers evolves. It is likely that technology integration will become so conventional that the lines between home and school will be blurred as students and teachers alike will consider the learning and collaborations once confined to the walls of the school a typical part of their everyday lives. In this way, Wagner et al.'s (2006) definition of culture has truly begun to shift "beyond the school."

In this "To-Be" future, technology-enabled instructional strategies are used regularly. Since technology devices are pervasive and regularly used in school, technology integration often occurs transparently. In addition to teachers using technology more frequently for instruction, instructional strategies have become more

sophisticated and granular. Just as each student has a specific set of technology skills, experiences, and preferences, teachers have begun to connect those attributes to learning styles with more precision. The result has been that students now have a high level of personalization in their instruction.

The traditional concept of "progressive education" still permeates the culture of The Winnetka Public Schools. Over half a century ago, progressive education luminary and former district superintendent Carleton Washburne (1952) wrote, "...progressive schools were often referred to as 'child centered schools'—the work grew out of children's interests and needs."

Since technology use has, for many years, been a major part of the child's experience outside of school, the next logical step has been realized that technology integration is now embraced by this school district that values progressive practices. As early as 1999 the district identified itself as "...a dynamic community of learners committed to respecting childhood, challenging the intellect, nurturing creativity, fostering reflection, encouraging action, and exploring possibilities for the future" (Winnetka District 36, 1999). As teachers have learned to capitalize on students' skills, experiences, and preferences regarding technology, these aspects of the district's vision have truly been reflected in the twenty-first century as technology integration is now considered a part of current and future progressive practice.

Conditions

Conditions, as described by Wagner et al. (2006), include the "external architecture surrounding student learning, the tangible arrangements of time, space, and resources" (p. 100). In the "To-Be" scenario where teachers capitalize on students'

technology skills, experiences, and preferences, the following four conditions are realized:

- Teachers and staff are aware of student technology interests, skills, and experiences outside of school.
- School/district rules allow the use of appropriate non-district owned technology devices and services in school (through a formal Bring Your Own Device policy).
- Students have high access to technology devices and services for learning in and out of school.
- The district is considered a leader in effective technology integration practices.

As teachers actively seek information from their students involving technology skills, experiences, and preferences, an ever-increasing awareness of these student attributes has developed. By seeking and using this information over time, teachers have begun to notice how certain student technology skills, experiences, and preferences relate specifically to success in their subject areas, and this information further informs lesson planning and instruction.

As technology use has become seamless, it has been necessary to change certain school and district rules to allow the use of student-owned technology devices and services during the school day. Both teachers and students benefit from a Bring Your Own Device (BYOD) policy and procedures to allow use of their personal devices on the district wireless network. Past bans on the use of personal devices have been lifted and replaced with guidelines for appropriate technology use. Students now have access to

their own personal mobile phones, smartphones, tablets, and laptop computers throughout the day for their learning. Teachers are offered continuing professional development activities to help them learn about the capabilities of these devices for instruction and to help them better manage the classroom environment.

Students and teachers alike use their own personal devices for learning and teaching throughout the school day at appropriate times. The guidelines allow maximum learning to take place while students practice responsible and appropriate use of their electronic devices during the school day. By realizing these aspects of this To-Be scenario, three of the National Technology Goals conveyed by the U.S. Department of Education Office of Educational Technology have been addressed, including: provide broadband Internet access to serve learners inside and outside schools; put a computing device in the hands of every student; and make connectedness the hallmark of effective teaching (Office of Educational Technology, U.S. Department of Education, 2010).

When district parents, staff, students, and community members expressed their desire for the district to be considered a leader in technology integration (Northern Illinois University Public Opinion Laboratory, 2012), leadership criteria had not been specifically defined. However, one of the major themes identified in an analysis of open-ended comments from the different groups revealed that the learning community valued technology use in the delivery of curriculum, not just "technology for technology's sake." The technology integration now in place in the district enhances teaching and learning and matches a description of an exemplary educational technology environment conveyed by Karen Cator, former director of the Office of Educational Technology for

the U.S. Department of Education. The To-Be scenario in The Winnetka Public School includes three attributes described by Cator (Scherer, 2011):

- All students are engaged by interacting with the teacher, with other students, or with the content.
- Assignments are compelling, relevant, and allow for different levels of depth.
- Learning is personalized to allow student choice, interests, and levels, while it scaffolds on prior knowledge.

As a result, teachers understand students' technology skills, experiences, and preferences and are able to engage students; plan and deliver relevant and differentiated assignments; and personalize learning.

Competencies

When Wagner et al. (2006) offered a definition of competencies as "the repertoire of skills and knowledge that influences skills and learning" (p. 98), they also mentioned the need for a systemic approach for professional development. They state that, "Competencies are most effectively built when professional development is focused, job-embedded, continuous, constructed, and collaborative" (p. 98). While Winnetka Public Schools teachers have long demonstrated a wide range of skills and knowledge in instruction, technology integration professional development had not been a major focus until strategic planning efforts brought technology forward as a priority. Along with redefining progressive education for the twenty-first century, developing technology integration competencies through professional development has played a major role in realizing three "To-Be" future scenarios:

- Teachers know students well, including their technology skills, experiences, and preferences.
- Teachers include technology integration strategies among other effective instructional strategies.
- Technology integration is used among other primary instructional strategies.

Teachers in The Winnetka Public Schools know their students well through a variety of intentional activities and programs. Teachers in the lower grades regularly devote class time to Social Emotional Learning (SEL) activities that encourage students to share information about their thoughts, feelings, and opinions, while students in the upper grades take part in an Advisory program that fosters relationships. In the To-Be future, teachers also get to know students in terms of their technology skills, experiences, and preferences. In the classroom, student technology use information is sometimes sought through surveys preceding technology integration activities. The results of these surveys often prompt discussions in Advisory or during class meeting times. For example, when students share stories about their favorite games, they discuss certain facets of the gaming experience, such as a storyline that is similar to a genre read in language arts, the teamwork that was required to complete a difficult level, or how a student inadvertently caused a rift in a relationship due to a heated verbal exchange during an online gaming experience. These types of conversations open dialogue for SEL discussions and also prove useful when teachers transfer the information to lesson planning. For example, when a group of students reported an interest in an online multiplayer game involving building structures with limited resources, the teacher suggested connecting the interest to an upcoming science and math project involving

architectural design using a three-dimensional, drawing app on the iPad. The gaming connection allowed the students to pursue a new, real-world interest that they had not previously identified.

As the knowledge of students' technology skills, experiences, and preferences increases, teachers now include technology integration strategies based upon this information among other effective instructional strategies. Further, as new instructional strategies have been discovered based upon student technology use, professional development activities have been offered based upon the new findings. When a district need is identified for technology integration, district-level professional development is offered formally or informally during the school day by district- or building-level technology staff. As a result of this study, several new lessons and strategies have been developed into courses that are useful to teachers and are shared through the Winnetka Teachers' Institute, a district professional development program.

As teachers have become increasingly familiar with student technology skills, experiences, and preferences, technology integration has become a primary instructional strategy. In a recent survey (Northern Illinois University Public Opinion Laboratory, 2012), 67.8% of teachers either strongly agreed or agreed that they "regularly integrate technology into [their] teaching." As teachers have begun to better know and understand their students, teachers are more likely to capitalize on students' technology skills, experiences, and preferences in their lesson planning and delivery. The percentage of teachers who integrate technology regularly is expected to approach 100% in the next administration of this survey.

The “To-Be” future state of teaching and learning in The Winnetka Public Schools described here relates a picture of the many potential benefits for our students when teachers capitalize on students’ technology skills, experiences, and preferences in teaching and learning contexts. By considering context, culture, conditions, and competencies (Wagner et al., 2006) in detail, the goals for improving teaching and learning in the district become clear. In a school district that values the ideals of progressive education including child-centered, project-based, authentic learning in a purposefully constructed learning environment with the best possible tools, a technology-integrated environment seems a logical and obvious next step for this learning community. The next section describes some specific conclusions and strategies from this study that teachers can begin using immediately to begin to realize the “To-Be” picture described here.

SECTION SEVEN: STRATEGIES AND ACTIONS FOR CHANGE

Bridging the As-Is Conditions and the To-Be Vision of Success

Sections two and six provided contrasting accounts of the technology-integrated learning environment of The Winnetka Public Schools that were examined during this study. Section two, Assessing the 4 Cs (As Is), introduced the issue that teachers were not capitalizing on students' technology skills, experiences, and preferences for teaching and learning. Section six, A Vision of Success (To Be), described a future scenario where teachers use students' technology skills, experiences, and preferences to enhance teaching and learning and transform the practice of progressive education. This study has used the framework of Wagner et al. (2006) to analyze teaching and learning with technology in The Winnetka Public Schools in terms of context, culture, conditions, and competencies.

This final section, Strategies and Actions for Change, will begin by bridging the current As-Is conditions and the To-Be vision of success by considering the differences between the "As-Is" conditions and the "To-Be" vision in each of Wagner et al.'s (2006) "4 Cs" (context, culture, conditions, and competencies). The As-Is/To-Be comparisons combine research findings discussed in section four and suggest strategies and actions for change. In each of the sections, factors regarding organizational theory, professional development, leadership strategies, and communication strategies, as informed by research and best practice, are conveyed.

In this discussion about strategies and actions for change, it is important to keep in mind that The Winnetka Public Schools is school district in an affluent community with a primarily homogeneous population. Students in this district have high access to technology services and devices. In this population where community members are

highly educated and parents are closely involved in their children's schooling, much is expected of the teachers, staff, and administration. As a result, the quality of teachers and staff in this district, like the three who participated in this study, is generally extremely high. Having served in technology leadership positions in five school districts with widely varied socioeconomic conditions and ethnicities served, I have found that each school district has its own set of distinct issues, both positive and negative, including The Winnetka Public Schools. When I contemplate the conclusions from this study, I believe that most of the findings are transferrable to most other school districts. As I report the strategies and actions for change in this section, I will mention when I believe that findings may differ from the conditions inherent in this community.

Context

In order to prepare our students to meet the "skill demands" in the "knowledge economy" of the 2020s (Wagner et al., 2006), students must be able to function in a technology-enabled environment. The major differences of context between current "As-Is" conditions and the "To-Be" vision are the regular uses of technology in the classroom for communication, collaboration, and everyday learning activities. The primary consideration to affect context changes is the need to provide greater access to technology-delivered services and devices in order to create an environment to support teaching and learning.

This study and my previous study (Fuller, 2012) indicate that students in The Winnetka Public Schools have high access to technology services and devices outside of school. However, all three teachers in this study acknowledged that although this out-of-school access seems to make students very comfortable using technology, students

benefit from the in-school opportunities provided by teachers through deliberate and expert lesson planning. By considering students' technology skills, experiences, and preferences, it was clear that student engagement was positively affected.

In terms of organizational theory, teachers reported and I observed instances of all seven of Wagner's (2008) "survival skills" for the twenty-first century: critical thinking and problem solving; collaboration across networks and leading by influence; agility and adaptability; initiative and entrepreneurship; effective oral and written communication; accessing and analyzing information; and curiosity and imagination. Critical thinking and problem solving instances were reported by Grade 6 teachers during the student research phase of the project and by all three teachers regarding the manner in which students combined multiple apps to create final projects; shared data among home, school, and devices; and when students assisted teachers and each other in the use of new apps. App use and troubleshooting experiences also exhibited agility and adaptability on the part of the students. Collaboration across networks was readily apparent in the Grade 5 projects, but was also observed by students in Grade 6 (in these examples, "networks" are defined as both person-to-person exchanges and literal use of the district's digital network and the Internet). The skills of effective oral and written communication and accessing and analyzing information were demonstrated by all students in this study both during the process and during assessments. Curiosity and imagination were both observed and discussed by all three teachers, especially Grade 6 teachers whose students were pursing an environmental topic of their choice. Finally, Grade 5 students who designed apps had the opportunity to demonstrate initiative and entrepreneurship skills when they researched and devised the marketing and pricing for their original app designs.

One leadership strategy to consider when affecting these changes in context is the issue of staying current not just with the present skills, experiences, and preferences of students, but also identifying likely future trends that may soon affect the "skill demands" of students. One historically reliable source to consider for this purpose is the annual NMC Horizon Report (Johnson, Adams, & Cummins, 2012) that examines the technologies that are most likely to impact K–12 education environments in the next five years. This study indicates that the NMC Horizon Report: 2012 K–12 Edition is spot-on with the predicted near-term trends that mobile devices and apps will be valued as learning tools, and that tablet computing would offer new learning opportunities as one-to-one computing devices for personalized learning.

While data from this and my previous study (Fuller, 2012) indicate that Winnetka students have higher-than-average access to technology services and devices (viz., Fuller, 2012, p. 44), current research (Ito et al., 2008; Ito et al., 2009; MacArthur Foundation, 2008) indicates that the majority of American school-aged children have ever-increasing access to Internet and devices both at home and school; thus, these issues of context and the findings in this section would likely be useful in other schools and districts.

Culture

As a result of recent strategic planning efforts in The Winnetka Public Schools, a shift is already beginning to occur in the culture of the district to acknowledge technology integration as a primary teaching and learning tool in the district. The main differences between the As-Is current reality and the To-Be future are in the areas of knowing the whole child through technology skills, experiences, and preferences, and fully supporting technology integration activities at the building level in The Winnetka Public Schools.

Providing additional support for technology integration is currently being discussed as part of strategic planning in The Winnetka Public Schools. As the District Technology Committee (DTC) addresses the various needs related to planning for a one-to-one technology deployment, the areas of device selection, technology infrastructure, and professional development have been studied and analyzed. In addition, the developmental needs of students at different grade levels and teacher professional development have been major planning topics during DTC discussions. Like Schmoker (2011), Winnetka Public Schools teachers believe that curriculum development, instructional strategies, and the fundamentals of teaching literacy are among the primary goals of teaching and learning. These areas are constantly being refined though an ongoing curriculum review cycle that uses the Understanding by Design principles of Wiggins and McTighe (2005) and includes the evaluation and recommendation of potential technology integration during the curriculum design process. The DTC has also acknowledged the need for additional building-level technology integration support at the three Kindergarten–Grade 4 buildings in the district. To this end, a formal recommendation will be presented to the school board to hire elementary building-level technology facilitators.

Due to high-quality teaching, high student achievement, and a tradition of progressive education inherent in culture of The Winnetka Public Schools, it is important that technology integration be implemented and maintained in a way that will move the district forward, but not negatively impact the solid foundations already in place in the district. In many ways, The Winnetka Public Schools fits Collins's (2006) definition of a "great" organization in several contexts, namely student achievement (Illinois Interactive

Report Card, 2013), in that the district "makes a distinctive impact and delivers superior performance over a long period." Collins also offers a leadership strategy appropriate for this discussion: great organizations "Preserve the Core and Stimulate Progress" by adhering to "core values combined with a willingness to challenge and change everything except those core values."

While other schools and districts might be ahead or behind The Winnetka Public Schools in terms of technology integration and support as suggested in this discussion of culture, all school districts would likely benefit by assessing or reassessing the manner in which technology integration is delivered, especially in light of new Common Core State Standards. Consistent use of Understanding by Design principles (Wiggins & McTighe, 2005) during curriculum review and seeking extensive input from teachers in technology integration planning has so far produced excellent results within the district.

Conditions

One of the conditions related to "external architecture surrounding student learning" as described by Wagner et al. (2006) in the context of this study was identified as teachers not knowing about student technology skills, experiences, or preferences outside of school. One assumption I stated in my previous research (Fuller, 2012) was that teachers had not intentionally been ignoring this aspect of knowing the whole child, but that they had simply never considered learning about student technology skills. One major difference between the As-Is and To-Be conditions scenario is that teachers in The Winnetka Public Schools will learn about the students' technology skills, experiences, and preferences outside of school and use the information in lesson planning and technology integration. Another condition requiring change to attain the To-Be future is

that district policy will need to be rewritten and school procedures altered to allow students greater freedom in using personal technology devices in school for the purpose of increasing student learning opportunities.

In order for teachers to learn how to capitalize on their students' technology skills, experiences, and preferences outside of school, both communication and professional development opportunities must be provided. Since strategic planning efforts are currently in process, there is still ample opportunity to embed the learning from this study into the professional development program being devised by the District Technology Committee (DTC). This study will be shared with DTC members for consideration as a follow-up source after the committee's completion of a formal review of literature during the 2012–2013 school year (Winnetka Public Schools District Technology Committee, 2013). Since the results of this study are specifically related to the teaching and learning issues of The Winnetka Public Schools and relate directly to the goals of strategic planning, it is likely that the DTC members will wish to include the strategies and actions for change presented in this study in both the strategic planning recommendations and the professional development program. In the shorter term, this study will also be shared with the superintendent's cabinet and district's administrative team. Assuming the superintendent's approval, this study will be shared with the entire district staff before the end of this school year through one or more communication mediums in place in the district, such as *The Winnetka Wire* (monthly electronic newsletter), the weekly curriculum update, and the monthly technology update. Finally, I plan to submit applications to present these findings at state and regional technology conferences during the 2013–2014 school year.

One specific leadership strategy that will need to be addressed both as part of strategic planning and to increase learning opportunities for students will be the revision of district policy to allow students to use personal technology devices in school. During the study, a few students in each of the eight participating classes elected to complete part of their technology-integrated projects at home using their own devices. In some cases, it was difficult for students to share certain types of media files since the district currently lacks a cloud-based storage system accessible to students at home. Further, students who wished to use personal technology devices to create media outside of school needed special permission from teachers to access their work on their own devices. When considering new policies regarding teaching and learning issues, Heifetz, Grashow, and Linsky (2009) recommend that leaders ask, "How does this new policy connect to our purpose? How does it help us educate kids?" Indeed, district policy restricting student technology access fits Heifetz, Grashow, and Linsky's criteria to consider revising existing policies and procedures.

The conditions described in this section are fairly specific to The Winnetka Public Schools; however, the issues are by no means unique and many of the ideas presented could apply to most schools and districts. My hope is that communicating the results and strategies of this study will benefit more organizations than just the The Winnetka Public Schools. As I develop professional development activities to assist teachers in applying the findings of this study to their own classes, I will pass along those resources at technology conferences, online, and through an electronic book version of this study available in the iBooks Store[3] on iTunes. Further, it is likely that revising the district

policy regarding personal student technology device use in school will be the topic of future research.

Competencies

As I have described, the competencies of the teachers and staff in The Winnetka Public Schools in the areas of instruction and curriculum development are high. When comparing the As-Is competencies described in this study to the To-Be competencies, the differences amount to increasing the technology integration strategies of teachers. To address these competencies, three leadership strategies will be discussed: the organizational theory of distributed leadership, the leadership strategy of capacity building, and a professional development model that teaches transformative technology integration.

The Winnetka Public Schools has a long tradition of shared leadership among teachers and administrators. Like other school districts, Winnetka's teaching staff includes both experts and opinion leaders. With many priorities currently underway in The Winnetka Public Schools as a result of strategic planning efforts, the district believes it important to involve teachers whenever possible in the planning and implementation of new initiatives. Fortunately, the District Technology Committee (DTC) is represented by members who are both experts and opinion leaders. Kennedy, Deuel, Nelson, and Slavit (2011) recommend that leaders identify staff who hold positions of status, consider the knowledge they bring, and involve them in shared leadership experiences. In addition, the DTC will continue to "ask high-level questions and focus on student understanding and achievement" (Kennedy, Deuel, Nelson, and Slavit, 2011) as the group moves forward to plan a one-to-one technology device environment in the district.

The issue of capacity building was discussed during this study in both of the teacher interviews after the students had completed their projects. The teacher participants were impressed by how well students combined the media produced in different apps, solved technology problems when they arose, and delivered high-quality products that matched the goals of the projects. Each of the teachers acknowledged that by successfully planning and completing lessons, they had built capacity in their classrooms for future technology integration projects. This was a powerful conclusion for these teachers related to competencies. At the classroom level, the students exhibited behavior that precisely fits Fullan's (2008) description of "capacity building:"

> Capacity building concerns competencies, resources, and motivation. Individuals and groups are high in capacity if they possess and continue to develop knowledge and skills, if they attract and use resources...wisely, and if they are committed to putting in the energy to get important things done collectively and continuously. (p. 57)

This same leadership strategy inherent in these Grade 5 and 6 classrooms must now be realized at the school and district levels. Designing a hands-on and practical professional development program that allows teachers the time to plan lessons, try apps, and explore media will allow teachers and administrators to have a similar capacity-building experience that was already demonstrated by the students in this study at the classroom level.

Another aspect that was experienced by the teachers and students in this study was the idea of transformative technology integration. Puentedura (2012) describes his SAMR model (substitution, augmentation, modification, redefinition) as a continuum of

technology integration experiences. At the two early stages of the continuum, technology is used to substitute practices already in use. At the two later stages, technology transforms teaching and learning in ways that were previously inconceivable. For example, during the environmental inquiry project, many students used the *Notes Plus* app to take notes for the research part of their project. The SAMR model would label this activity as simple "substitution" since technology acted as a direct tool substitute with no functional change—students typed notes instead of writing them. However, as some students created their presentations, many of their projects were "transformative" on Puentedura's continuum. One transformative example used the SAMR "redefinition" stage where technology allows for the creation of new and previously inconceivable tasks. For example, a student created an animation in the *Keynote* presentation app, exported it as a movie to the app *Explain Everything* and recorded a verbal explanation of the original animation while using a virtual laser pointer to highlight important visuals. Puentedura's SAMR model is another construct that was discussed by the DTC and is a likely candidate for inclusion in future district professional development programs as part of the proposed one-to-one initiative.

This set of change leadership strategies is meant to address the differences between the As-Is current conditions and the To-Be future state as described by Wagner et al.'s (2006) "4 Cs:" context, culture, conditions, and competencies. Clearly, these strategies represent a complex and interdependent set of organizational theories, leadership tactics, and professional development models that will require many years to plan, implement, and sustain. At the same time, the teachers and students who participated in this study experienced many positive changes described above in the

"4Cs" at the classroom level; therefore, the possibility of implementing these types of changes at the school and district levels seems somehow less daunting. Further, this study also uncovered a set of more specific recommendations for use by teachers in the area of technology integration planning. These eight strategies are revealed in the next section.

Creating a Technology-Integrated Environment for Our Students

Having bridged the gaps between the As-Is and To-Be scenarios described in The Winnetka Public Schools in terms of context, culture, conditions, and competencies (Wagner et al., 2006), this study has yielded two practical themes with four strategies each that serve to inform technology integration change in any school or district. The first theme, Enhance Technology-Integrated Student Learning Opportunities, includes four strategies that relate to student learning. The second theme, Provide a Technology-Integrated Environment, conveys four more strategies that can be used by teachers to enhance their learning environment. All of these strategies ask that teachers consider their students' technology skills, experiences, and preferences as part of the overall picture of knowing and teaching the whole child. These eight strategies are offered along with quotations from the teachers who helped identify them during this study.

Theme 1: Provide Technology-Integrated Student Learning Opportunities

Engage students by allowing choices. Teachers who valued student input and encouraged student choice in the lesson design process observed high student engagement that was both easily observed during classroom visits and apparent during the project creation process up to and including project assessment. Mr. A reported, "You could hear the electricity buzz."

Strategy 1—Allow students to make choices about their learning content and technology tools.

Share learning experiences (student-to-student; student-to-teacher). Throughout the project creation process, students were encouraged to try different apps, teach each other how to use app features, help each other solve problems, and learn along with the teacher. These shared learning experiences helped create a sense of community and collaboration and encouraged student leaders to emerge. Mr. W observed,

> ...helping each other out, problem-solving with me...looking at the user guides that come along with the apps... They took the time to look through and figure it out...and if somebody came along and said, "Oh, how did you do that?" another student would help out.

Strategy 2—Allow opportunities for students to share their technology skills, experiences, and preferences with other students and their teachers.

Create with digital tools, learn outside of school, and simplify learning experiences. By encouraging the creative use of digital tools, students were able to produce work that combined elements of media in ways that were unexpected and ultimately served to deliver high-quality products. At the same time, the tools provided opportunities to more easily access their content in and out of school while encouraging problem solving. In the classroom, Mr. W noted that,

> I never did hear anyone ever say, "I can't do that." They would work through figuring out if [they] wanted to put a movie in and to put different pictures, or take the comics and put it into a book, or...add more information... They were able to combine those things and put them

> together. That attitude, that mindset—that they were able to do whatever they wanted and make it look they way they wanted to—it was cool.

Strategy 3—Use current technology tools to allow students to learn inside and outside of school; easily access content; engage in real-world problem-solving; and create authentic digital products.

Practice student-centered assessment. Technology integration did not stop when the projects were completed. Teachers devised ways for students to use technology during the assessment process to demonstrate knowledge and provide peer assessments. After one situation, Mr. W reported,

> There was serious focus and students were really excited to share their work, too. It was really cool to see their excitement about it and they were really excited to look at each other's work, too, and see what other kids had made.

Strategy 4—Provide a variety of technology-enabled assessment methods to allow students to demonstrate and communicate their knowledge for multiple audiences (peers, teachers, parents, community, world).

Theme 2: Provide a Technology-Integrated Environment

Seek student opinions and match tools with student interests. Students reported their technology skills, experiences, and preferences to their teachers before the technology-integrated projects were designed. The teachers then planned activities based upon this information and further allowed student choice during the projects. Mrs. M believes, "If [students] can be honest with you...then you can design the project around what they enjoy. I think that we've proven that they will do a better job."

Strategy 5—Intentionally seek student opinions regarding technology skills, experiences, and preferences, and provide a variety of technology-enabled tools that match known student interests.

Build capacity in the classroom. This study is complete, but the technology-integrated learning in these classes has just begun. Teachers and students used this experience to build a foundation for future technology-integrated projects both in and out of school. Mr. W noted, "I think it was definitely building capacity for them in a way that, if we were to do another project like this, it would take way less time."

Strategy 6—Use technology-integration experiences to constantly build capacity for future activities.

Provide models for all teachers. The teachers who participated in this study have already had an effect on their peers who observed the student engagement, excitement, and high-quality projects produced during this experience. Just as the students helped each other, the participating teachers advocated for similar teaching and learning experiences throughout their building and the district. Mrs. M said,

> If we're not integrating it into what we do, it's just not going to be as worthwhile... Teachers will say, "What can we do?" and I'll say, "Well, the kids know how to do this so we can just integrate it into the classes."

Strategy 7—Use technology integration project examples resulting from student input as models for teachers who do not consider themselves comfortable teaching with technology.

Allow students to take the lead. When a student wanted to try an app or technique unfamiliar to the teacher, students were encouraged to try it. If the idea was unsuccessful,

the student tried something else; if the idea worked, the student moved ahead with it. The teachers acknowledged early in the process that there was no need to be an "expert" in the use of every app, service, or tool in the classroom. Mr. A encouraged student leadership and expressed,

> I don't ever feel the need to ever be an expert in anything... In the past, [the teacher] may be the one they relied upon to find those answers, but not in this case. Their intuitiveness, their ability to work through things they need to problem solve is what helped us to learn stuff as we went on.

Strategy 8—Allow students to use technology apps and tools in their assignments that are unfamiliar to teachers.

For teachers who wish to follow the recommendations in this study and learn about their own students' technology skills, experiences, and preferences, please feel free to use or adapt the survey instrument from this study (see Appendix C, Student Technology Use Survey for Technology Integration).

Conclusion

During this study, over 150 students and three exceptional teachers participated in surveys, discussions, co-planning, classroom visits, troubleshooting, and other teaching and learning activities. The result was this set of change leadership strategies and actions, as well as a set of eight strategies for Creating a Technology-Integrated Environment for Our Students. This study demonstrates that when teachers understand the technology skills, experiences, and preferences of their students, intentional strategies can be used in the classroom to increase engagement, differentiate instruction, and personalize learning.

When a student picks up a tablet-based computer or handheld device, such as an iPad or an iPod touch, the screen illuminates and the first interaction necessary is to swipe an area on the screen—"slide to unlock"—to gain access. This simple sliding motion allows the use of apps, utilities, web pages, a camera, a video recorder, an audio recorder—seemingly endless possibilities for teaching and learning. After a few uses, this action becomes nearly involuntary, but before a learner can tap the screen, they must slide to unlock. Perhaps at no time in history has such a small movement unlocked so much teaching and learning potential.

Endnotes

[1] In this study, "one-to-one" refers to a learning environment where all students have access to a computing device to use for their learning throughout the school day.

[2] iOS is the name of the operating system used to run Apple hardware devices with touch screens, such as iPad, iPhone, and iPod touch. This term follows a naming pattern established by Apple—several products are named with a lowercase "i" followed by an uppercase word (e.g., iMac, iTunes, iPad). "OS" is an abbreviation for "operating system."

[3] The iBooks Store is Apple's electronic book sales and delivery system that delivers electronic books to iOS devices. The iBooks Store is available within the iBooks iOS app, the iTunes Store, and within the iBooks application for Mac.

[4] The researcher danah boyd has chosen to spell her name with lowercase letters. On her website (www.danah.org) she writes, "I really don't like when people remove the 'h' or capitalize my name—it's not how i've chosen to identify."

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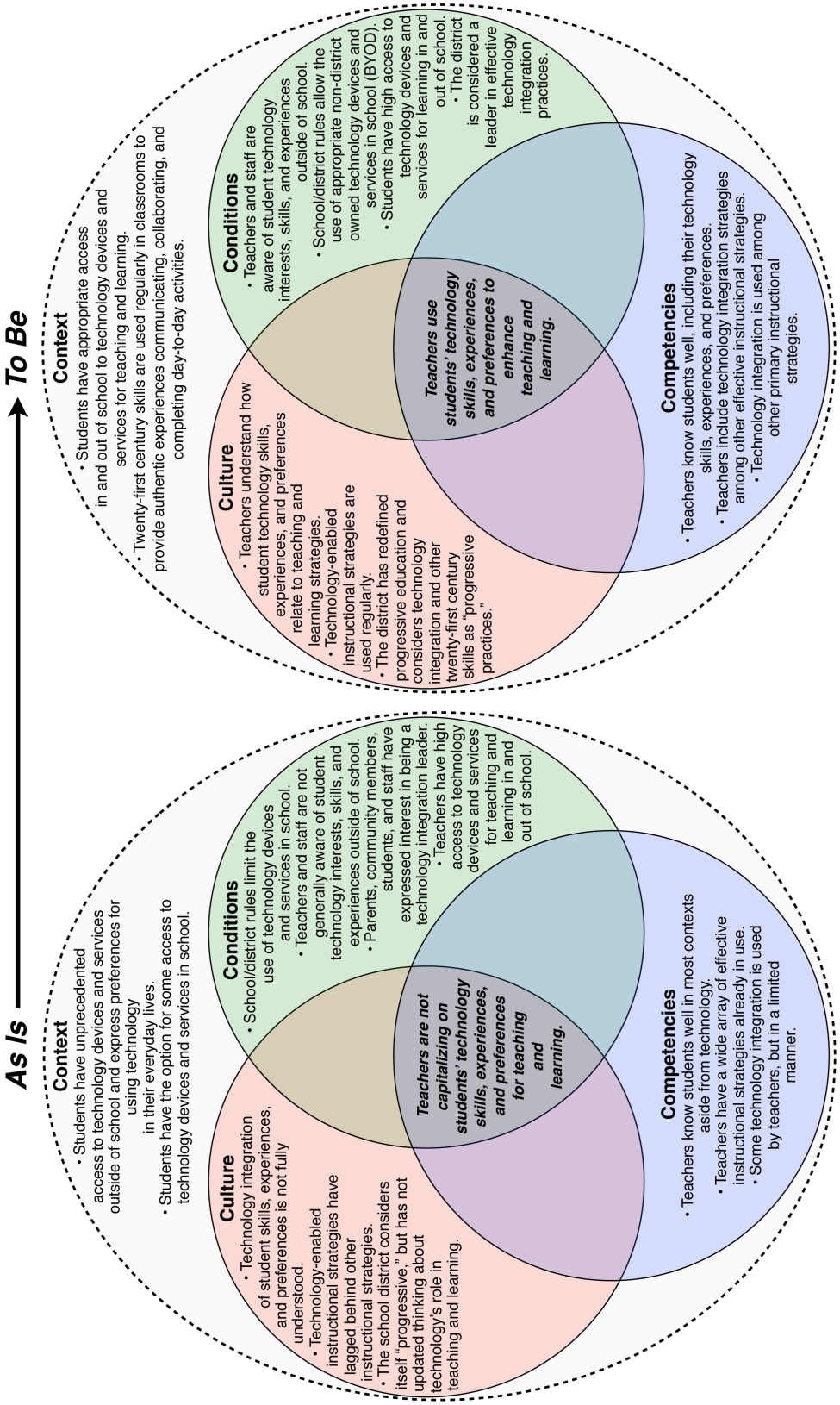
Appendix A
As-Is/To-Be Chart



Framework from Wagner et al. (2006). *Change leadership: A practical guide to transforming our schools.* San Francisco, CA: Jossey-Bass/Wiley.

Appendix B
Mission, Vision, and Values of The Winnetka Public Schools

MISSION

The Winnetka Public Schools is a community that honors the whole child, fosters creativity, inspires lifelong learning, and develops civic responsibility.

VISION

The Winnetka Public Schools will develop learners who are compassionate citizens, who contribute to their community, and are well prepared for a dynamic future.

VALUES

- Reflection
- Life-long Inquiry
- Whole Child
- Civic Responsibility
- Student Voice
- Creativity and Innovation
- Collaboration
- Meaningful, Purposeful, and Experiential Learning

Adopted 2012

Appendix C
Student Technology Use Survey for Technology Integration

First and Last Name:
[ ]

Technology Devices

Desktop computers I use at home:
☐ Mac desktop computer
☐ Windows desktop computer
☐ None
☐ Other [ ]

Laptop computers I use at home:
☐ Mac laptop computer
☐ Windows laptop computer
☐ None
☐ Other [ ]

Handheld devices I use at home (not phones):
☐ iPod touch
☐ iPad
☐ None
☐ Other [ ]

Electronic book (eBook) readers I use at home:
☐ Kindle
☐ Kindle Fire
☐ Nook
☐ None
☐ Other [ ]

Mobile phones I use at home:
○ I have my own mobile phone
○ I don't have my own mobile phone

The mobile phone I use most is:
[ ]

Gaming

Gaming console systems I use at home:
☐ Xbox
☐ Playstation
☐ Wii
☐ None
☐ Other _____

Handheld gaming systems I use at home:
☐ Nintendo DS
☐ Sony PSP
☐ iPod touch/iPhone
☐ iPad
☐ None
☐ Other _____

My favorite gaming system(s) I use at home:

My top 5 (or less) games I play the most:

Online Video

My favorite kinds of videos to watch online:

If you like making videos, what kinds have you made?

If you could make videos in school, what kinds would you like to make?

Technology in School

What technology do you most enjoy using at school?

Describe your favorite school projects that you have completed (with or without technology).

What technology have you used at school that has benefitted your learning the most?

If you could design your own school project that uses any kind of technology, what would it be?

What ideas do you have for using your own technology devices for learning?

Appendix D
Grade 5 App Design Project Description and Rubric

App Design Project

Design an app and present it to your peers.

Your presentation needs to include the following items:

- App icon design
- Name of app on App Store
- Name of app on screen (11 characters or less)
- "Tag line" describing the app (20 words or less)
- A descriptive paragraph explaining what the app does, who the audience is, and why your app is special. You may include a bulleted feature list if necessary. The entire description should fit on 1 slide.
- Price of app
- Three or more screens showing how the app will work
- Names of all app designers

Tools

- iOS app design templates
  - iPads in portrait and landscape
  - iPhone 5 in portrait and landscape
  - iOS buttons and interface elements to copy/paste
  - These are suggestions only—you can use any tools you want.
- iOS app project sample
  - "Cereal Box Maker" app example presentation.
  - You don't need to follow this example exactly, but you need to include the eight items shown above.
- Other resources
  - Use the Internet to find tips on icon design, designing apps, and marketing (getting people to buy) apps.
  - Use other iOS apps for examples.
  - Be aware of copyright. Do not make an app based upon something that was designed by others.

Groups

- You may work alone or in groups of 2–4.

Appendix E
Grade 5 Book Trailer Project Description and Rubric

Book Trailer Project

Create a book trailer about a favorite book from The Skokie School Library. *Book trailers of high quality will be shared with all of The Skokie School.*

Book Trailer Requirements
Persuade others to read your favorite book without giving away the ending.

- Less than 3 minutes long
- Storyboard plan of your script
- Script
- Images (be aware of copyright laws)
- Music (be aware of copyright laws)
- Movie created in technology of your choice: *iMovie, Animoto, Comic Life,* others
- QR code to attach to Resource Center books for others to learn about the book

Resources

ELA Common Core Standard Statements that Support Book Trailers
www.westerville.k12.oh.us/userfiles/4998/Classes/34432/Book%20Trailer%20%20Standards%20chart.pdf

Creating a Book Trailer
http://dragonlady2.wikispaces.com/file/view/CreatingaBookTrailer.pdf

Creating a Book Trailer Requirements
http://mrssatstpaul.edublogs.org/2011/05/03/creating-a-book-trailer-requirements

Book Trailers
www.darcypattison.com/marketing/book-trailers

Book Trailer Rubric

Name_____ Period_____

Title of Book_____ Number of Pages_____

	10	8	7	6	5	
Entices audience and creates intrigue.	I want to read this book NOW!	Putting it on my list.	Might be interested.	Probably won't read this book based on the presentation.	No way I would read this book based on the presentation.	_____/10
Gives information about the conflict, purpose, and/or basis of the book.	Perfect balance! Not too much... not too little. Clearly understand what this book is about.	Almost there...just a bit more or less. Basically understand what this book is about.	Needed more or less. Not totally sure what this book is about.	Too much or too little. Don't really know what this book is about.	Huh?	_____/10
Text	Extremely well written! Concise and to the point!	Pretty good! Maybe a bit too short or too long.	OK. Basic effort and word usage. Needed fewer words.	Too many words or confusing presentation of information.	Way too much! So much, I couldn't read it fast enough.	_____/10
Presentation provides interesting and accurate graphics and music that adds to the overall effect.	Wow! That was impressive.	Pretty good. Could have used just a little something.	Could be better. Wanted more or less.	Needed more or less.	Missing elements.	_____/10
Mechanics: spelling, grammar, and punctuation.	Perfect. No mistakes.	A couple minor mistakes.	A few errors. Needed some work.	Multiple glaring errors.	So many mistakes that it distracted the audience.	_____/10
TOTAL						_____/50

Appendix F
Grade 6 Environmental Inquiry Project Rubric

Name(s)_____

	Criteria	Novice—0	Proficient —1	Expert—2	Your Evaluation	Teacher's Evaluation
	Summary of Issue	The issue was not explained.	Some pieces of the issue were explained.	Issue was thoroughly explained and summarized.		
	Environmental Effects	The effects were not explained.	Some effects were explained but not related to ecosystem.	All environmental effects were explained and related to ecosystem.		
	Perspectives of People Involved	The viewpoints of people involved were not included.	The viewpoints of most people were included.	The viewpoints of all people involved were explained.		
	Solutions to Problem	No solutions were included.	Some solutions were included.	Solutions to problem were included and explained.		
	Personal Change	Had no ideas of what to change.	Partially explained some ideas of change.	Explained what could be done by group members to help solve problem and showed evidence of change.		
	Citations	Did not include citations for information, images, and/or videos.	Included some sources for information, images, and/or videos not properly cited.	Included at least 4 sources for information, images, and/or videos properly cited.		
PROJECT	**Text**	Text was not included or not relevant.	Some text was relevant and had some mistakes.	All text was relevant, readable, and grammatically correct.		
	Images/Video Links	No images or videos were relevant or were not included.	One or two images and/or videos were relevant and of high quality.	At least three images and/or videos were relevant and of high quality.		
	Digital Creation	Digital creation was not included or not relevant.	Digital creation was somewhat relevant, hard to hear, and is easy to follow.	Digital creation was relevant, audible (if necessary), and is easy to follow.		
	Creativity/Aesthetics	Project did not stand out, was confusing, or was not cohesive.	Some of the project was creative, average to look at, elements were not cohesive.	Project was creative, interesting to look at, clear, and all elements worked well together.		
	Organization	Project was unorganized and hard to understand.	Project was somewhat organized and was hard to read.	Project was organized, easy to understand and read.		

Notes:

Appendix G
Teacher Interview Protocol

Lesson Planning

How was your lesson planning affected by knowing student technology skills, experiences, and preferences in advance?

At the time you planned the lesson, what aspects of student technology skills, experiences, and preferences most influenced the planning?
How was your planning influenced?

Looking back, what aspects of student technology skills, experiences, and preferences were the most important and/or made the most differences from a planning standpoint?

What were some specific ways you used knowledge of student technology skills, experiences, and preferences in planning the activity?

How did you feel after you learned about student technology skills, experiences, and preferences?

Lesson Delivery

As students were completing the project, what (if any) differences were apparent from previous technology integration activities?

What aspects of the process were most affected as students completed the projects?
Example process areas (if needed):

- Engagement
- Motivation
- Time spent on task
- Interest
- Mastery of content
- etc.

Assessment

How did the technology integration allow students to meet the lesson goals?

How did these projects differ from projects completed when student technology skills, experiences, and preferences were not known in advance?

In what ways did knowing student technology skills, experiences, and preferences in advance affect the outcome of these projects?

Other Observations

What can you say to other teachers about the experience of planning a project knowing in advance about student technology skills, experiences, and preferences?

How important will it be in your teaching from now on to learn in advance about student technology skills, experiences, and preferences?

What other observations can you offer having completed this study?

Appendix H
Eight Strategies to Create a Technology-Integrated
Environment for Our Students

Provide Technology-Integrated Student Learning Opportunities	
Engage students by allowing choices.	Strategy 1—**Allow students to make choices about their learning content and technology tools.**
Share learning experiences (student-to-student; student-to-teacher).	Strategy 2—**Allow opportunities for students to share their technology skills, experiences, and preferences with other students and their teachers.**
Create with digital tools, learn outside of school, and simplify learning experiences.	Strategy 3—**Use current technology tools to allow students to learn inside and outside of school; easily access content; engage in real-world problem-solving; and create authentic digital products.**
Practice student-centered assessment.	Strategy 4—**Provide a variety of technology-enabled assessment methods to allow students to demonstrate and communicate their knowledge for multiple audiences (peers, teachers, parents, community, world).**
Provide a Technology-Integrated Environment	
Seek student opinions and match tools with student interests.	Strategy 5—**Intentionally seek student opinions regarding technology skills, experiences, and preferences, and provide a variety of technology-enabled tools that match known student interests.**
Build capacity in the classroom.	Strategy 6—**Use technology-integration experiences to constantly build capacity for future activities.**
Provide models for all teachers.	Strategy 7—**Use technology integration project examples resulting from student input as models for teachers who do not consider themselves comfortable teaching with technology.**
Allow students to take the lead.	Strategy 8—**Allow students to use technology apps and tools in their assignments that are unfamiliar to their teachers.**

Appendix I
Sample Personal Immunities Map and Sample Big Assumption

Sample Personal Immunity Map			
1	**2**	**3**	**4**
Commitment	**Doing/Not Doing**	**Hidden/Competing Commitment**	**Big Assumption**
Leader is committed to helping teachers learn about students' technology skills, experiences, and preferences in order to apply the information to enhance teaching and learning.	Leader has developed many professional relationships with teachers across the district who are interested in participating in this research. Leader is known by staff and regularly visits classrooms. Leader has strained relationships with a few teachers who are opinion leaders.	Leader is committed to the frustration that many teachers/staff members are more concerned with their real/perceived technology functionality issues than with furthering their technology integration efforts. Leader is committed to teachers not discovering disagreement with certain technology initiatives in place in the district (e.g., SMART Boards, certain online services). Leader is committed to delivering technology professional development.	Leader assumes that if the wrong decisions are made in connecting students' technology skills, experiences, and preferences to classroom activities that educational experiences will not be enhanced and teachers/staff will lose faith the leader's ability and technology integration efforts will decrease among teachers.

Framework from Wagner et al. (2006). *Change leadership: A practical guide to transforming our schools.* San Francisco, CA: Jossey-Bass/Wiley.

Appendix J
Sample Actionable Test of Big Assumption

To test the Big Assumption, the leader can:

1. Identify one or more teachers who have recently completed technology integration projects or activities
2. Ask the teacher(s) for an informal meeting to discuss the experiences they had during the project:
   - Was the teacher(s) supported by the curriculum and technology supports provided by the district?
   - Did any barriers prevent the teacher(s) from completing their project successfully?
   - Can the teacher(s) suggest any improvements from curriculum, technology, or other district systems to ensure future success?
3. Identify one or more simple, immediate ways to provide identified supports to the teacher(s) and follow up with the teacher(s) with one week.

This Big Assumption test can be completed quickly and as part of a normal school day. The test will allow the leader to immediately gather data regarding authentic needs of teachers already integrating technology. This is only a beginning step that will allow the leader to begin to identify potential issues and needs among staff so curriculum and technology systems can be improved over time and begin to reach additional teachers. Since this test is actionable, the follow-through will also help the leader establish or maintain relationships to help them make a difference in helping overcome the fears they identified in their Big Assumption.

Framework from Wagner et al. (2006). *Change leadership: A practical guide to transforming our schools.* San Francisco, CA: Jossey-Bass/Wiley.

Appendix K

Strategies and Actions				
	Preparing Phase		**Envisioning Phase**	
Lever	**Strategies**	**Actions**	**Strategies**	**Actions**
Data Accountability Relationships	Learn about students' outside skills, experiences, and interests using technology.	Develop one or more tools for teachers to learn about students' outside skills, experiences, and interests using technology (based upon focus group protocol in Fuller, 2012)	Identify teachers interested in working with students' outside skills, experiences, and interests using technology in the classroom.	Work with interested teachers to administer the tool to students (target: at least 2 teachers from 5–6)
Data Accountability Relationships	Connect students' outside skills, experiences, and interests using technology with possible classroom activities using current data.	Identify possible connections based upon previous research (Fuller, 2012).	Connect students' outside skills, experiences, and interests using technology with possible classroom activities in the classroom.	Work with teachers and students to use students' outside technology skills, experiences, and interests and integrate them into classroom activities.
Data Accountability Relationships	Use rubrics to assess the effectiveness of technology use (not the technology itself).	Develop a method to teach teachers how to add technology-integration to rubric-based assessments that defines the effectiveness of technology used for each project.	Assess technology-integrated projects based upon the effectiveness of technology use (not the technology itself).	Work with teachers to assess technology-integrated projects using a rubric.

Framework from Wagner et al. (2006). *Change leadership: A practical guide to transforming our schools.* San Francisco, CA: Jossey-Bass/Wiley.