Pepperdine University

Graduate School of Education and Psychology

DISTRIBUTED LEARNING IN DESIGNING CURRICULUM IN A ONE-TO-ONE COMPUTING ENVIRONMENT

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Doctor of Education in Educational Technology

by

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DEDICATION

There can be only one dedication of this work, and that is to my wife, Jennifer. She went through every minute of this with me, stayed up late, got up early, suffered my defeats, celebrated my victories, and generally took care of me. This work would not have been possible without her love and support.

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Abstract

This qualitative study examined the access to, and use of, online resources, such as primary sources, lesson plans linked to standards, and participation in professional organizations and communities. The goal of this study was to examine how teachers have taken up the task of designing curriculum for delivery in classes where students have their own computers 24/7. It queried teachers about their theory of change linked to the implementation of one to one computing, the methods used to create and apply their own curriculum, and their orientation in general towards the use of technology in learning. It examined teachers' views on student achievement in the use of teacher-made curriculum, and teachers' impressions about the effectiveness of teacher-created curriculum as opposed to textbook centered curriculum.

The primary focus was to examine the process and the effectiveness of teachers making their own curriculum for use in a one-to-one computing environment. While replacing textbooks with computers provided the context of this study, the goal was to examine how distributed learning and cognition affected the pedagogy of teachers in a technology-rich environment.

The study revealed that teachers in a one-to-one environment are taking advantage of the technology to enhance their teaching, and thereby their students' learning. It also showed that, even though this school is immersed in technology, the technology was not finally the point. Teachers did not feel the need to use the computers constantly, with a few teachers opting to use them very little. Teachers at the school combined traditional lesson planning and curriculum design techniques with state of the art digital tools. Teachers generally found that the formula was working, that students' achievement was

going up, and that the school was a more effective learning environment.

Teachers were able to create their own curriculum, using Internet resources, receiving critical support from the school, plan in collaborative groups, believe that use of Internet resources is as good or better than that provided by state-approved textbooks. Technology was generally viewed as a positive influence on students, and student outcomes were positively influenced by the use of technology.

Chapter One
Introduction

There are computers everywhere, from the boardrooms of corporate America, to the checkout counter at the local fast-food chain outlet. As technology has progressed, computers have become smaller, and more powerful. The laptop computer has begun to supplant the desktop, as they have become equals in computing power. The laptop computer represents an approach to more personalized, mobile, and engaged educational experiences and allows learners to "gather, store, organize, analyze, re-present, and communicate information and ideas (Sahl & Windschitl, 2000, p. 5)". It is not uncommon to see all manner of people working on their laptop in public spaces, from coffee houses to public transportation.

> We stand at the beginning of a major revolution in the way people learn . . .. We are moving rapidly toward a future when computers will comprise the dominant delivery system in education for almost all age levels and in most subject areas. Not since the invention of the printing press has a technological device borne such implications for the learning process (Bork, 1985, p. 3).

In recent years, there has been an effort to get computers into schools. Indeed, some districts, in response to the No Child Left Behind (NCLB) legislation of 2002, have mandated a minimum number of computers in every classroom. Although the infusion of laptops into the educational arena was inevitable, an independent girls' school in Melbourne, Australia (Methodist Ladies' College) became the world's first laptop school in February 1990. The Governor of the state of Maine introduced a large-scale, bold initiative titled "From Lunchboxes to Laptops" in 2000 during his

State of the State speech. This proposal promised, beginning in 2002, to provide every seventh grader in Maine with an Internet-ready portable computer.

In September 2005, Appleton High School, part of a school district south of Tucson, Arizona, opened to much fanfare and national media attention. I discovered the school from watching a news feature on the CBS television show, The Early Show, on September 21st of that year. The story spoke of a school where a history teacher "gives a traditional lecture, but the students take notes on their computers. Their homework is posted on the school Web site. They do research over the Internet and turn in their assignments online" (Morales, 2005). My interest aroused, I looked for more documentation and found a story in Wired Magazine that explained more. The story quoted the district superintendent, "We've always been pretty aggressive in use of technology, and we have a history of taking risks." He added that schools typically overlay computers onto their instruction, "like frosting on the cake… We decided that the real opportunity was to make the laptops the key ingredient of the cake ... to truly change the way that schools operated" (Look, Ma, No Schoolbooks!, 2005).

I immediately planned a visit and arrived unannounced at the school's door. I introduced myself and asked to speak to the principal. To my surprise, I was ushered into the principal's office and given much of the same history that I had seen and read previously. I explained to the principal that I wanted to do a study on the school, and she immediately said yes. In fact, the superintendent who I had seen on television only days before was visiting the school that day, and the principal introduced me. He said that he would like to see a study of the school, and offered whatever support I needed.

I found that this was a small high school, which was meant to be kept small. The initial enrollment was 327 students, mostly ninth and tenth graders, with only 41 eleventh graders. There was no senior class during the first year. In fact, the principal of the school told me that the initial enrollment was based more on the fact that parents felt that the school's smaller population would be good for their children, and less about the prospect of using technology on a day-to-day basis.

The school is located in a middle-class suburb of Tucson, Arizona, close to a couple of military bases. As a result, many of the students were military dependents. In that first year, the students were 79% white, 15% Latino, 3% African-American, and 2% Asian. The school was not even finished when I first visited, with some rooms still under construction as classes began the school year.

As the news reports I had seen had said, the school used laptop computers instead of textbooks. When administrators had looked at the budget for the new school, they realized that they had enough money to buy textbooks or technology, but not both. They were faced with the choice of designing the new school and it's curriculum as every other school in the area had been, with textbooks from established publishers that came with conventional curriculum grounded on state standards, or becoming a cutting edge, technology-savvy campus that both delivered its instruction and collected student work digitally.

This was not an easy choice. The former was the safe course of action. The most successful schools in the state had done it countless times. The latter had not been attempted in Arizona. It would be an experiment where success would be lauded, but failure would be devastating to administrators and students alike. The former was

a sure thing, while the latter was a calculated risk. And while there was much anecdotal evidence that one to one computing enhance the educational experience for the students, there was little hard data that supported the idea.

In the end, they chose to buy laptop computers and issued one to every student. They setup a contract arrangement where the students' parents would agree to be responsible for the laptops and accessories that their student received. They also contracted with several online curriculum developers to provide lessons and support for teachers and students. All students at the school were supplied with a new Apple laptop computer, as well as access to resource sites that the school paid for, such as Turnitin[1], a site where students delivered assignments that had features that allowed teachers to catalog and review student work, Powerschool[2], a browser-based, cross-platform school management system, and Studywiz[3], a virtual learning environment designed to make online learning intuitive and practical.

The argument for computing in schools is much the same as the argument for national health care. There is already a national health care plan in place, it just happens to be the most costly and inefficient method possible. Likewise, school districts use computers for accounting, scheduling, record keeping, and so on. The school administrators use computers for timekeeping, attendance, record keeping, and even keeping score at sporting events. School buses have computers in them to help regulate engine functions, school bells are timed using computers, teachers use personal computers to create assignments and keep records. It seems axiomatic that

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1 http://turnitin.com/static/index.html

2 http://www.powerschool.com/

3 http://www.studywiz.com/

computers are necessary in school, so why aren't the customers, the clients, the students in the schools, automatically given computers to do their work on? Everyone already knows that computers are essential.

Computers are everywhere, and in everything. They are in the obvious places—laptops, cell phones, guidance systems, switching equipment—but they are also in the most unlikely of places—refrigerators, cameras, stereos, washing machines, toaster ovens. The micro in microprocessor has shrunk the computer down to where in can fit into a greeting card, a pocket watch, or a heart pacemaker. Ubiquitous computing is here. It is a reality. About the only place we don't see ubiquitous computing is, ironically, in schools, for students.

In 2006, the Arizona State Legislature passed House Bill 1512 creating an e-Learning Task Force to establish an e-learning Pilot Program. The project has been funded by the legislature for $3 million over a 3-year period. The project is limited to no more than 10 sites and/or 10,000 students. The project is to focus on the single curriculum area of middle school math and to achieve academic and motivational gains compared to state and national averages. If one does the math, the state is putting up $300 for each student for a program that will last for three years, or $2 a week. With that, they will establish online learning in a core subject area. Money certainly isn't the issue.

In 1945, after the first atomic bomb was detonated in the New Mexico desert, Albert Einstein, who famously wrote to President Truman about the potential of nuclear power in the production of weapons, said that “Everything has changed,

except for they way that we think". That is the situation with computing in schools. Personal computing is all around us, except in schools.

Statement of the Problem

Ideas contrasting traditional learning environments technology enhanced environments are widespread (Clark, S., 2006; Kinlaw, 2003; Mara, 2006, Hunting, 2006; Lemke & Coughlin, 2006). A traditional learning environment is described as teacher-centered instruction, single-path progression, single-sense stimulation, single media, isolated work, information delivery and passive learning, fact-based, reactive student response, and an artificial context. By contrast, a technology enhanced environment might feature student-centered instruction, multiple-sensory stimulation, multiple-media, multiple-path progression, collaborative work, information exchange with inquiry-based active learning, critical thinking, proactivity, and authentic context, all designed by on site educators.

Much has been written about the pedagogical impacts, the theoretical rational, and the practical implications of providing technology to students, but the evidence with respect to student achievement is mixed often with very little attention paid to it (Cuban, 2001, & 2004). The school's purpose is to educate students and graduate students, and then move them into the next phase of their educational experience--community college, a university, a trade school, or the workforce. A compelling measure of success is the ability of the students to move to the next level with competence.

In addition to using technology as a substitute for more conventional and customary methods of curriculum delivery, teachers have access to a wide scope of resources unavailable even five years ago. The introduction of one-to-one computing makes it possible for teachers to offer a more expansive scope of learning opportunities to

their students. It is possible to give students entrée to a panoply of alternatives that result in customizing their learning. Therefore, the research questions are aimed at discovering how teachers may be able to use this new tool in their classrooms.

Research Questions

The specific research questions are:

- To what extent do teachers use computer tools to design curriculum that supports distributed learning and cognition and enhance learning in a classroom environment?
- To what extend do teachers work collaboratively to design and produce content?
- How do teachers use the Internet as a resource in lieu of state approved textbooks and how do tthey rate the quality of Internet resources as compared to textbooks?
- What relationship, if any, is there between student achievement and the use of technology?

The study examined how teachers have taken up the task of designing curriculum for delivery in classes where students have their own computers 24/7. It queried teachers about their theory of change linked to the implementation of one to one computing, the methods used to create and apply their own curriculum, and their orientation in general towards the use of technology in learning. It examined teachers' views on student achievement in the use of teacher-made curriculum. It examined teachers' impressions about the effectiveness of teacher-created curriculum as opposed to textbook centered curriculum.

Rationale

Schools have been employing computer labs, rooms set aside that teachers may bring their classes to so that they work on computers, for many years. A recent mandate in the Los Angeles Unified School District (LAUSD) called for schools to have an average of five computers per classroom. The order didn't say that the computers had to be disbursed among the classrooms of the school, but rather, seemed to indicate a computer-to-student ratio that should be maintained campus wide. Computer labs, while providing students access to computers, bring the obvious inconvenience of scheduling class time and moving students from between their regular classrooms and the lab (Lowther, Ross, & Morrison, 2003, p. 23), and how to then save, move, and use the information that the students glean from their time on the computers. Moreover, if even one child in a class does not have his/her own computer, a one-to-one environment does not exist, because it necessarily means that some computer sharing will occur, and somebody will be left with nothing to do, even if only for a short time. So if a typical computer lab has thirty seats, a class of thirty-five or forty will come up short.

Another strategy schools have used is to put a classroom set of laptop computers on a rolling cart, thereby making the same set of computers available to many classrooms, and not limiting them to a specific room on campus. Data acquired from a yearlong study revealed advantages for one-to-one laptop students over the cart students (Ross, Morrison, Lowther, Wilson-Relyea, & Wang, 2003, p. 24). Again, the number of students that can be accommodated by a twenty-computer cart is usually not enough for the typical urban class size, and students still would only have a limited amount of time with the computers, and no at-home time. Additionally, carts raise

security concerns because nobody is responsible any particular computer, but instead, the computers are used by the entire community. Besides, “One does not think of community pencils—kids have their own. They are tools to think with, sufficiently inexpensive to be used for work and play, drawing, writing, and mathematics. A computer can be the same, but far more powerful” (Negroponte, 2006).

Despite the growing use of laptops in schools, there are relatively few controlled studies of their effectiveness for learning. In a review of research on technology used to enhance home-to-school connections, there were only twelve studies dealing with classroom laptops (Penuel et al., 2002). “The studies in combination showed small positive effects of the laptop treatments on student achievement. Why such effects occurred, however, was unclear, because of inadequate descriptions of the applications as well as apparent research design limitations in the identified studies” (Lowther, et al., 2003, p. 25).

NCLB says that every student must be tech literate by the eighth grade (Wong, 2006, p. 32). A recent magazine article cited three secondary schools from the United States and Canada where one-to-one computing works (Crais, 2006). It points to efforts by district and school administrators to embrace technology to “enhance the curriculum and provide a way to ensure that students have the technology skills they need to enter college” (p. 28). But again, there is no data to support these ideas, just the observations of the educators involved. And while these testimonies lend weight to the idea that one-to-one computing works to raise student achievement, they are not proof. Additionally, NCLB is not clear on what it means to be tech literate.

Technology and art have always been uneasy bedfellows. To some, the very

> mention of the two in the same sentence is anathema. But technology has played a part in every artistic achievement in history, from the creation of paint for the walls of Lascaux, to motion pictures, to digital manipulation. Every example of human art has a corollary in technological advance (Smith, 2004).

In that sense, what does technology mean? And how much technology makes a student "literate"? "You know, a pencil is a word processor, it's just slower than some others" (Smith, 2007).

Limitations of the Study

The study was limited to the experiences of stakeholders at a high school in southern Arizona. Since the school uses one-to-one instruction exclusively, employing teacher-designed curriculum, it provides a good examination of designing curriculum in a one-to-one environment, but the results may not be applicable to all other high schools.

Definition of Key Terms

Appreciative Inquiry. Appreciative inquiry is a collaborative process that seeks the best in people, their group or organization, and their world (Cooperrider, Whitney, & Stavros, 2003) It requires an orderly investigation into the "life-giving" forces of the organization. This study uses appreciative inquiry as a theoretical research perspective to identify and discover the positive core embraced by teachers and students for the use of emerging technologies in a technology rich learning environment where students have access to one-to-one laptop computers.

Digital Age. The Digital Age refers to the impact of technology on every aspect of human life – from the influence of technology on the workplace to the flow

of goods and information globally, to the influence of technology on daily life (Partnership for 21st Century Skills, 2003). The Digital Age permits computer-based tools to complete the tasks of everyday life (Trilling & Hood, 1999) and places particular emphasis on the impact of the expanding interaction among members of the global society (Partnership for 21st Century Skills).

Laptop Computer. A laptop computer is a portable computer that can run on a rechargeable battery, usually weighs less than eight pounds, and is able to fit on a person's lap[4].

Teacher-designed Curriculum. Curriculum that the classroom teacher has designed independently, or in concert with other teachers at the school, including unit plans, specific assignments, and curriculum pacing.

Textbook-based Curriculum. Curriculum that is based on state-approved textbooks, including unit plans, specific assignments, and curriculum pacing. Typically this curriculum is aligned with federal state learning standards.

One-to-One Laptop Initiative. A learning environment where students and teachers have access to a wireless laptop computer at school and at home (Pitler, Flynn, & Gaddy 2004).

Paradigm Shift. A paradigm shift represents a change in the commonly held belief about a specific concept or idea. A paradigm shift occurs over time, transforming and morphing in a series of reiterations as a result of change (Kuhn, 1996).

Technology Integration. Technology integration allows students to choose the

[4] http://nces.ed.gov/

most effective technology tool and then successfully harvest the information needed to effectively and efficiently synthesize and analyze the data and then to present it using multimedia (U.S. Department of Education; National Center for Educational Statistics, 2002b).

Technology-rich. Technology-rich is the pervasiveness of many different types of technology and electronic communication within an organization, business, or school in addition to computers, hardware, and software.

Wireless. A computer wireless network system that connects two or more pieces of equipment; computers, and peripheral devices that access the computer network without aid of a wire or cable (U.S. Department of Education; National Center for Educational Statistics, 2002b)

Stakeholder. Any person with a direct impact upon, or who is directly impacted by, Appleton High School. These will include, but may not be limited to, students, parents, teachers, school administrators, district administrators, and appointed and elected officials.

Standardized Tests. Tests that are given to a group in a similar setting under similar conditions in order to determine and evaluate against a "norm."

Student Achievement. Quantification of student graduation rates, standardized test scores, and admission to college.

Organization of the Remainder of the Study

Chapter One has included an introduction to the topic, a description of the purpose and rationale of the study, research questions, limitations of the study, and definitions of selected terms frequently used in the study. Chapter Two contains a review of related literature. Chapter Three describes the methodology for the study

and the rationale for the study's design. Chapter Four describes the findings that emerged from the data. Chapter Five includes a discussion of those findings, a presentation of the study's conclusions, and recommendations for further study.

Chapter 2
Review of Literature

This chapter explores the current implementation of one-to-one computing in schools and how teachers are using distributed learning along with that technology to design relevant curriculum in four sections.

The first section examines at the teacher-as-designer, what the objectives are, how it might be delivered, and how it can be assessed. It looks at the how teachers design their curriculum, and the theory behind constructivist learning design. It examines what a successful course might look like, and how curriculum delivery is considered in the design process. It explores how Bloom's Taxonomy is addressed in curriculum design.

The second section looks at the impact of technology in teaching and learning. It examines the relationship between students and laptops, how one-to-one access changes students' daily routine, and ideas of how students relate to digital technology. It explores the relationship between learners and technology, and how teachers are learning to deal with that relationship.

The third section explores the use of distributed learning, and its corollary, cloud computing. In a distributed resources environment learners gain a greater degree of control of how, when, and where their learning occurs (Bowman, 1999). Distributed learning refers to a particular perspective on learning at many different levels, mediated by artifacts ranging from blackboards to computer networks. It is an instructional model that allows instructor, students, and content to be located in different, non-centralized locations so that instruction and learning occur independent of time and place, with the ability to access resources from anywhere on the Internet.

The fourth section profiles ubiquitous computing in schools, how it is working in

classrooms today, and by extension how it might work in the future. The shift to technology-enriched teaching has happened in many schools across the country (Mara, 2006; Morrison, Lowther, & DeMuelle, 1999; Niles, 2006). This section looks back at some large-scale implementation projects across the country.

At the 2007 conference of the Consortium for School Networking, seven former chairs of the group's board of directors, as well as many other industry leaders, gathered for an informal conversation centered on the question: Given the needs of today's learners, as well as the current context of technology in most school districts, what are the most important ed-tech leadership issues that are not receiving attention? One central theme was the need to shift the focus in the national dialog about educational technology from the technology itself to the changes it enables in teaching and learning. A second theme was the need to overhaul teacher education in the United States to produce a new generation of educators who are not only comfortable with technology, but expect it to be used in schools (Pierce, 2007).

Teachers Designing Curriculum

In many ways, teachers have been designing their own curriculum since teaching began. Once a teacher gains some experience in the classroom, it is likely that he or she will start to change the available resources and make them their own. Some teachers resist technology (Thorpe, 2003) in the classroom, so there is no reason to believe that they would do otherwise when designing curriculum. Soloway (2000) has written that the integration of technology is the biggest challenge in teaching in 200 years. Mara (2006) states that focusing on teacher training is at least as important as having computer hardware.

Crais (2006) quotes a school administrator; “It is quality instruction and implementation of research-based teaching practices with integrity that are most likely to improve student learning”, not just computers in the classroom. The Bessie Carmichael Elementary School5 in San Francisco uses release time/substitute support, teachers meet one-on-one with their coach and design appropriate student projects. They pay an outside contractor to come in and train teachers in the most effective methods of designing and delivering curriculum. If students are to use technology as a daily tool, then it is incumbent upon teachers to leverage that tool in the designing of curriculum for those students.

The following criteria drawn from advice on how to creating a successful online course also apply to classroom instruction:

1) clearly articulated objectives and expectations,

2) a course structure that facilitates collaborative learning,

3) assignments and activities that facilitate participation and communication among students,

4) timely feedback for students from the instructor,

5) an appropriate use of technologies to enhance learning.6

It is clear from this list that central goals of teaching and learning do not change with the medium in which they are delivered. However, the methods and techniques employed by teachers in designing and delivering curriculum can very widely. In a one-to-one computing environment, where every student has a laptop computer 24/7, new opportunities, and obstacles, present themselves.

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5 http://portal.sfusd.edu/template/default.cfm?page=es.carmichael

6 http://www.ibritt.com/resources/dc_instructionaldesign.htm

Objectives

When teachers design curriculum, researchers indicate that identifying the instructional objectives is paramount (Lowther et al., 2003). The objectives serve as a guide to developing the curriculum, and they identify how to effectively assess student achievement (p. 48). Lowther et al., write that Mager first made the use of behavioral objectives fashionable in 1984, where specific behaviors can be identified and performed by a student, such as identifying a piece of writing or performing a mathematical calculation. "A Mager type objective has three parts—the action verb and related content, the criteria, and the conditions" (p. 48). The behavioral objective asks the student for something in particular, then the teacher can assess whether the student has accomplished it. This roughly relates to the three lower tiers of Bloom's Taxonomy7, knowledge, understanding, and application. They are beginning steps in cognitive development, and are considered lower-order thinking skills, where "students are asked to receive or recite factual information or to employ rules and algorithms through repetitive routines. Students are given pre-specified knowledge ranging from simple facts and information to more complex concepts."[8]

An alternative to behavioral objectives is cognitive objectives (Lowther et al., 2003, p. 50). Here, students use higher-order thinking skills, analysis, synthesis, evaluation, the top three tiers of Bloom's Taxonomy, to manipulate information and ideas and transform their meaning and interpretation. Students combine facts and ideas in order to synthesize, generalize, explain, or hypothesize some conclusion or interpretation.9 Students create new knowledge based upon the information and data that they are

7 http://www.officeport.com/edu/blooms.htm
8 http://education.qld.gov.au/corporate/newbasics/html/pedagogies/intellect/int1a.html
9 Ibid

studying.

Cognitive objectives lend themselves to constructivist learning, where learners construct their own knowledge on the basis of interaction with their environment. As outlined by Gagnon and Collay (n.d.)—

> "Constructive Learning Design" has been through a variety of revisions in the past seven years and now emphasizes these six important elements: Situation, Groupings, Bridge, Questions, Exhibit, and Reflections. Teachers develop the situation for students to explain, select a process for groupings of materials and students, build a bridge between what students already know and what they want them to learn, anticipate questions to ask and answer without giving away an explanation, encourage students to exhibit a record of their thinking by sharing it with others, and solicit students' reflections about their learning.

Constructivism lends itself to a one-to-one environment because students have access to virtually limitless resources. It is only for the teacher to open the door and let the students through, giving them permission to construct their own education.

According the U.S. Department of Education10, the Internet is an appropriate vehicle for promoting meaningful engaged learning. It allows students to work on authentic, meaningful and challenging problems that are similar to tasks performed by professionals in various disciplines, interact with data in ways that allow student-directed learning, build knowledge collaboratively, and interact with professionals in the field. Teachers in a one-to-one computing environment can take full advantage if the Internet in

10 http://ed.fnal.gov/doe/

identifying objectives for student achievement. They can more closely match the learning styles and abilities of their students to resources (Sternberg, 1999). But teachers have a tendency to focus on methods rather than objectives, techniques rather than understanding, materials rather than process, and structure rather than vision (Levy, 1996). “Before we can make meaningful use of the many tools and structures designed to help educate our children, we need to develop a vision of what is important for our children to learn” (p. 2).

Curriculum Delivery

The time it takes to deliver a conventional lecture may not be necessarily be the same as the time it takes for an average learner to follow the navigational system on an online. The retention rates of learners under computer based training modules plummet after about 45 minutes (Ross, n.d.). Curriculum delivery by way of the computer needs to be highly structured with discrete units of instruction to accommodate student feedback, queries, reinforcement and remediation in order to fulfill lesson objectives. One answer is the shift to backward planning. Backward design is a process that focuses on assessment first and instructional activities last. It shifts teacher perspectives. Traditional curriculum design often begins with textbooks or activities that are required by state standards. Curriculum, lessons, are then planned based on the agenda that those resources set and then some type of assessment is planned when students have ploughed their way through. Backward design forces teachers to look at the big picture with the end goals in mind. In backward planning teachers set the vision or the essential understanding of their curriculum or unit, decide how students will provide evidence of their learning, and

finally design instructional activities to help kids learn what is needed to be successful.[11] Backward planning relies on project-based learning, where students are presented a project that is to be completed, and the resources to complete it.

Wiggins and McTighe (2005) explain how methods and materials are shaped by clear ideas about what the desired outcome should be. “Lessons, units, and courses should be logically inferred from the results sought, not derived from the methods, books, and activities with which we are most comfortable.” They go on to state that the best lessons are derived from examining the "learnings" sought, and planning to achieve those learnings (p14). Backward planning has been a central theme of the George Lucas Educational Foundation, which has published many first-hand stories of teachers implementing it in their classrooms.[12] Papert (n.d.), writing for Lucas, said that the one-to-one computer initiative in Maine made it possible to create a little project where with just 10 kids, we took them out of the regular school and they spent their time—five hours a day—doing project-based work. We used computers, we used MicroWorlds Logo, we used Lego. Some of them built airplanes, some of them built guitars. They worked on projects. And everybody who saw this was staggered at the difference of the energy that they showed there—the kind of involvement, engagement—compared with the lethargic, rebellious attitude in the classes.

Other one-to-one projects have reported similar results. One place where it's working is the New Technology High School, in Napa, California, a thoroughly project-based school since its launch in 1996. " ‘We needed a new type of instruction that better reflected the goals we wanted each student to achieve, demonstrate, and document,’ says

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11 http://www.arps.org/users/ms/coaches/backward design 101.htm

12 http://www.edutopia.org/

Paul Curtis, one of the original lead teachers at New Tech and now director of curriculum for the New Technology Foundation" (Pearlman, 2006). Teachers at the school build their instruction around eight Learning Outcomes—content standards, collaboration, critical thinking, oral communication, written communication, career preparation, citizenship and ethics, and technology literacy. They embed them in all projects, assessments, and grade reports.

Educational Goals and a Vision of Learning Through Technology

Before technology is purchased or teachers participate in their first professional development session, the educational goals for students should be determined. What do students need to learn, and how can technology promote those learning goals? Schools can convene a technology planning team comprising administrators, teachers, other instructional staff, technology coordinators, students, parents, and representatives of the community. Goals, expectations, and criteria for student learning are set, based on national and state standards, the student population, and community concerns. The team determines the best types of technology to meet those goals. Parents and community members are involved in presenting broader perspectives (Critical Issue: Using Technology to Improve Student, n.d.).

Rather than using technology for technology's sake, the planning team ensures that particular educational objectives are achieved more efficiently, in more depth, or with more flexibility through technology.

The planning team then develops a vision of how technology can improve teaching and learning. Without a vision, lasting school improvement is almost impossible (Byrom & Bingham, 2001. The emphasis on meaningful, engaged learning with technology, in which students are actively involved in the learning process, is foremost.

Educational technology is less effective when the learning objectives are unclear and the focus of the technology use is diffuse (Schacter, 1999).

The school's vision of learning through technology also emphasizes the importance of all students having equitable access and use of technology—females, special-needs students, minority students, disadvantaged students, students at risk of educational failure, rural and inner-city students. All students need opportunities to use technology in meaningful, authentic tasks that develop higher-order thinking skills (Critical Issue: Using Technology to Improve Student, n.d.).

Professional Development

It is important to provide professional development to teachers to help them choose the most appropriate technologies and instructional strategies to meet these goals. Students cannot be expected to benefit from technology if their teachers are neither familiar nor comfortable with it. Teachers need to be supported in their efforts to use technology. The primary reason teachers do not use technology in their classrooms is a lack of experience with the technology (Niles, 2006). Teachers who received professional development with computers during the last five years were more likely to use computers in effective ways than those who had not participated in such training (Niles, p. 123).

Teachers cannot be expected to learn how to use educational technology in their teaching after a one-time workshop. Teachers need in-depth, sustained assistance not only in the use of the technology but also in their efforts to integrate technology into the curriculum. Teachers also need embedded opportunities for professional learning and collaborating with colleagues in order to overcome the barrier of time and teachers' daily schedules (Critical Issue: Using Technology to Improve Student, n.d.).

Teachers also need time to become familiar with available products, software, and

online resources. They need time to discuss technology use with other teachers. "Transforming schools into 21st century learning communities means recognizing that teachers must become members of a growing network of shared expertise" (Critical Issue: Using Technology to Improve Student, n.d.).

Teachers Resist Technology

In many cases, it was not the students who resisted new technology, but the teachers. According to Thorpe (2003), "participants adapted the new technological resources to existing practices, resulting in varying degrees of change in organizational strategies, content resources, and student activities" (p. iii). Teachers, as well as the school network, were unprepared for a sudden infusion of technology use, even though teachers feel supported by site-based trainers, administrators, colleagues, and students. Most teachers made use of the new electronic tool across academic disciplines. Kinlaw (2003) reported that they used virtual share tools, created websites, made connections to numerous web resources, and used electronic presentation tools. Soloway (2000) thinks that asking teachers to integrate technology is the biggest challenge they have had in 200 years.

According to Cuban (2001, & 2004), teaching and learning do not change with computer technology. Cuban makes a persuasive case that computer technology has been oversold and underused and has no significant influence on the classrooms of today. Teachers use computer technology in ways that are similar to their already established classroom practices and pedagogies. "Teachers are gatekeepers to school and classroom improvements. Their perceptions, beliefs, knowledge, attention, motivation, and skills come into place when policies (such as those involving computer technology) from state, federal, and district levels arrive at the schoolhouse steps" (Cuban, 2004, p. 106). In other

words, the teachers' pedagogies and beliefs regulate the level and amount to which new technology influences the classroom. Computers may not be changing, transforming, or revolutionizing classroom teaching and learning (Clark, S., 2006).

Bahrampour (2006) reported that some districts are even deciding to abandon one-to-one programs because teachers don't know how to teach with them and students aren't using them. They are finding that laptops are little more than "expensive paperweights" if teachers are not trained to use them in efficient ways that address the curriculum, and that students in classes where the teacher doesn't know how to teach using the computer as a resource see no reason to use it themselves. "Young teachers tend to adapt more quickly...but some teachers say they have felt pressured to emphasize laptops, even when using them might not be the best approach" (p. 2).

Abramson (2002) notes that, "technology or computers do not of themselves confer literacy; nor does their absence inhibit literacy" (p.4). Mara (2006) asks how can technology improve instruction, and how can technology increase learning opportunities for students? Laptop programs around the country have found that computer maintenance and security, student safety, and teacher training are at least as important as having the hardware, and without them, computers are just expensive paperweights.

Even with technology in the room, Gardner (1993) notes that most teachers still relied on teacher-centered instruction, instead of allowing students the freedom to learn in their own individual styles. Individual students having personal computers would necessarily lend itself to individuals learning at their own pace, and in the way that works best for the individual. Many teachers use computers for delivering instruction instead of facilitating student-centered activities such as inquiry and problem solving. Students were

more likely to use the computer as a learning tool rather than a delivery vehicle. Lowther et al. (2003) reported that Laptop students were more attentive and interested in learning as compared to non-laptop students. Laptop students also achieve better results on writing and problem solving assessments.

Access to ubiquitous technology can create new challenges for maintaining student engagement in the learning process. Niles (2006) noted that some teachers feel that continuous connection to the Internet and various forms of communication create a distraction for their students. "Ubiquitous access to technology in a school environment (has) created a natural tension between the teachers' understanding of how students should use technology and how students chose to use technology. Yet, students learning in the technology-rich 21st Century require teachers who can offer innovative pedagogical practices and positive student learning environments that allows for student engagement in the learning process" (p. 121).

Peters (1982) contends that the most effective change occurs as close to the consumer as possible. Kinlaw (2003) extends this observation into education by assuming the effective change should happen as close to the students as possible which means in classrooms.

Summary of Teacher Created Curriculum

Successful curriculum design includes clearly articulated objectives and expectations, a course structure that facilitates collaborative learning, assignments and activities that facilitate participation and communication among students, timely feedback for students, and appropriate use of technologies. Teachers need in-depth, sustained assistance not only in the use of the technology but also in their efforts to integrate technology into the curriculum, as well as embedded opportunities for professional learning and collaborating with. Technology is a tool that has been used for instructional delivery, but that has the potential to impact the teaching and learning environment.

Technology and Classroom Instruction

Computing has always been in schools, albeit in analog form. The abacus dates back to 500 B.C., and slide rules have been used since 1614, when John Napier discovered the logarithm which made it possible to perform multiplication and division by addition and subtraction. Thirty years ago, high school students were forbidden from using hand-held calculators, as it was seen as a form of cheating. It is not as though a lot of students had calculators though, as a simple, four-function hand-held calculator cost nearly $500 in 1970. However, these electronic gadgets were seen as giving students an unfair advantage. Students of that era were consigned to using the slide rule, an analog computer consisting a ruler-sized stick with a sliding insert. The stick and the insert had geometric scales printed on them, and by matching up pairs of numbers, a student could accomplish complicated computations. Using this method, the answers could not be figured to an exact number, but rather a very close approximation, requiring the student to compute the last few places of the answer by hand. Many of the calculations used to

put men on the moon in 1969 were accomplished using a slide rule.

As recently as a few decades ago, the user had to be steeped in technical knowledge, know his way around the hardware, and know a few tricks in order to be productive with computers. People who did not even own a computer were tempted to buy one just because they wanted to be able to use Amazon.com (O'Reilly, 1999). Imagine, a web application that was so desirable that people are willing to invest in new technology just so they could use it. "The secret is that computers have come one step closer to the way that people communicate with each other. Web-based applications use plain English to build their interface—words and pictures, not specialized little controls that acquire meaning only as you learn the software" (O'Reilly). And while there have been "killer apps" in the past, those were largely directed at those people who were already on board with computing, from IT professionals to amateur geeks, getting excited about the latest computer program to do this or that. This time, even people without extensive experience with computing saw the potential in using technology to enhance their lives.

Today, nearly every student carries a personal computer with them at all times, one much more powerful than the computers that helped land a man on the moon. That computer is a cell phone, and while they might be the most ubiquitous computer of our time, few are being used as educational tools in the classroom. "In the U.S. it's pretty much universally acknowledged that computers are essential for 21st century students, although there is still considerable debate about how and when to use them. But to most educators "computer" means PC, laptop or, in some instances, PDA" (Prensky, 2004, p. 1). The debate about whether cell phones are appropriate, or even legal, in schools has

not been resolved, so in the classroom, computing generally means the personal computer, or more precisely, the laptop computer.

Students As Native Speakers of Technology

Prensky asserts that it is not that we don't know that computers are essential; it is simply a matter of how to employ them. Today's students have grown up with digital tools. They are what Prensky (October 2001) calls digital natives, "'native speakers' of the digital language of computers, video games and the Internet". By contrast, most instructors in today's schools are what Prensky calls digital immigrants, "who speak an outdated language (that of the pre-digital age), who are struggling to teach a population that speaks an entirely new language" (p. 1).

Pitler et al. (2004) add that this generation of students wants, indeed, needs to be connected at all times, using digital communication and entertainment devices constantly.

> Many in this generation will not own a telephone that is connected to a wall by a wire. They do not know what a record or even a cassette tape is; instead, they carry an entire music collection in an MP3 player in their pocket Many are connected to the Internet 24 hours, 7 days a week. Digital natives expect their world of information, music, and personal contacts to be with them at all times, whether at school, at home, or in the park. They do not see these technologies as mere tools for learning but, rather, as basic elements of their environment (p. 1).

Szymanski (2006) adds that students that are constantly connected have access to the absolute latest information available. Having anytime access to a plethora of Internet resources, and the Google factor, in the hands of every student has changed the type of

information used to support learning. Teachers often take advantage of current and immediate access to information on the Internet and add meaning and relevancy to assignments. “This is particularly evident with social studies, science, or literature assignments that exhibit some connection to a current event or scholarly project” (p. 4).

One-to-One Computing in Schools

While the testing issue is not likely to be resolved anytime soon, districts, schools, and teachers around the country have steeped their classrooms with the type of media that will excite students enough to engage them in the process of learning. Televisions (with video capability), recordings (CD or tape), overhead projectors, and multimedia additions to textbooks have all made their way into the classroom. Another way of getting media in front of students is to employ computers as a tool. In a one-to-one environment, every student must have a computer. If even one student is without a computer, then a one-to-one environment does not exist. “If you want One Laptop Per Child, there's no elasticity whatsoever. You get five more kids, you need five more laptops” (Negroponte, 2006, December 1, p. 4).

It is the laptop computer that has made one-to-one possible. When laptops are brought to class, a student-to-computer ratio of 1: 1 can be achieved. Home-to-school linkage is also improved (Lowther et al., 2003, p. 25). Lowther et al. have reported that teachers and students see laptops as a vehicle for increasing student interest in learning, and for raising the overall level of academic stimulation in the classroom. Teachers in whose classes laptops were employed were positive about the usefulness of the computers, while “students were very positive about having a laptop, and indicated that the best aspects were easy access to online resources, ease of creating and editing work, and ability to make assignments look much better. Students indicated that the worst

aspects of having the laptop was dealing with technical difficulties and carrying it to and from school" (p. 39). Students in this study reported that the laptop had influenced changes in promoting more project work, research, higher-level thinking, writing, and cooperative learning. Students said that the computer helped them stay organized and helped them access online resources. They also said that their parents were happy with the use of computers. According to Prensky (2001), it is not surprising that digital natives would be positive about the use of computers in their classrooms.

Niles (2006) has noted that the introduction of laptops fosters "bi-directional learning" (p. 114), wherein digital native students function in the capacity of teacher, teaching their teachers as the teachers teach them. Technology has changed the way teachers and students communicate.

One-to-one initiatives can make powerful changes to the learning environment. Pitler et al. (2004) wrote about an initiative in British Columbia, where teachers became facilitators, rather than orchestrating, students' learning. Students took on increased responsibility for their own learning. Teachers' instructional practices and students' attitudes, motivation, work habits, and engagement in learning were also positively impacted.

Technology as a Tool

Technology is a tool that has been used for instructional delivery, but that has the potential to impact the teaching and learning environment. Niles (2006) observed that when students learned "*from* technology," they were likely to be using the computer as a tutor, directing drill and practice, and or delivering information. Niles contrasted this with "Learning *with* technology" where students used the technology as a tool, as "a way of navigating the learning process, and enabling them to improve higher-level critical-

thinking skills, and creativity, and to construct new knowledge" (p. 3). Educators must begin transitioning the practice of learning *from* technology to learning *with* technology. The greater goal is that of transforming the teaching and learning process (Kinlaw, 2003).

It is likely that teacher training is the key to this transition. "In the 1980s, technology was segregated from the curriculum, and computer literacy courses were taught by 'computer teachers.' In the 1990s, technology became supplemental to the curriculum" (Soloway, 2000, p. 23). Technology scattered about without meaningful teacher training will not be used, and will end up being evidence that technology cannot work in school. Teachers cannot use technology that they have little or no access to, either physically or functionally, "let alone integrate that technology seamlessly into curricular activities" (Norris, Sullivan, Poirot, & Soloway 2003, p. 15). Just as a teacher must get students to "buy in" to a lesson or unit, so too must districts, principals, and on-site technology coordinators work to get teacher buy in by properly equipping teachers with the tools to use technology to advance lessons in class. Sufficient access to technology, adequate teacher preparation, appropriate curriculum, supportive school district and site administration, and parental support are necessary for technology to be effective (Norris, Soloway, & Sullivan, 2002).

Universal Access

Beyond facilitating more frequent use of technology in class, providing students with better access to computers can provide students with more equitable access to resources and learning opportunities. Some educators have argued that providing students with a computer that has Internet access gives them the ability to use up-to-date learning resources that before were available only to those who lived close to a library or benefited from school budgets that allowed for regular purchases of new textbooks

(Penuel, 2002,). Gulek, & Demirtas (2005) noted higher GPA's, higher end-of-semester grades, and higher achievement on writing assessments for students who use laptops all day at school, as compared to students who do not.

According to Kinlaw (2003), students use the Internet to access lessons both from online curriculum providers and by teachers at their school.

> In a teacher's classroom who integrates laptop computers, a student might enter the classroom and be directed to check the teacher's website for the week's plans and activities using their wireless computer. Homework assignments would be posted on the site as well as links to related websites. Students might then download and complete a review activity on a previous lesson and place it in the teacher's drop box. The teacher would introduce the lesson and provide an outline of an ensuing discussion using an electronic presentation tool. The teacher would make the electronic presentation available to students by placing it in a virtual share folder so that students could use the classroom presentation as notes for subsequent study and review (p. 111).

Students working with laptops tend to spend more time on schoolwork but are more likely to multi-task as they work, something they are less likely to do when using traditional teaching tools. “Non-work activities (are) interspersed with work, such as checking and sending email, instant messaging, reading news and announcements from clubs and organizations, etc” (Fay, 2006, p. 10). While some teachers may regard these as distractions to the student, Fay argues that students often multi task, whether they are doing mundane chores or critical thinking. They also tend to work as much away from

the classroom as they do in class, although they limit the locations they work in to the same small group of places, instead of working everywhere. Some studies have looked at how students are using laptops in their classrooms and at home. Throughout the studies, students use laptops mostly for writing, taking notes, completing homework assignments, keeping organized, communicating with peers and their teachers, and researching topics on the Internet. They are using word processing software, Web browsers, e-mail clients, and chat programs (Penuel, 2002).

Kinlaw (2003) further reported that students worked wherever it was convenient for them to do so, and were not restricted to working on their school site, but rather, worked at home more.

> Students increased their tendency to work in their rooms, an environment that was more physically comfortable but less conducive to learning or working (more distractions, and less feedback and help); and worked less in a communal setting (cluster or studio); that was more conducive for learning and working (feedback, help, community-building, "inspiring" as one student put it); but less physically comfortable. Even though students recognized these advantages and disadvantages, they opted to work in environments that offered physical comfort over better work/learning environment (p. 18).

Laptops provide students with the flexibility to choose their work location, rather than being locked down to a particular location at school or at home. Classes of students with and without laptops differ significantly in work time spent in a computer lab, in the classroom, and at home. Fay (2006) reported that 91% of students with laptops reported

working at home, while 94% of students without laptops only worked at school. Additionally, students without laptops tended to rely more on group activities and interactions with other students, while laptop students tended to be more independent in the way they worked and gathered research. And, even though students spent the same amount of time in class, students with laptops spent more of their class time working, as opposed to students without laptops.

Enhanced Communications and Flexible Work Locations

Szymanski (2006) reported, "nearly all research studies regarding laptops identify soaring levels of communication as one of the most obvious changes" (p. 2). Student-to-student, student-to-teacher, and teacher-to-student communication by e-mail as well as Internet-based learning environments became the norm instead of the exception. Perhaps even more important is the notion that communication can easily move beyond the traditional classroom community. By using electronic bulletin boards, students have the ability to acquire information that supersedes the age group and locale confines of the classroom. According to Davis (2004), students interact with a greater range of feedback sources (peers, teachers, and others) and show evidence of using specific criteria when they give feedback to others.

Niles (2006) found that the traditional forms of communication were not the primary forms of communication anymore, and were being eclipsed by students' use of emerging technologies, including instant messaging (p. 115). Increases in electronic communication among students promote a sense of anonymity and with it a sense of equality. "Email and instant messaging served as students' vehicles for social exploration and global interaction, and allowed them to feel connected beyond the borders of their school" (p. 116). Emerging forms of communication enabled by one-to-one laptop

computer are allowing this generation of students a bridge to their peers across the street, and across the world.

The laptop has caused a decentralization of the classroom in favor of teachers doing more guiding and facilitating, and less of drill. Teachers said that laptop computers played an important role in their teaching, that they used the computers to design complex assignments, and that they were four times as likely to use the computers for classroom purposes than were teachers whose students did not each have a laptop (Mara, 2006). Three quarters of teachers in the laptop group indicated that students who lacked computer access were being shortchanged as learners and almost that same percentage indicated that students made effective use of computers to improve their own learning (p. 196). Davis (2004) reported that students with laptops show more willingness to take risks, tailoring their learning experience to their own needs. Students were also more likely to offer help to one another, and reported that they were more motivated to learn since getting laptops to use in school.

Laptops, Literacy, and 21st Century Skills

Laptops have also been used to foster literacy. Warschauer (2006) noted that laptop programs were not usually established to improve reading (p. 60), but that they did help teachers scaffold reading assignments by better access to supplementary and background information. Twenty-first Century learning skills concentrate on working with information to produce knowledge. Key dimensions of 21st century learning are: content (global awareness, financial, economic and business literacy, civic literacy), learning skills (information and communication skills, thinking and problem solving skills, and interpersonal and directional skills), and information and communication technology (ICT) literacy. According to The Partnership for 21st Century Skills, these

elements of learning are critical for every child's success as a worker and citizen of the 21st century (Framework, 2004). The concept of learning skills acknowledges the need for students to think critically, analyze information, comprehend new ideas, communicate, collaborate, solve problems, and make decisions, while ICT literacy recognizes that technology is essential to realizing these learning skills in today's knowledge economy (Honey, Fasca, Gersick, Mandinach, & Sinha, 2005). "21st century students need "knowing how to learn" skills that enable them to acquire new knowledge and kills, connect new information to existing knowledge, analyze, develop habits of learning, and work with others to use information" (Warschauer, 2006, p.18).

Summary of Technology Use in the Classroom

Today's students have grown up with digital tools. They are what Marc Prensky calls digital natives, native speakers of the digital language of computers, video games and the Internet. Students that are constantly connected have access to the absolute latest information available. Students have reported that the laptop had influenced changes in promoting more project work, research, higher-level thinking, writing, and cooperative learning. Students have said that the computer helped them stay organized and helped them access online resources.

Technology has changed the way teachers and students communicate. Traditional forms of communication are not the primary forms of communication anymore, and are being eclipsed by students' use of emerging technologies, including instant messaging, promoting a sense of equality. Beyond facilitating more frequent use of technology in class, providing students with better access to computers can provide students with more equitable access to resources and learning opportunities. Laptops provide students with the flexibility to choose their work location, as well as to foster literacy. Laptop programs

can help teachers scaffold reading assignments by providing better access to supplementary and background information.

Distributed Learning

One benefit of having one-to-one computing is taking advantage of distributed learning strategies. Distributed learning refers to a particular perspective on learning at many different levels, mediated by artifacts ranging from blackboards to computer networks. "Distributed learning comes from the concept of distributed resources. Distributed learning is an instructional model that allows instructor, students, and content to be located in different, non-centralized locations so that instruction and learning occur independent of time and place. The distributed learning model can be used in combination with traditional classroom-based courses, with traditional distance learning courses, or it can be used to create wholly virtual classrooms" (Saltzberg & Polyson, 1995).

The idea of place is a primary but poorly understood piece of educational practice. Most people have vivid memories of a school or a classroom, where they learned with other students, heard the scratches on a chalkboard, or sensed the aroma of food being prepared in the cafeteria. The virtual world changes this scenario. “The relationships among learners, teachers, resources, and places are put into new configurations that challenge our notion of time and place” (DiStefano, Rudestam, & Silverman, 2004, p.xxv). “Distributed learning acknowledges the breaking down of the distinction between face-to-face and distance education. There is now an expectation that learners who study at a distance are able to communicate with students and tutors within electronic tutorial groups online, wherever they are based” (Lea & Nicoll, 2002, p.4). Learning is

increasingly distributed in space, in time, across levels, across organizations, and across different types of learners. Distributed learning refers to changes in knowledge, behavioral repertoires, and propensities to engage in various forms of behavior that occur in individuals, groups, and institutions as a consequence of joint activity mediated by a wide range of artifacts (Price, 2005). Bowman (1999) quotes Saltzberg & Polyson about the definition of distributed learning.

> Distributed learning is not just a new term to replace the other 'DL,' distance learning. Rather, it comes from the concept of distributed resources. Distributed learning is an instructional model that allows instructor, students, and content to be located in different, non-centralized locations so that instruction and learning occur independent of time and place. The distributed learning model can be used in combination with traditional classroom-based courses, with traditional distance learning courses, or it can be used to create wholly virtual classrooms (1995).

Bowman goes on to say that they might better be called “distributed resources”, because that term “shifts focus to environments where learners have access to content, experts (the teacher and beyond), peers, and services that are independent of time and place”. In a distributed resources environment, students gain a greater degree of control of how, when, and where their learning occurs. They have increased responsibility for their own learning and are no longer passive receivers of information. Teachers gain greater ability to organize and design environments that maximize learning opportunities and more freedom to experiment with effective new learning modes. Schools gain a greater ability to allocate resources for learning opportunities (1999). "An abundance of

research shows that alternatives to the traditional semester-length classroom-based lecture method produce more learning. Some of these alternatives are less expensive; many produce more learning for the same cost" (Barr & Tagg, 1995).

Distributed learning would be difficult, if not impossible, without the use of technology. Technology is the tool that produces distributed learning experiences and reach the goals and learning objectives that a teacher as outline for a class. "Distributed learning does not need to mean complicated, technology-laden alternatives to classroom instruction. Overhead transparencies aid learning by providing organizational structure; movies, videos and photographs provide visualizations; web links expand the information resources available to the learner; electronic communication such as discussion forums and email facilitate collaborative learning activities" (Bowman, 1999).

Distributed learning extends the opportunities for interaction between teacher and student, incorporating the latest technology and resources available on the web. "In fact, the 'anytime, anyplace' nature of this new set of electronic educational opportunities may well have its greatest impact on residential education. Not only does distributed learning occur anywhere and at any time, but these conditions can be modified along a number of dimensions" (Oblinger, Barone, & Hawkins, 2001, p.1). The future of distributed learning will not be a one-size-fits-all approach. Instead of being the end of traditional classroom education, online learning (i.e., learning environments that use the Internet and/or the web) allows for differentiation of institutions, learning styles, and pedagogy. "The variations provided by online learning environments will not only rival—but are likely to surpass—the diversity of types of institutions that currently characterizes American higher education" (p.2). Hawkins (2000) cites three axioms that illustrate this

nexus of technology and education—new technology affords exciting opportunities for more effective learning, offers the prospect of reaching more learners, and will transform higher education, as we know it today.

The National Defense University has explored prototype development of an education architecture which integrates all joint and Service Professional Military Education institutions (National Defense University, Army War College, and Air Command and Staff College, etc.) using a system called the Joint Virtual Learning Environment (JVLE). JVLE extends the power of knowledge from a campus to the field13. In fact, the U.S. military has been at the vanguard of distributed learning for some time. The U.S Army has more than 2,600 web-based courses, 231 Digital Training Facilities, and a transportable system of twenty networked workstations, servers, simulation software, web-based training courses, collaboration, and video training capabilities connected to the world-wide-web via satellite communications, called Deployed Digital Training Campuses, used primarily to train Soldiers in-theatre14. The U.S. Air Force has a corollary organization called Air Force Institute for Advanced Distributed Learning, under the auspices of the Air University.

The use of social networking and collaborative sites could be viewed as the civilian corollary to the military model. "Computer-supported collaborative learning (CSCL) enhances team performance through tools for communicating each person's ideas, structuring group dialogue and decision making, recording the rationales for choices, and facilitating collective activities. With the teacher's guidance, learners utilize these "groupware" tools to develop a shared mental model or to perform work-related

13 http://www.adlnet.gov/downloads/AuthNotReqd.aspx?FileName=DoDADLImplPlan19May.pdf&ID=255
14 DLS Factsheet http://www.dls.army.mil/home_index.html

tasks" (Dede, 1999, P.8). For example, Google has introduced several types of these resources, including Google Groups, Google Docs & Spreadsheets, and Google Sites. Each of these enable users to create and edit files online, and feature the ability to instantly share work and collaborate with others. They offer the user the opportunity and ability to move work off of the desktop, where local applications and hardware limit the ability to collaborate with other users, and onto the Internet, where online applications, storage, and sharing exponentially expand the user's options.

Cloud Computing

Cloud computing is an Internet-based development for the use of computer technology. The implementation of more powerful Web browsers, that work across platforms, has made it possible to "think about moving computing and data away from the desktop and the portable PC and simply displaying the results of computing that takes place in a centralized location and is then transmitted via the Internet on the user's screen" (Markoff, 2007).

As a metaphor for the Internet, "the cloud" is commonplace, but when combined with "computing," the meaning gets less definitive. Some define cloud computing narrowly as an updated version of utility computing, virtual servers available over the Internet. Others think bigger, arguing that anything accessed outside the firewall is "in the cloud," including conventional outsourcing. Cloud computing becomes clear only when you think about what IT always needs, a way to increase capacity or add capabilities on the fly without investing in new infrastructure, training new personnel, or licensing new software. Cloud computing extends IT's existing capabilities. Cloud computing is still relatively new, with a largely unorganized group of providers large and small delivering cloud-based services, everything from full applications to storage services (Gruman &

Knorr, 2008).

There are several incarnations of cloud computing. Some of them are software as a service, utility computing, web services in the cloud, and platform as a service. The thrust of each of them is to move applications and files off of the individual user's local computer and onto web-based servers. Schools around the country are adopting cloud computing with Google. More than one dozen new universities are integrating Google cloud computing, by way of Google Docs & Spreadsheets, into their education infrastructure. The office suite includes e-mail, calendaring and docs useful for information sharing and studying. It allows users to create and collaborate online through a browser. No other software is necessary.

"The idea is breaking out everywhere in Silicon Valley. Dozens of start-ups are creating an increasingly rich set of Web-based applications and more than a dozen efforts are under way to move the computer 'operating system' itself onto the Web and away from the desktop" (Markoff, 2007). Not so in education, though. When educators were asked "how likely are you to integrate a cloud-based solution in the next 12 months," nearly half were unaware of the impacts cloud computing could have on their infrastructure, over a third were looking into or already using it, and there a significant number of respondents that were not interested15. In fact, nearly half of the respondents asked, "What is a cloud?"

The University of Melbourne has undergone a fundamental reshaping to ensure its place in an evolving global knowledge economy. The result is a strategy called Growing Esteem, developed after extensive consultation. Growing Esteem understands the

15 Survey Says – Education Needed on Cloud Computing by Aaron Hollobaugh
http://www.imakenews.com/hosting/e_article001237624.cfm?x=b11,0,w

university as performing three related functions—research and research training, teaching and learning, and knowledge transfer. “Each relies on IT, and the overall strategy requires enterprise systems to bind together the strands. Like other universities, Melbourne is part of an academic world with blurred boundaries around the development of new knowledge, proliferation of technologically fueled, new ways of communicating, and recognition that an agile institution paradoxically needs standardized systems to enable collaboration” (Davis, O'Brien, & McLean, 2008). By extending learning and collaborating into the cloud, Melbourne is able to serve a more diverse population, both ethnographically and geographically.

Six Assumptions

Dede (2004) makes six assumptions about educational improvement. They are fostering 21st century skills and knowledge in learners; providing support for inquiry-based learning in classrooms, in homes and in communities; changing professional development to train teachers to unlearn the beliefs, values, assumptions and cultures underlying schools’ standard operating practices; creating learning communities that model classroom instruction and teacher professional development that enable a shift from the traditional transfer and assimilation of information to the creation, sharing and mastery of knowledge; utilizing distributed learning and as a mode for delivering professional development; and creating learning communities based on distributed learning strategies (i.e., “distributed learning communities”) as a powerful mechanism for knowledge diffusion.

In advocating distributed learning for professional development and the creation of learning communities, his “vision for educational improvement is based on a multilayered model of distributed learning communities that aids educational practice,

professional development and the transformation of schooling to foster 21st century knowledge and skills. In particular, emerging devices, tools, media and virtual environments provide novel ways to enable distributed learning models of teacher preparation, induction and professional development designed to achieve this vision for educational improvement" (p.3).

Using a distributed learning communities strategy, teachers organize and facilitate not only student-directed activities, but also the involvement in learning of families and social service professionals. This requires specialized professional development, as well as preparation for shifting relationships of all those involved in the instructional process (p.6).

He cites "ubiquitous computing interfaces", where educational environments are steeped with portable wireless devices that infuse virtual resources as students move through the real world (p.4).

Summary of Distributed Learning

Distributed learning refers to changes in knowledge, behavioral repertoires, and propensities to engage in various forms of behavior that occur in individuals, groups, and institutions as a consequence of joint activity mediated by a wide range of artifacts (Price, 2005). Distributed learning is an instructional model that allows instructor, students, and content to be located in different, non-centralized locations so that instruction and learning occur independent of time and place. It would be difficult, if not impossible, without the use of technology. Technology is the tool that produces distributed learning experiences and reach the goals and learning objectives that a teacher as outline for a class.

Cloud computing is a vehicle for using that technology. It enables users to work

and collaborate completely online, without the need for special software, and independent of platform. While the concept is still relatively new, it has taken hold in schools around the globe. There are several incarnations of cloud computing, but the purpose of each of them is to move applications and files off of the individual user's local computer and onto web-based servers.

Ubiquitous Computing in Schools

Weiser (1993) formed a working definition of ubiquitous computing that holds up well a decade and a half later—

> Ubiquitous computing names the third wave in computing, just now beginning. First were mainframes, each shared by lots of people. Now we are in the personal computing era, person and machine staring uneasily at each other across the desktop. Next comes ubiquitous computing, or the age of *calm technology*, when technology recedes into the background of our lives. Ubiquitous computing is roughly the opposite of virtual reality. Where virtual reality puts people inside a computer-generated world, ubiquitous computing forces the computer to live out here in the world with people. (It) is a very difficult integration of human factors, computer science, engineering, and social sciences.

Simply put, ubiquitous computing is the omnipresence of computers in the hands of students.

They work with them at school, at home, for work, and for play. According to Penuel (2002), "Ubiquitous, 24/7 access to computers makes it possible for students to access a wider array of resources to support their learning, to communicate with peers

and their teachers, to become fluent in their use of the technological tools of the 21st century workplace. When students are also able to take computers home, the enhanced access further facilitates students keeping their work organized and makes the computer a more 'personal' device" (p. 332). Teachers report that ubiquitous laptop access had made them better teachers, and that it had made students more independent in their learning (Mara, 2006), tailoring their computer use to their own particular needs. Students also felt that the laptop computers helped them learn more effectively. Similarly, some parents have seen "marked improvement in their children's motivation, willingness to do homework, and ability to access a variety of tools via the computer to support their learning both at home and at school" (p. 198).

Wilson & Peterson (2006) have noted that teachers report that using technology for learning has increased their student-focused practice and their students' motivation, achievement and technology skills. Classroom observations have exhibited lessons that were significantly more effective at engaging students in learning than average teaching approaches.

Ubiquitous Computing is Here

The shift to technology-enriched teaching has happened in many schools across the country (Mara, 2006; Morrison et al., 1999; Niles, 2006). Perhaps when nobody was looking, perhaps has a part of some higher plan, technology has come to schools. Many districts have mandated minimum numbers of computers in every classroom, and have committed to wireless connectivity, smart boards, and access to e-mail for students and teachers. "If districts utilize funds as outlined by the state(s), technology can become an integral part of school life, as it is already for students in their personal lives" (Price, 2006, p. 27). But it is not enough to have *the stuff*. Fortmeyer (2007) reported, "The days

are long gone when computers were rare objects in schools, rolled around on carts from classroom to classroom. Now, the most wired schools hand out laptops or PDAs to students, assign homework online, and facilitate classroom presentations using PowerPoint" (p. 1). Computers are the pencils of the 21st century, part of every students' basic educational kit.

Clark (2006) found that integration of one-to-one computing at a university went smoothly as a result of collaborative leadership. The culture of teacher training and support had made the conversion so trouble-free that one administrator thought that they might have forgotten something. Clark credits the establishment of a participatory institutional culture extending across several decades, as well as a long-term commitment to instructional technology implementation, that have resulted in policies within that university that have been able to successfully "'just roll forward' with one-to-one laptop computing" (p. 16). An attitude of cooperation existed that made the transition to new technology seamless.

It's Not About the Box

Seven-time Tour de France winner Lance Armstrong wrote a memoir about his cycling career entitled "It's Not About The Bike," suggesting that cycling was more than the use of human-powered transportation, but rather about what the cyclist does with it. Similarly, computing in schools is not about the computer, but rather what the students do with it. Fortmeyer (2007) pointed out that school technology administrators say that infrastructure upgrades, though necessary, are useless without a comprehensive e-learning plan (p. 2). The George Lucas Educational Foundation sponsors a blog in which one writer explains the planning that is involved in converting a school to all laptops. "Becoming a laptop school requires much more than simply distributing the high-tech

tools to teachers and students. It requires a comprehensive plan covering everything from payments to student safety to repairs. It also requires the support and commitment of an entire school community" (GLEF Staff, 2001, p. 1).

The Economics of One-to-One Computing

However, "for states that are struggling economically, one-to-one computing programs are being viewed as a way to restore and maintain economic viability. In Michigan, for example, policymakers see ubiquitous computing as a strategy for diversifying the state's industries in a tight economy" (Pitler et al., 2004, p. 3). By leveraging the power of technology, in the form of computers, connectivity, and enhanced communication, states are realizing that one-to-one computing doesn't cost, it pays.

The Maine Learning Technology Initiative was an attempt for that state to bolster its economy by training a new generation of digital professionals. It allows districts to serve students in urban and rural areas with the same instruction because the resources are online. Pitler et al. (2004) wrote, "Providing 'digital equity' is another motivation for implementing state and district one-to-one computing programs. These programs can level the playing field for students by providing all students with access to the technological equipment they must know how to use in today's workplace" (p. 3).

As for cost, Nicholas Negroponte, the long-time director of the MIT Media Lab, began the One Laptop Per Child (OLPC) project, aimed at putting computers in the hands of third-world children. That project relies on economies of scale to produce a laptop computer that will cost as little as $100, but will give students 21st Century capabilities (Negroponte, 2006, p. 5). He is proving that for a small per-capita cost, governments can provide technology to every child. He has convinced corporations to reshape their

business plans because has shown them that they can manufacture large numbers of computers that have very little profit margin built in, but still make a decent profit because of volume. Economies of scale are necessary to make this vision a reality. The OLPC project has since made a computer for $188, and other manufacturers, notably Intel, are introducing computers in the $200-$400 category. Even if Negroponte's computer is not successful, he has changed the notion about what can be done at the low end and focused the attention of the world on this initiative.

One-to-One Initiatives

In Arizona, the state legislature passed a law in 2006 mandating an online learning pilot program, which affects the schools I will be studying. The legislature said that it recognized that digital technology has transformed the productivity of most organizations in the United States and that digital technology has the potential to equally transform education. Their stated intention was to "implement a system helping teachers and schools to achieve academic and motivation gains at least double the national and state average...to transform education through digital technology". It called for, " A central delivery system with the ability to deliver course work to fifty thousand students simultaneously at the highest reliability level both at home and at school. The pilot program shall be conducted at up to ten schools that provide instruction in any two grades consisting of grade six, seven, eight or nine."16 Districts recognize the need for a comprehensive e-learning plan. It can mean anything from curricular changes in specific subjects to offering a high school diploma program solely via Web site.

Fortmeyer (2007) noted the use of web-based curriculum by a Colorado school district.

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16 From an unofficial release on the Internet--http://azelearning.info/home/mod/resource/view.php?id=15

> The Littleton Public Schools, in Littleton, Colorado, implemented a Web based learning program to help students with special circumstances complete their high school coursework. Using the Blackboard K−12 Starter Edition, the Littleton school district offers a wide selection of classes students access online or at a computer lab set up at the city's Arapahoe Community College. Class.com provides course content, but the district could eventually use its own class materials (p.2).

Students in Alaska can access advanced placement courses via the Internet, instead of a complicated tele-conferencing scheme used in the past. “And, with Blackboard, like other Web based programs, assessment is instant and can be shared with a wider community of teachers, parents, administrators, and fellow students” (Fortmeyer, 2007, p.2).

Summary of Ubiquitous Computing in Schools

The shift to technology-enriched teaching has happened in many schools across the country. Computing in schools is not about the computer, but rather what the student can do with it. Providing digital equity is a factor for states and districts in considering and implementing one-to-one computing programs. One-to-one programs can help level the playing field for students by providing all students with access to the technological equipment.

Conclusions

Access to the Internet and personal computers is becoming ubiquitous in schools and with it the potential for teachers to approach curriculum in new ways. Online resources bring the world into the classroom for those teachers and students who know

how to use them. Teacher training may be the stumbling block that makes it more difficult for this potential to be realized.

Without adequate preparation and support, teachers may continue to teach in ways that do not engage today's students. A typical student might wake up to music from a clock radio, watch a music video while getting dressed, talk on a cell phone while eating breakfast, and listen to an iPod while riding the bus to school. Once in class, this student is isolated in a chair and listening to a teacher lecture, with occasional notations on a chalk or white board. This student moves from a media-rich environment to surroundings devoid of any media at all. Additionally, even if a student is immersed in a media-rich class, the state-mandated testing that the student will face as a result of No Child Left Behind will be paper and pencil tests, in which media is also absent.

Teachers at Appleton High School have embarked on the ambitious path of customizing their students' learning. Technology is central to their efforts, but students are their central focus. They are employing distributed learning and cloud computing to deliver content to their students. Distributed learning refers to changes in knowledge, behavioral repertoires, and propensities to engage in various forms of behavior that occur in individuals, groups, and institutions as a consequence of joint activity mediated by a wide range of artifacts. Technology is the tool that produces distributed learning experiences and reach the goals and learning objectives that a teacher as outline for a class (Bowman, 1999). Cloud computing is a vehicle for using that technology. It enables users to work and collaborate completely online, without the need for special software, and independent of platform. Not only does distributed learning occur anywhere and at any time, but these conditions can be modified along a number of dimensions" (Oblinger,

Barone, & Hawkins, 2001, P.1).

Garrison & Anderson (2003) worry that some educators do not regard technology as a paradigm shift, but rather simply another step in the evolution of teaching. “It is self-evident that the history of technology in education extends back to the clay tablets, slate drawing boards, and handmade paper of pre-Gutenberg education” (p. 33). Because of this apparent continuum, they argue, some educators like to think of the technologies as being a succession of tools that are defined and studied as a subset of the way they are used, instead of a reconfiguration of the entire educational model. Those that do see a paradigm shift view new computing as concentrating on users accomplishing tasks better instead of machines executing commands (Shneiderman, 2003). In a one-to-one environment in school, students have been found to increase their academic achievement (Gulek, & Demirtas, 2005), teachers have become facilitators and students have taken responsibility for their own learning (Pitler et al., 2004), students have become more independent (Mara, 2006), students have accessed the most up-to-date curriculum (Penuel, 2002), and teachers have taken advantage of today's students' ability, and desire, to multi-task (Fay, 2006).

When one thinks of one-to-one computing in schools, the most obvious situation is how students use computers *in* a classroom (Penuel, 2002, p. 330), but laptop students are using their computers wherever they are, for whatever they need, at whatever time they need it. They are *digital natives* (Prensky, October 2001) who assume the use of technology in their lives. Teachers are by-and-large *digital immigrants,* learning the language of digital technologies on the job.

Marshall McLuhan (1995) famously wrote that “in a culture like ours, long

accustomed to splitting and dividing all things as a means of control, it is sometimes a bit of shock to be reminded that, in operational and practical fact, the medium is the message. For the "message" of any medium or technology is the change of scale or pace or pattern that it introduces into human affairs" (p. 1). Districts have spent millions on equipment, but it is not enough to have the boxes, wires and even portable tablets. Teachers, like the ones at Appleton High, are being asked to take a leadership role in crafting a new pedagogy. Equipment alone does not shape new forms of curriculum or delivery. Teachers and students alike are learning how to use new technology, instead of having it use them. With access to the Internet and personal computers becoming ubiquitous in schools, I will be investigating how teachers approach curriculum and what changes they take in implementing new learning environments. Teachers are adopting new ways of thinking and teaching in order to design meaningful and engaging curriculum for 21st century students.

Assumptions Going Forward

In the research that I reviewed in the course of this study, there was a clear consensus on the role of technology—the introduction of one-to-one computing is not enough to transform an already successful school. Study after study (Clark, 2006; Kinlaw, 2003; Mara, 2006; Thorpe, 2003) has shown that introducing one-to-one computing in poor rural or inner-city schools has a marked increase in student achievement, but in the suburbs, such as in the case of this study, state test scores for schools with and without one-to-one computing are similar. If a low-performing school can make an incremental jump in achievement, it is seen as real progress, but that same amount of increase in a moderately performing school may not be seen as meaningful.

Lance Armstrong's memoir suggests that a bike without a rider is useless, and rider without a bike, is walking. Sufficient access to technology, adequate teacher preparation, appropriate curriculum, supportive school district and site administration, and parental support have been found to be necessary for technology to be effective (Norris, Soloway, & Sullivan, 2002). The primary reason why teachers do not use technology in their classrooms is a lack of experience with the technology (Niles, 2006). Teachers who have had the flexibility to use Internet resources in the design of their curriculum along with training and support have been able to use it effectively. One of Dede's (2004) six assumptions was to change professional development to train teachers to unlearn the beliefs, values, assumptions and cultures underlying schools' standard operating practices. As Cuban (2004) noted, "Teachers are gatekeepers to school and classroom improvements. Their perceptions, beliefs, knowledge, attention, motivation, and skills come into place when policies (such as those involving computer technology) from state, federal, and district levels arrive at the schoolhouse steps" (p. 106). Computers may not be changing, transforming, or revolutionizing classroom teaching and learning (Clark, 2006), but the methods that teachers use to employ computers may be. How they acquire those methods, be it through professional development, training, mentoring, or trial and error, may have an impact on how effectively they implement technology in their classrooms.

Chapter Three
Methods

This qualitative study is a descriptive case study examination of the process social science teachers use to find and create curriculum using Internet and computer tools. In particular, I examined the access to and use of online resources, such as primary sources, lesson plans linked to standards and participation in professional organizations and communities. The use of the Internet in lieu of state-approved textbooks could signal a potentially radical power shift in the authority and control of teachers and their relationship to the content knowledge and knowledge communities. The primary focus is to examine the process and the effectiveness of teachers making their own curriculum for use in a one-to-one computing environment. While replacing textbooks with computers provides the context of this study, the goal was to examine how distributed learning and cognition affect the pedagogy of teachers in a technology-rich environment.

Qualitative research is called for in this case because, while there has been a fair amount of research conducted on one-to-one computing, none have looked specifically at the process and implementation of teachers authoring curriculum specifically designed for that situation. This is not a domain in which definitive answers exist, but rather, an emerging arena that requires the participants exercise their own judgment as to whether the system in place works to the advantage of students and teachers. The circumstances that exist at Appleton High School are necessarily site-specific, but the conclusions may well be applicable to similar schools. Also, responses are the opinions and reactions of individual stakeholders, and thus be the result of their own interpretation.

Purpose of the Study

Since opening, Appleton High School has asked teachers to create classroom curriculum in lieu of using state-approved textbooks and other district and school-provided materials. This purpose of this study was to investigate the process through which teachers are creating their own curriculum, what challenges they face in doing so, and the implementation process in the classroom. I was interested exploring the way in which the use of the Internet affects the range of the knowledge base used in the classroom. With access to Internet teachers, trainers, coaches, and mentors, as well as the vast data sources available, teachers might enlarge the context of classroom learning including more people. It is also possible this resource might encourage teachers to address student needs on a more individual basis.

Statement of the Problem

Ideas contrasting traditional learning environments to digital technology enhanced environments are widespread (Clark, 2006; Kinlaw, 2003; Mara, 2006, Hunting, 2006; Lemke & Coughlin, 2006). A traditional learning environment is described as teacher-centered instruction, single-path progression, single-sense stimulation, single media, isolated work, information delivery and passive learning, fact-based, reactive student response, and an artificial context. By contrast, a digital technology enhanced environment might feature student-centered instruction, multiple-sensory stimulation, multiple-media, multiple-path progression, collaborative work, information exchange with inquiry-based active learning, critical thinking, proactivity, and authentic context, all designed by on site educators, and focused on the individual needs of each student. It should be noted that while these factors are not limited to digital technology enhanced

learning, the nature of the environment makes individual student learning more practical, and therefore more likely in a classroom with many students.

Much has been written about the pedagogical impacts, the theoretical rational, and the practical implications of providing technology to students, but the evidence with respect to student achievement is mixed often with very little attention paid to it (Cuban, 2001 & 2004). The school's purpose is to educate students and graduate students, and then move them into the next phase of their educational experience--community college, a university, a trade school, or the workforce. A compelling measure of success is the ability of the students to move to the next level with competence.

In addition to using technology as a substitute for more conventional and customary methods of curriculum delivery, teachers have access to a wide scope of resources unavailable even five years ago. The introduction of one-to-one computing makes it possible for teachers to offer a more expansive scope of learning opportunities to their students. It is possible to give students entrée to a panoply of alternatives that result in customizing their learning. Therefore, the research question is aimed at discovering how teachers may be able to use this new tool in their classrooms.

Research Questions

The specific research questions were:

- To what extent do teachers use computer tools to design curriculum that supports distributed learning and cognition and enhance learning in a classroom environment?
- To what extend do teachers work collaboratively to design and produce content?

- How do teachers use the Internet as a resource in lieu of state approved textbooks and how do they rate the quality of Internet resources as compared to textbooks?
- What relationship, if any, is there between student achievement and the use of technology?

The study examined how teachers have created curriculum by using Internet resources in place of textbooks to structure their classroom instruction. Will teachers offer more customized teaching to students in classes where students have their own computers 24/7? Part of this study was to query teachers about their theory of change linked to the implementation of one to one computing, the methods used to take advantage of Internet resources to create and apply their own curriculum, and their orientation in general towards the use of technology in learning. It examined teachers' impressions about the effectiveness of a distributed learning model for curriculum as opposed to textbook centered curriculum.

Research Approach

There are several considerations when deciding to adopt a qualitative research methodology. Strauss and Corbin (1990) claim that qualitative methods can be used to better understand any phenomenon about which little is yet known. They can also be used to gain new perspectives on things about which much is already known, or to gain more in-depth information that may be difficult to convey quantitatively. Thus, qualitative methods are appropriate in situations where one needs to first identify the variables that might later be tested quantitatively, or where the researcher has determined that quantitative measures cannot adequately describe or interpret a situation.

Qualitative methods were chosen as the primary methods for this project to allow a thorough understanding of the challenges faced by teachers who create curriculum in a school that employs one-to-one computing among students. A case study approach will enable me to study one-to-one computing situated in the system of related issues, most specifically distributed learning and cognition in the design and creation of classroom curriculum. Case study research provides a method of gaining an understanding of complex issues that can extend beyond experimental research and provide support for previous research. Through case study research not only can we observe and discuss the software/hardware that is being used but, more significantly, how it is being applied to amplify teaching and learning by expanding the possibilities for student interaction beyond traditional classroom methods and practices.

Conceptual Framework

This research begins with the notion of, as Davies (2004) puts it, "not knowing what is not known" (p. 13). Grounded theory succeeds data, rather than preceding it. Glaser and Strauss (as reported by Davies) contend that grounded theory "fit(s) the situation being researched". It is "discovered empirically rather than expounded a priori ... grounded theory can play the role of conventional theory for any subsequent study" (Lincoln and Guba, 1985, p. 206). There is a continuous loop of feed back and feed forward (p. 235). Qualitative research encourages iterative questioning. Each new bit of information has the potential of forking into an entirely new area of exploration. As such, questioning teachers at Appleton may yield questions heretofore unconsidered.

The Association for Educational Communications and technology reports that, while they may be enlightening, qualitative studies do not usually focus on the

perceptions and attitudes of those who adopt new technology (Savenye & Robinson, 2001). This study will, adding to that literature.

Sources of Data and Data Collection Strategy

This study approached the problem in a three step iterative process.

- An interview with the principal of Appleton High School
- Interviews with a small number (3-5) of teachers at the school
- A survey administered to all 36 of the teachers at the school

Phase 1: Principal Interview: The first step was a phone interview with the principal, and two follow-up queries made through e-mail. The goal was to get information about the whole school regarding technology infrastructure, the resources that are available to all teachers and any school policies considering the use of IM, specific search engines, blogging, or other forms of interaction. Additionally, this interview helped me get a sense of formal learning structures at the school. (Appendix A)

Phase 2: Teacher Interviews: Using the interaction with the principal as a guide, I identified a small number of teachers that from the principal's perspective are responding well to this challenge. Using the information from the principal interview, I interviewed the three teachers to examine—

- Design of Curriculum-the tools used, the role of standards, the use of media, the methods and process of implementation
- Collaboration Formal and Informal-the extent to which teachers collaborate, the form of partnerships or groups among teachers, instructional grouping, teachers meeting and form of professional development.

The goal was to understand in the formal and informal supports for teacher learning and teacher development of curriculum, paying close attention to power relationships and partnerships that have evolved. (Appendix B)

Phase 3: Teacher Survey: The analysis of the teacher interviews was designed to surface issues that called for a deeper understanding in the larger context of the school. Using what was learned in the teacher and principal interviews, a survey was constructed for the teachers at the school. Issues discovered in the interviews became the focus of a set of survey questions that were distributed to all of the school's thirty-six teachers online. Teachers were given gift cards as incentives to complete the survey.

Site Observations

Following my first visit to Appleton, the principal and the superintendent told me that I could visit the campus as often as I wished, and I took advantage of their offer and visited six time, for a total of 10 days. On my initial visit, I was invited to observe teachers in their classrooms to get a sense of how they used the computers in class. This observation helped me understand how they integrated technology into their lessons.

Later, as my study got underway, each time I visited the school, for interviews or to administer the survey, I took the opportunity to visit some of the teachers, who by that time, had become friends as well as colleagues. I was invited by teachers to look in on particular lessons and observe what they were doing. On one visit, I met a couple of teachers from another local high school, and I was invited to visit their classrooms. I did, and I have returned to their classes on each subsequent visit.

My observations were informal, and directed towards acquiring a deeper understanding of the context and culture of the school. I questioned teachers about their

methods and what outcomes they saw in their students. I shared some of my resources with teachers who were curious about what I did. Overall, the observations were very collegial in nature, and the relationships formed were likely to have influenced teachers' willingness to complete the survey.

Research Design

Population

For the purposes of this study, the population being studied was teachers and administrators at Appleton High School, south of Tucson, Arizona. District and school administrators were eager to have the study performed, and therefore were most willing to help in any way they can. They offered their cooperation, and it was gratefully accepted.

Sampling

Interviews were conducted with three teachers at Appleton High School, two suggested by the principal and one was recommended by one of the teachers. Teachers from different subject areas were selected as good examples of teachers who were highly engaged in the process of change that I sought to explore. The teacher interviews were designed to help refine the questions on a survey that was then administered to all 36 teachers at Appleton High.

Collection of the Data

There were three data collection strategies used in this study—an interview with the principal, the teacher interviews, and the teacher surveys. The principal was interviewed to get information about the school's technology infrastructure, resources available to teachers, and school policies regarding technology. Interviews were conducted with a small number of teachers at Appleton, based upon the principal's

recommendations. From these interviews, I constructed surveys that were given to all teachers at Appleton High School. Teachers participating in the interviews received a $10 gift card, and teachers participating in the study received a $10 gift card, all to a local or online retailer of their choice.

Interview Process and Protocol

Mara (2006) laid out an effective reasoning for what is termed purposive interviewing. He states that the main purpose of interviews in case study research is to obtain a special kind of information. The researcher wants to know the views of the participants—what is on their minds. Merriam (1998) states that the most common type of interview sampling is *purposive,* where the researcher selects which groups and individuals to sample or interview. It is not necessary to control every aspect of the process, as in a quantitative study, because the purpose is to learn more about a specific group, event, or problem. "Purposive sampling is based on the assumption that one wants to discover, understand, gain insights; therefore, one needs to select a sample from which one can learn the most" (p.98).

Purposive Sampling

This investigation employed purposive sampling to interview teachers at Appleton High School. The primary purpose of case study interviews was to discover what participants really think about a project or event and what is really on their mind. This investigation employed a semi-structured research protocol, however, the interview process was open-ended, and the questions (Appendix B) necessarily led to follow-ups in directions that the teachers felt were important.

Data Collection Tools

Principal interview. During the principal interview, I asked about teacher

planning, if and how it might be done in groups, and whether there was a formal structure for that. I also asked about the formulation and design of curriculum, and how teachers were doing that. I asked what specific teachers, in interviews, might be able to help give me an understanding of how teachers were designing curriculum, how they were accessing Internet resources, and how they were interacting with each other. A copy of the principal interview is in Appendix A. I used the principal interview to construct a teacher interview to explore the issues that the research literature saw as most important.

The teacher interviews. The principal recommended three teachers which she felt would be most helpful to understand the changes related to the laptop program that were taken place at Appleton High. I knew two of the teachers from a previous visit, and I knew that they had opinions about how the laptop program was going. I scheduled interviews with two teachers and when doing the second interview, one teacher recommended a teacher who would show a contrast with his views. I decided to contact this teacher in place of the one that the principal had recommended. A copy of the teacher interview is in Appendix B.

Teacher A was a male veteran social studies teacher who also had experience in using digital media. He was a member of the design team for Appleton High School, and head of the department.

Teacher B recently came to teaching from industry and was in his second year of teaching digital arts. He was working on transforming his extensive experience in industry and knowledge of the field of information technology into classroom methods and curriculum. He had started his tenure at the school in a support role, managing, among other things, technology for the school. This teacher suggested that I interview

Teacher C was a relatively new teachers with just less then five years of experience who taught advanced mathematics and studio art. Teacher B believed that Teacher C would provide a broad perspective on how digital technology worked in academic core classes and elective classes. Teacher C's experience in curriculum design was only that which is part of basic credentialing coursework.

The whole school teacher survey. I used the interview of the principal to look for broad themes that I could pose as questions to the faculty at-large. There was no sampling of teachers, because the entire population responded to the survey. I based the survey questions upon information collected in the literature review, as well as information from the interviews. For example, questions about curriculum design flowed from research done by Wiggins and McTighe concerning backward design, where methods and materials are shaped by clear ideas about what the desired outcome should be; Questions concerning students' and teachers' comfort level with technology flowed from research done by Prensky; Questions concerning distributed learning flowed from the work of Saltzberg & Polyson, Lea & Nicoll, Bowman, and others. Then I used the information from the teacher and principal interview to mark areas, topics, or outcomes that would be fruitful to explore.

When the survey was ready for launch, I travelled to the school on the day of a faculty meeting. I was given time to introduce myself to the faculty at-large, and explain what my study was about and how each teacher could contribute. Before the meeting I gave the assistant principal a link to the survey, and she emailed it to the faculty moments before the meeting began. When I spoke to them, I asked them to look for the email that had the link and take the survey as soon as they could. When I finished speaking, I went

to the back of the room and waited for the meeting to end. As I waited, I checked the survey site, and was surprised to see that a couple of the teachers who had brought their laptops had already responded. In the end, all 36 teachers responded to the survey.

Analysis of the Data

The teacher interviews were recorded and I had them transcribed by a professional service. The content was reviewed and organized into six topics— design of curriculum, collaboration and structure, training, support, curriculum design, and implementation process The teacher surveys contained two types of questions—multiple choice, where the choices were known, and opened ended questions for areas where answer options were harder to predict. I used basic descriptive statistic to code the multiple-choice questions For the open-ended questions, I read through all of the responses to a single question. I then coded the responses into a set of responses and I counted each time a teacher gave one of the listed responses. I indicated the total number of teachers that responded and the total number of responses. It was possible for a teacher to list multiple responses, and all were counted and fit into categories. If a response did not fit into a category that I had already established, I created another category. As a result, some categories had only one response. Usually a teacher only gave one answer, but when they gave more, they were recorded. This only happened on three questions. I reported the data in terms of the number of teachers who gave a particular response.

Timeline

The timeline for the study was as follows. The principal interview was conducted in April 2008. This consisted of a face-to-face interview, but also included some follow-up by e-mail. Interviews with three teachers were also conducted April 2008. Analysis of the interviews and construction of the teacher survey occurred during the spring and early summer of 2008, and the surveys were administered in July of 2008. Coding of the surveys occurred in late summer.

Reliability and Validity

Reliability is the extent to which an experiment, test, or any measuring procedure yields the same result on repeated trials. Without the agreement of independent observers able to replicate research procedures, or the ability to use research tools and procedures that yield consistent measurements, researchers would be unable to satisfactorily draw conclusions, formulate theories, or make claims about the generalizability of their research. Cox (1996) contends that it is crucial that the researcher determines if the surveys or questionnaires being used will answer the research/guiding questions that are being asked in the study.

Research Quality

For purposes of this study, the quality of the data gathering process was gauged by focusing on the creditability, dependability, transferability, and confirmability of the study, and its data and data collection procedures (Lincoln & Guba, 1985). An outside researcher reviewed the surveys for this study independently, and I coded the responses to the teacher surveys.

Specific Procedures Used to Ensure Reliability and Validity

External Validity

Merriam (1998) states that external validity is concerned with the extent to which the conclusions of one case study can be generalized or applied to other similar situations. Creswell (2003) states that the notions of reliability, generalizability, and validity have different levels of importance, depending on the type of research being conducted. Unlike experimental research, it is not usually the intent of the researcher in a qualitative case study to attempt to make broad generalizations between what might be found in the study of one situation and what might then be pronounced as a likely finding for all other similar situations. Such an approach or pronouncement would make little sense at all, since the primary purpose of case study research is to find out what is true and valid for a specific project, not for all projects of that particular type (Merriam, 1998).

Internal Validity

Internal validity is concerned with the match between the researcher's findings and what is actually taking place, and is most important for case studies. Radcliffe, cited in Merriam (1998), reminds us that since data do not speak for themselves, there is always an interpreter, who is the researcher. Validity, then, should be seen as interpreting the investigator's experience. Morse and Richards (2002) contend that validity and reliability in qualitative research should more appropriately be considered aspects of trustworthiness, credibility, and consistency. Creswell (2003) indicates that while the terminology might vary in defining validity, the qualitative researcher, through consistent and appropriate practice, can and should produce findings that are both valid internally and reliable as well.

Reliability

Replicability— a measure of reliability— is far more difficult when conducting qualitative research. However, without some degree of replicability, quantitative research has less value. The primary concept behind experimental studies is to create such controls over the particular conditions that another researcher, given the identical conditions, should be able to produce very similar results. However, in *qualitative* research there is no attempt to isolate and control variables. Rather, the intent is to explain an event, condition, or situation. Merriam (1998) indicates that since there can be many interpretations of what has happened in a particular situation, there can be no absolute benchmark around which to replicate the event. Guba and Lincoln (as reported in Mara, 1996) contend that the key factor in qualitative research is the notion of internal validity. Since one cannot have internal validity without also having reliability, "a demonstration of internal validity amounts to a simultaneous demonstration of reliability" (as reported in Merriam, 1998, p.171).

Creswell (2003) suggests that the most important first step for increasing the validity and reliability of case study research is in the triangulation of data–using a range of data sources to build a logical and coherent justification for the themes that emanate from the data. This requires using multiple sources of data to help guarantee construct validity by providing multiple measures of the same phenomenon. To help ensure both reliability and validity in case studies, Yin (1994) recommends employing three principles of data collection:

a. Principle 1- Use multiple sources of data.

b. Principle 2- Create a case study database.

c. Principle 3- Maintain a chain of events.

This study used multiple sources of data (interviews and surveys) to support principal 1. Principle 2 was supported by creation of a case study database. This made it possible for data to be sorted, structured, and analyzed both alphanumerically and chronologically as previously described. This structure further supported Principle 3, the proper maintenance of the chain of events. Yin (1994) claims that by using a structured research discipline that includes capturing and presenting research in the order in which events occur, the researcher in a case study helps to increase the reliability and validity of the study. To support that goal further, this case study will employ a chronological structure to assemble and analyze the data.

Considerations For Use of Human Subjects

This study was exempt from IRB review. It involved established educational settings using normal educational practices comparing the effectiveness of curriculum and instructional techniques. Participants' names and other identifiers were not included in the study, and are held in a secure location by the researcher. Additionally, all participants were adults in the teaching profession who are familiar with the terms and techniques being studied. Finally, all participants were asked to give their consent to be included in the study, and were entitled to withdraw at any time without penalty or other consequence to their work.

Chapter Four
Findings

This chapter presents the results from the findings of this study, including a brief review of the purpose of this study and the theoretical perspectives. This purpose of the study was to investigate the process through which teachers create their own curriculum, what challenges they face in doing so, and the implementation process in the classroom. It was an exploration of the way in which the use of the Internet affects the range of the knowledge base used in the classroom. With access to Internet teachers, trainers, coaches, and mentors, as well as the vast data sources available, classroom teachers might enlarge the context of classroom learning including more people. It is also possible this resource might encourage teachers to address student needs on a more individual basis.

This qualitative study is a descriptive case study examination of the process teachers use to find and create curriculum using Internet and computer tools. In particular, it examined the access to and use of online resources, such as primary sources, lesson plans linked to standards and participation in professional organizations and communities. The primary focus was to examine the process and the effectiveness of teachers making their own curriculum for use in a one-to-one computing environment. While replacing textbooks with computers provided the context of this study, the goal is to examine how distributed learning and cognition affect the pedagogy of teachers in a technology-rich environment.

Qualitative research was used in this case because, while there has been a fair amount of research conducted on one-to-one computing, none had looked specifically at the process and implementation of teachers authoring curriculum specifically designed for that situation. This is not a domain in which definitive answers exist, but rather, an

emerging arena that requires the participants exercise their own judgment as to whether the system in place works to the advantage of students and teachers.

The study answered the following research questions:

- To what extent do teachers use computer tools to design curriculum that supports distributed learning and cognition and enhance learning in a classroom environment?
- To what extend do teachers work collaboratively to design and produce content?
- How do teachers use the Internet as a resource in lieu of state approved textbooks and how do they rate the quality of Internet resources as compared to textbooks?
- What relationship, if any, is there between student achievement and the use of technology?

The study examined how teachers created curriculum by using Internet resources in place of textbooks to structure their classroom instruction. Part of this study queried teachers about their theory of change linked to the implementation of one to one computing, the methods used to take advantage of Internet resources to create and apply their own curriculum, and their orientation in general towards the use of technology in learning. It examined teachers' impressions about the effectiveness of a distributed learning model for curriculum as opposed to textbook centered curriculum.

This study approached the problem in a three step iterative process.

- An interview with the principal of Appleton High School
- Interviews with three teachers at the school
- A survey administered to all of the teachers at the school

I begin with a composite description of the school based on observations, materials I collected and the teacher and principal interviews. Following the description, there are six sections where I integrate responses to the survey questions with the teacher interviews to provide the main findings of this research.

School Context

Appleton High is a new school, different from existing schools in terms of size, teaching approach and technology use. The school opened in 2005 with 327 students and currently has 734 students. It is an open enrollment school and students can choose to attend from anywhere in the area. The school is located in a middle-class suburb of Tucson, Arizona, close to military bases. As a result, many of the students are military dependents. In the first year, the students were 79% white, 15% Latino, 3% African-American, and 2% Asian, and those ratios are similar today. There are presently 36 teachers and an average teacher-student ratio of 21, with 25 students considered to be a large class. The teachers arrive to school at by 8 a.m. and the school day is from 8:20 a.m. until 3:30 p.m. The school as an attendance rate of 93%, a promotion rate of 97%, a dropout rate of 2%, and a four-year graduation rate of 90%[17].

Teachers use blogs and email to communicate with each other throughout the day. It was not uncommon to see teachers asking for help, resources, or supplies via email, instead of sending a student to ask. When my survey was launched, the assistant principal

[17] According to the Arizona Department of Education School Report Card

simply emailed the link to every teacher simultaneously. It was a normal way for her to disseminate information to the teachers.

Students were directed to teachers' blogs to access assignments, warm-up activities, and resources. A number of classes that I visited began with students going directly to the teacher's online material without being instructed to do so. It was just the routine of the class. The school also uses TurnItIn[18] as the place where students can turn in papers. The site acts a repository for the work, and has a plagiarism detection feature as well.

During breaks, students can be seen all about the campus, laptops open, in groups and individually, accessing class materials, comparing notes, and listening to music. I observed a high degree of peer mentoring around technology; more experienced students helping newer students use their laptops in flexible ways. There is a tech center where students, and teachers, can bring their laptops for inspection and service. Most minor repairs are done right on campus by the tech coordinator. Major work is sent out, and loaner computers are available for use until computers are returned from repair. There is a school server where students and teachers can store their work. It helps minimize data lose when computers require repair.

When I first visited the school, I noticed that there was a real sense of openness, to me as an outsider, and to the idea of the school being part of a research study. The principal and teachers (even the district superintendent) expressed a feeling of receptiveness to my study and me. Teachers welcomed me into their classrooms without reservation. They shared their lesson plans with me, and invited me to look at their blogs.

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[18] http://turnitin.com/static/index.html

They asked me to have lunch with them and invited me to sit in on their meetings.

This openness can be seen as a marker of teacher confidence in their teaching. Teachers had no reservation in allowing me to observe their practices. They encouraged me to walk among the students during passing periods and lunch, and to ask students what they thought about the school and the courses of study. On a couple of visits, when I started to sign in as a guest, the office staff waved me through. I was not viewed as a stranger that had to be marked. The relationships I developed with the teachers made it easier for me to understand the changes. I will describe these changes in x areas:

- Curriculum Design with the Internet
- Teacher Collaboration and Curriculum Creation
- Comparison of Internet-driven Curriculum and Textbooks
- How Teachers Combined Computer and Internet Use With Traditional Methods of Teaching
- How Student Achievement May Be Affected by the Use of Technology
- How Teachers See Their Students

Curriculum Development and the Internet

Teachers in the interviews and on the survey indicated that they have created most, if not all, of the curriculum they used in their classes. As shown in Table 1, nearly all of the teachers develop their own curriculum. More than three-quarters of the teachers (86%) used state standards. Almost all teachers (91%) agreed that the school provided needed resources for curriculum development. When asked directly about which resources were most valuable (with the option of selecting all four, the Internet was chosen by 76% of the teachers. These results are validated by the teachers' clear

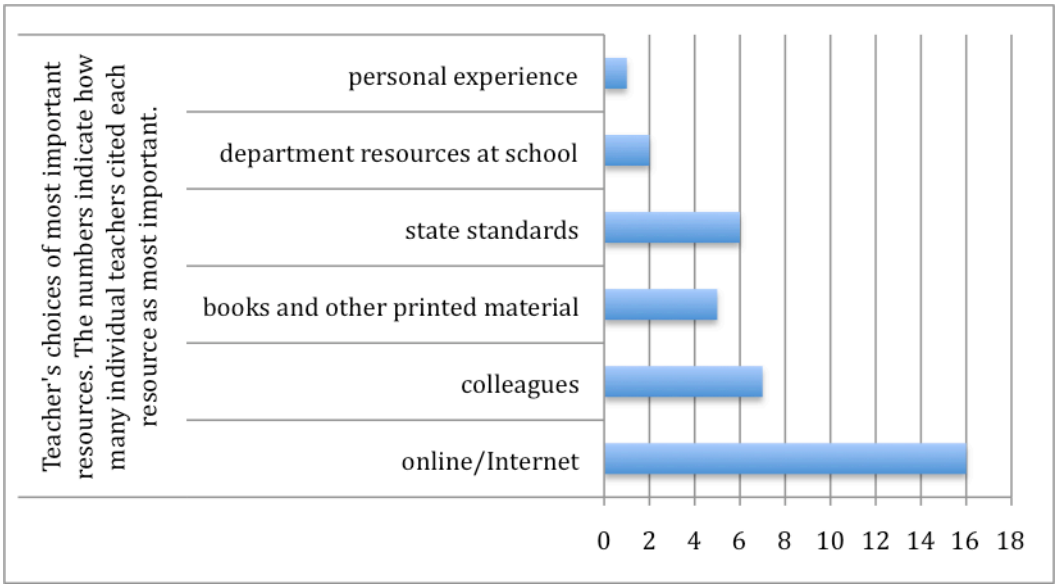
evaluations of the Internet as the most important resources (Table 2).

Table 1- Survey Results on Curriculum Development.

ITEM	Strongly Agree	Agree	Disagree	Strongly Disagree
I develop curriculum on my own. (N=36)	14%	64%	17%	5%
State Education Standards are helpful in the design of my curriculum. (N=36)	25%	61%	14%	0%
The resources I need to develop curriculum are available to me at my school. (N=36)	28%	61%	11%	0%

The one overarching resource that teachers mentioned was the Internet. One teacher said, "The most valuable resources that I've (used) have been online. My ability to go on and find anything I need. With a school like this and with the resources we have available as far as being able to access the Internet, it's been amazing" (Teacher interview, April 29, 2008).

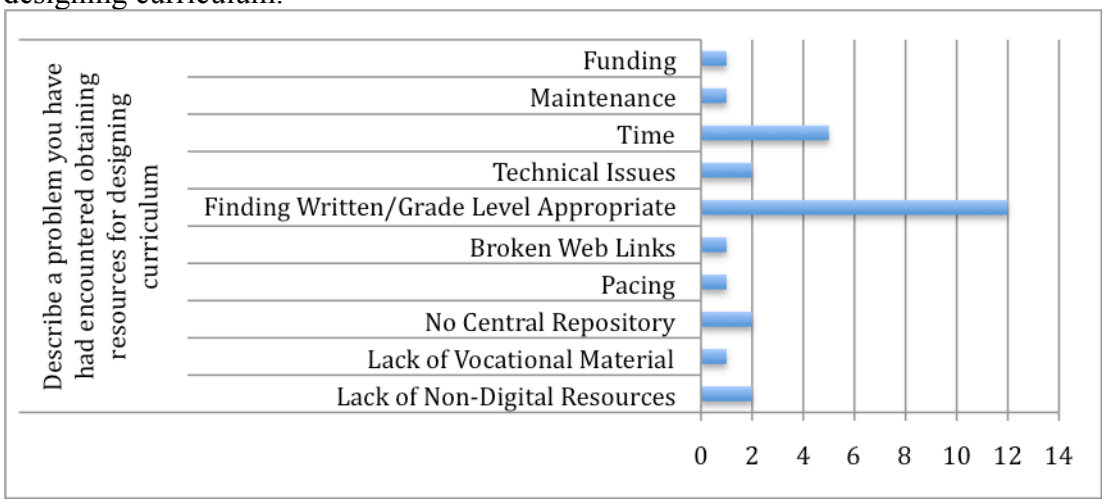
Table 2- Teachers' choices of most important resources.



Note--The numbers indicate how many individual teachers cited each resource as most important.

Teachers were asked in open-ended questions to describe a problem they had encountered obtaining with resources for designing curriculum for their classes. The results were coded into ten categories. Teachers were able to identify as many problems as they wished to. The numbers at the bottom of the chart represent how many teachers chose each issue.

Table 3- Describe a problem you have encountered obtaining with resources for designing curriculum.



As Table 3 shows, the overwhelming problem that teachers had was in finding grade level material. It would seem that this was separate and apart from the use of technology. And in fact, some teachers lamented the lack of non-digital material for their classes. Others complained that there was no central repository of lessons or content, while many simply needed more time to plan.

Teachers responded to open-ended questions about the role of the school and the district in providing them with resources to develop their curriculum. A large majority, 88%, felt that they were supported or highly supported. “[The] school has been very supportive about making technology work for all students”, noted one teacher. Comments from other teachers reflected a deep level of support from the school. New teacher

induction included a weeklong training, where teachers were given guidance on how to structure their classes, on classroom management, and on the performance objectives that the school had established. The school provided the laptop program as a resource and a map of the objectives for each quarter. “If I am need of assistance all I have to do is ask for it”, commented one teacher. “The curriculum maps help guide instruction”, said another.

One teacher noted that the school was quite different from other schools in the district. “This school is an exception to the rule. Here I am open to use and explore many different resources. I worked at a different school in the district and the admin was not as supportive. I feel very capable in designing my own curriculum.” In service training and professional development were mentioned as useful resources for teachers, and were viewed as “opportunities” by some. They noted that trainings were “extremely relevant” to what teachers were doing in their classrooms. One teacher added, “Teacher input is taken into account when deciding upon what opportunities will be made available.”

Praise for the school’s methods were not universal. One teacher commented that the performance objectives divided instruction into a series of parts that didn’t address the whole. “I feel that the PO ‘a la cart’ approach sacrifices the teaching of a subject as a contextual body of knowledge”, said the teacher. And then added, “The PO-based approach tends to concentrate on the bricks at the expense of the mortar, standardized to the point of scheduling POs on a calendar. I prefer more flexibility.”

Many teachers indicated that the district was a valued resource for curriculum development. They noted that the district provided a database for use in designing curriculum. The district also provided the opportunity for teachers to identify what

quality content would look like for their students, and helped in the vetting process when culling through those resources with respect to the one-to-one computing environment that was established at the school. “We were treated like professionals, and didn't have anything forced on us there are resources available on databases and people have been helpful”, said one teacher, adding that “(This) is an amazing school district, one that supports all of its employees to the fullest.”

But teachers also mentioned that they could always use more resources. “The district provides a map for us to use, but without textbook resources it can be challenging to find appropriate materials for certain performance objectives”, said one. “Supplying more resources would put the program in a position to deliver a top-notch education. We have a budget to purchase materials but that is not bottomless. There are always things we'd like but can't afford”, said another.

This data can be summarized into the first study finding:

Finding 1: The majority of teachers were successful in creating their own curriculum by using Internet resources, and receiving critical support from the school.

Teacher Collaboration and Curriculum Creation

The second research question investigates the extent to which teachers either work alone or worked together in the process of developing materials with access to the Internet. Past research suggested that the use of technology might encourage a collaborative approach to the challenge to design curriculum (Edelson, Gordin, & Pea, 1999).

All most all of teachers (95%) said that they planned in groups (Table 4). One

teacher said that group planning was more predominant in the core areas, while elective content was more individual. This teacher attributed this to the belief that electives, such as art and music, are much more dependent on the talents of the particular teacher, whereas the core subjects are governed to a greater extent by prescribed content and expected outcomes.

Table 4- Survey results for teachers working collaboratively.

ITEM					
Teachers at my school plan curriculum in groups (N=34)	Daily	Weekly	Biweekly	Monthly	Never
	0%	21%	24%	50%	5%
Time is set aside for teachers to formally plan together (N= 33)	0%	21%	24%	50%	5%

Teachers felt that staff development time was useful in their planning (Table 5). The principal noted, "(Teachers) work together a lot and we do it much less formally than oftentimes schools try to. Our own teachers do most of our professional development. So other teachers know who's an expert in certain areas and who's trained them on a certain. We spend a lot of time discussing at staff meetings thoughts and ideas about teaching kids and what's the best way to get to kids and I would say that within the department, people work together very much" (Principal interview April 30, 2008).

Table 5- Survey results for staff development and teacher involvement outside of school.

ITEM				
	Strongly Agree	Agree	Disagree	Strongly Disagree
Staff development features training and innovations that teachers can put into practice on the next school day (N=33)	24%	64%	12%	0%
Staff meetings and professional development are valuable resources in planning my curriculum (N=35)	24%	64%	12%	0%
Teachers participate in communities beyond the classroom that help with curriculum design (N=34)	20%	71%	9%	0%

The principal also said that they are making an effort to involve every teacher in national conferences by content area. All most all of the teachers (90%) were engaged in educational communities outside of the classroom (Table 5). Teachers were active in organizations such as the Academy Village, a collaboration with a local university meant to support small learning communities; the National Science Teacher's association and the Planetary Society, as well as their state level equivalents; teachers are members of their respective national content area organizations (NCSS, NCHE, etc.), attend workshops and conferences, and sometimes present at those functions; the math teacher retention program run by a local university; teachers attend the National Conferences for their content area; the school district has several committees that meet together to plan core curriculum in all the core academics that teachers participate in. One teacher also noted that, “Other school districts, starting to use technology, call on us to jump start their efforts, we gladly share what we know and what we have built.” Teachers met formally once per month as a group, and then twice per month by department or subject area.

Teachers also mentioned a strong level of support among the teachers themselves. “My fellow teachers have been amazing in providing me with resources”, said one

teacher, and while teachers had expressed appreciation for the roles of the district and the school, it was their colleagues that received the most praise. One teacher noted that they had received a lot from the school, but the "everything else I have gotten through fellow teachers." Another teacher said that during his/her first year teaching teachers met often to discuss the required curriculum.

All of this data can be summarized in the second finding of the study:

Finding 2: Teachers engaged in curriculum planning in collaborative groups.

Comparison of Internet-driven Curriculum and Textbooks

While it was clear that the teachers were working together and using the Internet as an active part of their instructional design, the next research question investigates that degree to which the teachers valued the quality of materials that were coming from the Internet.

Since the school was founded with the idea of replacing textbooks with computers, this was an important area of concern. When asked about the quality of Internet resources, most teachers (68%) evaluated it as better content than that which is found in textbooks (Table 6). If teachers answered different in form, but similar in quality to textbook content, they were sent on to the next set of questions, but if they answered better quality content, they were led to a question that asked them to elaborate on how they thought that that was the case. In their responses, they pointed to the variety, the deeper content, expanded activities (86%), deeper treatment of content (62%), and students' ability to personalize their education (76%) as reasons for its superiority to textbooks.

Table 6- Teachers' comparison of online content vs. textbook content.

Compared to using textbooks, having students access content on the Internet overall is (N=36)		
Different in form, but similar in quality to textbook content	Better quality content	Not the same level of quality content found in textbooks
37%	60%	3%

"It gives teachers more to work with. Often textbooks only have a few examples or activities that go with a grammar concept I teach", said one teacher. Another teacher said that the Internet only provided deeper treatment if students knew where to find it. In general, the teacher said, the information they find can be superficial, and not get at the heart of the topic. "We have to steer their surfing", the teacher said. Only one teacher thought the Internet did not offer the same level of quality as found in textbooks, and noted that it was too difficult for students to find information in the Internet, and that the information that was found was of a piecemeal nature. So with respect to the quality of the materials used as assessed by the teachers, I report the third finding of the study:

Finding 3: Teachers found that the use of Internet resources provided information that as good or better than that provided by state-approved textbooks.

How Teachers Combined Computer and Internet Use With Traditional Methods of Teaching

Since the teachers selected to make the shift from the use of textbooks to the use of computers, all students at the school were supplied with a new Apple laptop computer, and every classroom was outfitted with state of the art digital technology to take advantage of the students' access to ubiquitous computing.

While most of the teachers (80%) said that students use there laptop in class every

day (Table 7) and all most all (90%) of teachers said (Table 8) that students have Internet access all or most of the time and only slightly more than half (55%) reported that they were posting resources to the Internet regularly.

Table 7- Survey results for how students use computers in the classroom.

Item	In every class, everyday	In most classes, everyday	At various times during the week	Weekly	Less then a few times a month
How often do students use their laptops in the classroom? (N=35)	34%	46%	14%	3%	3%
	They have constant access	Most of the time	Sometimes	Rarely	Never
How often do students have access to the Internet in the classroom? (N=35)	69%	23%	9%	0%	0%

Table 8- Survey results for how teachers use the Internet in the classroom.

Item	For every assignment	For most assignments	For some assignments	A few times a year	I don't post on the Internet
I post class lessons on the Internet (N=34)	24%	32%	27%	3%	15%
I post class resources on the Internet (N=34)	20%	35%	30%	9%	6%

Teachers agreed overwhelmingly (94%) that the use of digital technology in their classrooms enhanced their students' ability to access class content. One teacher explained this benefit in this way: "My government students learn about the concepts through the news, as it's happening -- that's a civics skill. My history students can get their hands on primary source documents unavailable in textbooks or our library." Another teacher

noted that students could access information that was updated, and in many different formats and levels.

Other teachers cited students' improved organizational skills, chances for differentiated learning, and the independent nature of work on the Internet as positives. This comment represents their perspective. "Students in my classes conduct research, complete writing assignments, and analyze literature via technology." Although another sounded a note of caution, "Some learners can't use the technology properly due to their disability. Computers are more of distraction. Others don't do well reading off a screen, really need a hard copy." In general, though, the teachers' reaction was positive, summed up by this teacher. "My students can use the Internet to foster independent learning. As an example, during bell work yesterday a few students accessed purplemath.com to ensure they remembered the quadratic formula correctly."

The fourth finding of the study summarizes this data:

> *Finding 4: While students have access to the Internet and their laptop computers throughout the school day, only about half of the teachers are using the computers as part of their daily classroom routine.*

How Student Achievement May Be Affected by the Use of Technology

Most of the teachers (90%) felt that digital technology was a positive influence to some degree (Table 9). Only a few teachers (10%) had any negative feelings about it at all, and more than 80% felt that it was either engaging or highly engaging for students in their classrooms (Table 10). "The amount of information and resources that the Internet provides is amazing. It would be difficult for me to return to a non-Internet based teaching curriculum", was the way one teacher explained this. Another teacher focused

on Students' ability find diverse resources, stating that the use of the Internet teaches students how to use those resources in their education and "opens a whole new world of knowledge." Another teacher explained this result by saying it helps the students to learn how to research in the modern day society. "In today's world it is important to learn these skills since almost every job uses computer technology and the Internet as a main resource for research." But again, some teachers (9%) noted that Internet required discernment and editing by students. This view is represented by comments like "Since there is so much info floating about, it is about sorting through and confirming accurate information."

Teachers were nearly unanimous (96%) in agreeing that enhanced communication was a benefit of the Internet. Students e-mail questions to teachers and to each other, and interact on blogs and wikis. One teacher described it in this way; "It makes turning in work, and sending brief info to others a lot easier. We reach a lot more students faster using the Internet."

Table 9- Survey results for teachers' view of technology affect on students.

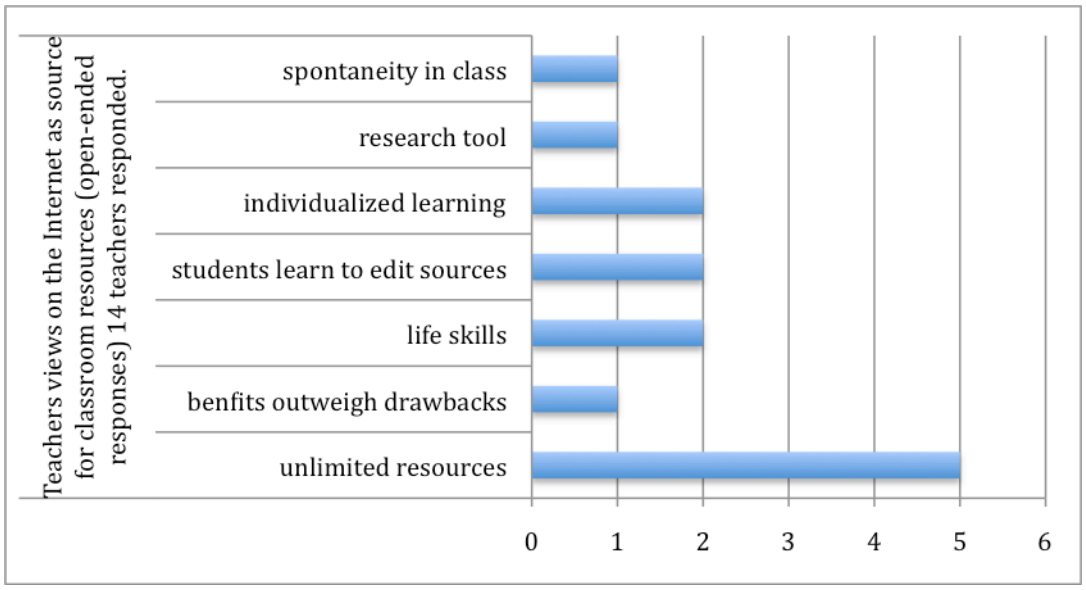
ITEM	Strongly Agree	Agree	Disagree	Strongly Disagree
Access to Internet resources is a positive influence on my students' learning (N=34)	65%	35%	0%	0%
Access to Internet resources is a negative influence on my students' learning (N=34)	0%	12%	50%	38%

Table 10- Survey results on teachers' view of student engagement.

ITEM	Highly Engaged	Engaged	Neither More or Less Engaged	Less Engaged	Not Engaged
Because of the technology, students are _____in school and extracurricular work (N=34)	18%	64%	18%	0%	0%

Teachers were given the opportunity to share comments about the availability and value of resources from the Internet. With 40% of the teachers opting to do so (Table 11), unlimited resources was the answer given most, while individualized learning, students' ability to edit resources, and life skills also had multiple responses. Spontaneity in class, use as a research tool, and the benefits outweighing the drawbacks were also noted. The number of teacher responses is noted along the bottom of the chart. Teachers made as many comments as they deemed necessary.

Table 11- Teachers views on the Internet as source for classroom resources (open-ended responses) 14 teachers responded.



Teachers said that achievement and engagement were enhanced by the presence of all the technology. They said things like, “Engagement is big at this school. I love seeing students constantly using their laptops. Sometimes their attention may be on other subjects that are not school related, but I think more often than not, this leads to them focusing on content related subjects.” and “I have a wide variety of resources to teach with, so I'm not stuck with something that is inherently dry -- it keeps them more interested, which tends to lead to better learning outcomes.” But there were a few who felt that it was either “a distraction” or had “no effect.”

According to the principal, the graduation rate is comparable to other high schools in the area, but he/she stressed the engagement, the constantly on nature of the students as reasons for better attendance and increased standardized test scores. One teacher said that they didn’t do this to get higher test scores, “although they did (go up).” Another teacher said, “The fact that we have replaced textbooks with a much more diverse package of resources, means that the kids have to work harder on it. The fact that we have teachers that have really worked hard on this campus to not just change the tool that we use, but change how we teach with it has made a big difference. It’s a package of things. It’s not the tool in and of itself; it’s what the tool enables us to do and if teachers don’t choose to find ways to maximize the tools’ potential to teach better, the tool will just be bells and whistles.”

While Appleton did not have a track record with regard to test scores, since it was a new school, results from the first round of state testing gave the school a rating of “highly performing”, according to their Arizona School Report Card for 2006-07, issued

by the Arizona Department of Education[19]. This is similar to other schools nearby, where most schools are performing well on benchmark tests. Also, as a new school, the latest test scores did not include a senior class, as there was none during that round of testing.

Discipline problems seem to be lower at the school, too, although there can be different kinds of issues. There is an Internet filter to regulate what students can see on their computers, but it's not perfect, and some teachers chafed at the idea that students were not being taught how to use the web responsibly, but rather, they were simply cut off from sites deemed offensive for some reason.

These data point to the fifth and sixth findings of the study:

Finding 5: Technology is generally viewed as a positive influence on students.

Finding 6: Teachers report student achievement was positively influenced by the use of technology

How Teachers See Their Students

In the course of the teacher survey, teachers were asked how they viewed their students vis-à-vis their acceptance of technology, and the idea of digital natives versus digital immigrants. While these questions were not the focus of the study, I viewed this as an opportunity to ask teachers in the field about a popular area of study, and they yielded some interesting insights.

Marc Prensky (2004) asserts that it is not that we don't know that computers are essential; it is simply a matter of how to employ them. "In the U.S. it's pretty much universally acknowledged that computers are essential for 21st century students, although there is still considerable debate about how and when to use them. But to most educators

[19] http://ade.az.gov

“computer” means PC, laptop or, in some instances, PDA” (p.1). Today's students have grown up with digital tools. They are what Prensky calls digital natives, “'native speakers' of the digital language of computers, video games and the Internet” (October, 2001). By contrast, most instructors in today's schools are what Prensky calls digital immigrants, “who speak an outdated language (that of the pre-digital age), who are struggling to teach a population that speaks an entirely new language” (p. 1). When teachers were asked about their students being “digital natives,” fewer than half (Table 12) had even heard the term before. Given Prensky’s explanation of the term, they agreed that most of their students fell into the category (Table 13). However, one teacher commented that the whole digital native thing was “a big lie”, that (he/she) knew much more about the computers and how to use them than did the students, and that a considerable portion of the beginning of each school year had to be devoted to basic computer use and organization.

> I am so far ahead of my kids and most of our teachers here are so, our kids can play games, our kids can text each other on phones, and they can play with their touch iPod, but they don’t know how to manage bookmarks. They’re terrible at desktop file management. The whole thing about ‘You’re going to learn from your kids’ it’s a big lie. So at the beginning of the year, I have to spend time teaching them the little tech skills that they’re going to need to get by successfully so they can think about the content and they don’t have to think about the technology. (Teacher interview, April 29, 2008)

Table 12- Teachers' knowledge of the term "digital native."

ITEM	Yes	No
I have heard of the terms "digital native" and "digital immigrant" (N=34)	45%	55%

Table 13-Teachers' view of whether their students were "digital natives."

ITEM	Digital Natives	Digital Immigrants	Neither
I believe that most of my students are (N=33)	52%	30%	18%

Summary and Conclusions

This study yielded six basic findings.

1. The majority of teachers were successful in creating their own curriculum by using Internet resources, and receiving critical support from the school.

2. Teachers engaged in curriculum planning in collaborative groups.

3. Teachers found that the use of Internet resources provided information that they judged was as good or better than that provided by state-approved textbooks.

4. While students have access to the Internet and their laptop computers throughout the school day, only about half of the teachers are using the computers as part of their daily classroom routine.

5. Technology was generally judged by teachers to have a positive influence on students.

6. Teachers report that student achievement is positively influenced by the use of technology.

Teachers were able to create their own curriculum, using Internet resources, but receiving critical support from the school, teachers plan in collaborative groups, teachers believe that use of Internet resources is as good or better than that provided by state-approved textbooks, while students have access to the Internet and their laptop computers throughout the school day, only about half of the teachers are using the computers as part of their daily classroom routine, technology is generally viewed as a positive influence on students, and student outcomes are positively influenced by the use of technology.

It revealed that teachers in a one-to-one environment are taking advantage of the technology to enhance their teaching, and thereby their students' learning. It also showed that, even though this school is awash in technology, the technology was not finally the point. Teachers did not feel the need to use the computers constantly, with a few teachers opting to use them very little. Teachers at the school combined traditional lesson planning and curriculum design techniques with state of the art digital tools. Teachers generally found that the formula was working, that students' achievement was going up, and that the school was a more effective learning environment.

As one teacher pointed out, they didn't adopted technology in order to raise test scores, even though scores went up. Rather, they wanted to make school a user-friendlier environment, where student engagement would increase. Most of the staff felt like it worked. Teachers did identify some problems, but overall were very positive about the school's vision and mission.

The findings indicate that teachers created their own curriculum, using Internet resources, and received critical support from the school, teachers plan in collaborative groups, teachers believe that use of Internet resources is as good or better than that provided by state-approved textbooks, that while students have access to the Internet and their laptop computers throughout the school day, only about half of the teachers are using the computers as part of their daily classroom routine, technology is generally viewed as a positive influence on students, and student outcomes are positively influenced by the use of technology.

Chapter Five
Conclusions

Literacy is commonly thought of as the ability to read and write. Literacy may also be seen in the social context of literacy practice. In the digital age, literacy means many things. The gateway to literacy in the digital age is the personal computer. The faculty of Appleton High School was not chosen because of their technical acumen, but maybe in spite of it. The teachers who came to the school were first committed to delivering the highest possible quality education to their students, and they collectively embraced the opportunity to infuse technology into their teaching preparation and delivery. This is a dedicated group of teachers, and perhaps only through such dedication can such a radical new way of thinking gain a foothold in a public school.

As I approached the design of this study, the concern from senior researchers was that it might be difficult to get enough teachers to participate in the study. They worried about the degree of cooperation, and suggested guidelines and procedures for accounting for the teachers missing from the data set. By the time I administered the survey, the original principal had left and a new principal had taken over. This new principal was the former assistant principal, who had been onboard at the school since before it had opened. Although I had not met him previously, he seemed to be completely up to speed on what I was doing, and offered to help in any way possible. He asked the new assistant principal to be my liaison, and she was helpful in every way. In the end, *all* of the teachers participated in the study in whatever way they were asked, whether it was in interviews or completing the online survey. The level of cooperation was obviously welcomed.

It may, therefore, not be too surprising that there is a high level of teacher buy-in

with regard to the use of technology. Even the teachers who admitted that they didn't use technology as much as some others gave their support to those who had fully immersed themselves and their students in the latest digital resources. It was not that some of the teachers were afraid of technology. Indeed, only three of the 36 teachers expressed any fear of technology at all, with 75% of the teachers saying it was never a problem. The teachers simply trusted their colleagues to help them through the difficult parts without judgment, but rather support and encouragement.

What may be surprising was their willingness to speak to an outsider about their practice, and what they view as the positive, and negative, aspects of integrating technology. They are proud of what they accomplished, and many of them believe that they have broken new ground in the use of one-to-one computing, and how they have adapted their methods of designing curriculum. They appeared eager to share the story of their accomplishments.

Reviewing the Research Questions of the Study

The goal of this study, as indicated in Chapter One, was to examine how teachers have taken up the task of designing curriculum for delivery in classes where students have their own computers 24/7. It queried teachers about their theory of change linked to the implementation of one to one computing, the methods used to create and apply their own curriculum, and their orientation in general towards the use of technology in learning. It examined teachers' views on student achievement in the use of teacher-made curriculum. It examined teachers' impressions about the effectiveness of teacher-created curriculum as opposed to textbook centered curriculum. The specific research questions were:

- To what extent do teachers use computer tools to design curriculum that supports distributed learning and cognition and enhance learning in a classroom environment?
- To what extend do teachers work collaboratively to design and produce content?
- How do teachers use the Internet as a resource in lieu of state approved textbooks and how do they rate the quality of Internet resources as compared to textbooks?
- What relationship, if any, is there between student achievement and the use of technology?

The data indicated that:

- The majority of teachers succeeded in designing their own curriculum by using Internet resources with school support.
- Teachers engaged in curriculum planning in collaborative groups.
- Teachers reported that the use of Internet resources provided information that is as good or better than that provided by state-approved textbooks.
- While students had access to the Internet and their laptop computers throughout the school day, only about half of the teachers are using the computers as part of their daily classroom routine.
- Technology was generally judged by teachers to have a positive influence on students.
- Student achievement was positively influenced by the use of technology.

I will discuss the relationships of these findings to the literature and their

implications for educational policy.

Teacher Created Curriculum

Over and over, in person and through the survey, I heard that teachers had relied on the Internet for resources, ideas, and utilities in designing their classroom curriculum. Almost two-thirds of the teachers identified the Internet as their most important resource in their lesson creation and implementation. As one teacher expressed it: “The most valuable resources that I’ve (used) have been online. My ability to go on and find anything I need. With a school like this and with the resources we have available as far as being able to access the Internet, it’s been amazing.” This comment was typical of what many teachers stated.

In a one-to-one environment, this is hardly a surprise. Every teacher and every student have the Internet available to them throughout the day. Teachers share resources, give assignments and supply resources, while students use those resources and deliver completed work, all in a seamless fashion. As I walked around the school during lunch and passing periods, students everywhere had their laptops open, as did the teachers who awaited them in classrooms.

Curriculum Planning and Teacher Collaboration

In many ways, teaching can be a solitary existence. Teachers cloistered in their classrooms, each with heavy load of students and class preps, are the master of all they survey as they lead their students. Much of teachers’ credential training extols the virtues of collaboration, but in practice, it can be easy for a given teacher to feel isolated. With the introduction of ubiquitous technology, teachers at Appleton communicate with each other throughout the teaching day. Many of the teachers have personal blogs that other

teachers, and students for that matter, regularly comment on.

In addition, there are routinely scheduled planning sessions, and planning is an important feature of staff meetings and professional development as well. These meetings happened before school, on days when the students have a later start time. This gives the faculty time at the beginning of the day, before the pressures of teaching to address the issues of the day. The majority of the staff felt that these meetings were worthwhile and productive. There was a sense of teamwork everywhere on the campus among teachers, so it was not surprising that teachers found collaboration useful.

The Quality of Internet Resources

Teachers were effusive in their praise of content on the Internet. They cited greater range of perspectives, deeper treatment, and a more personalized student experience as some of the reasons for their enthusiasm. They noted that more views and more up to date content are available, and that there was more information to explore than a textbook could possibly provide. “It gives teachers more to work with. Often textbooks only have a few examples or activities that go with a grammar concept I teach. So instead of having to write my own I can tell my kids to go to a website and do an activity there.”

They noted that the Internet provides a constructivist approach to learning that offered opportunities for spontaneity, and a wider variety of resources, that were more current. Only one teacher felt that it was too difficult for students to find information among the myriad of resources available. It is, perhaps, the extensiveness of information ironically that makes it difficult for students to find what they need.

Classroom Use of Technology

In the most counter-intuitive finding of the survey, not every teacher used the laptops and Internet resources regularly in classroom instruction. While they have constant access to the laptops and the Internet, some teachers felt that more traditional methods were more effective in their classrooms. Lowther et al. (2003) reported that Laptop students were more attentive and interested in learning as compared to non-laptop students, and that laptop students also achieve better results on writing and problem solving assessments. But it seems that some teachers felt that their subjects did not lend themselves to the use of digital content or Internet resources. A particular example was a math teacher, who used the Internet as a place where student could access warm-up activities from her blog, but decided that ciphering with pencil and paper was a more effective strategy for teaching algebra.

Technology Effects on Students

Technology is a tool that has been used for instructional delivery, but that has the potential to impact the teaching and learning environment. Niles (2006) observed that when students learned "*from* technology," they were likely to be using the computer as a tutor, directing drill and practice, and or delivering information. Niles contrasted this with "Learning *with* technology" where students used the technology as a tool, as "a way of navigating the learning process, and enabling them to improve higher-level critical-thinking skills, and creativity, and to construct new knowledge" (p. 3). The greater goal is that of transforming the teaching and learning process (Kinlaw, 2003). Teachers at Appleton have begun transitioning the practice of learning *from* technology to learning *with* technology.

About 90% of the teachers felt that technology had a positive influence on their students. They cited limitless resources, individualized learning, enhanced opportunities for students to edit resources, and spontaneity as evidence for this claim. “What you’re doing is designing lessons that allow students to construct their own learning and you do the guidance that you need to herd them in the direction that you want to herd them in, but that’s where the tech actually allows you to do things you couldn’t is when you use it in a way that you construct learning”, one teacher in an interview noted.

In one of the interviews, a teacher did sound a note of caution. “If tech- oriented or tech-enabled transitions are led by teachers and administrators who are driven by educational outcomes and qualitative improvements and pedagogy and student learning, then you can end up in the right direction. If it’s driven by IT people who are really excited by the bells and whistles of it, you go in the wrong direction because IT, and they hate to hear this, they’re a support function.” Indeed, about a fifth of the teachers at Appleton said that their professional development was not as useful as it could be. The primary reason for why teachers do not use technology in their classrooms is a lack of experience with the technology (Niles, 2006). This suggests that IT providers should be teacher-centered in their training methods and goals. Just as it is important for a teacher to get students to buy-in to a lesson or unit, so, too, districts, principals, and on-site technology coordinators need to work to get teacher buy-in by properly equipping teachers with the tools to use technology to advance lessons in class. Sufficient access to technology, adequate teacher preparation, appropriate curriculum, supportive school district and site administration, and parental support have been found to be necessary for technology to be effective (Norris, Soloway, & Sullivan, 2002).

One of the other teachers interviewed was more hopeful about the introduction of technology.

> My overall feeling about it [technology] is that it's helping a lot actually. For instance, what I experienced at another high school that I taught at where there weren't laptops is that it's really hard to get kids engaged sometimes. And it's really hard to get them engaged with a textbook that's old; maybe it's five years old or whatever the case may be. The one thing I noticed about the laptop school being here is that you can walk around campus at lunchtime or you can walk around campus after school and students are at least participating in the process. They might not always be doing schoolwork, but they're engaged in the actual instrument and it keeps them somewhat involved in the process, which I don't think you find all the time in other high schools.

Student Achievement and the Use of Technology

"You know we didn't open this school to get higher test scores, although they did," said one teacher. The teacher added,

> We have replaced textbooks with a much more diverse package of resources, and that means that the kids have to work harder on it. The fact that we have teachers that have really worked hard on this campus to not just change the tool that we use, but change how we teach with it, has made a big difference. It's a package of things. It's not the tool in and of itself; it's what the tool enables us to do and if teachers don't choose to find ways to maximize the tools' potential to teach better, the tool will just

> be bells and whistles. If you have no woodworking skills, it doesn't matter how great your table saw is. You're still going to end up with something that doesn't glue together right. I don't know if that makes any sense or not.

It's Not About the Box

Seven-time Tour de France winner Lance Armstrong wrote a memoir about his cycling career entitled "It's Not About The Bike," suggesting that cycling was more than the use of human-powered transportation, but rather about what the cyclist does with it. Similarly, computing in schools is not about the computer, but rather what the students do with it. An experienced cyclist uses the bike as a tool, working with its strengths to maximize his performance. At Appleton High School, it's not about the box. The laptops are a tool, used by highly trained and supported teachers to maximize their students' performance. I didn't go in to this study believing one thing or another, but as I worked on it, I began to think that using the laptops in class seemed logical and natural. It makes sense. If there is one constant theme throughout this work, it is that one size does not fit all. This faculty embraced the technology, and the opportunity to create their curriculum. Creative administrators and dedicated teachers turned obstacles into assets. I saw the value of one-to-one computing, coupled with adequate teacher and student training, and utilizing the Internet to maximum benefit.

Implications

The central implication that immerged from the data is that teachers were able to incorporate 21st century digital tools into their teachers under specific conditions. These conditions include ubiquitous access, a strong sense of common purpose and shared

commitment of the faculty, effective resources from the school and the district, student engagement, with parental and the community support. Many teachers were effusive with praise for the support they received from the school's administrators, and stated that the district had offered more support to this school than they had seen had other schools they had worked at.

Everything worked at Appleton. It was a perfect storm of high-quality hardware, district and school support, teacher buy-in, and regular and meaningful training and professional development. Buy-in at the school is the highest that I have ever seen. It seemed like every teacher was onboard, willing to work toward the goals established when the school was opened—smaller learning environment, infusion of technology, locally created curriculum. Finally, it would not have possible without the Internet, which seems obvious, but it has the facility to transform correspondence learning into significant and purposeful engagement.

According to the U.S. Department of Education[20], the Internet is an appropriate vehicle for promoting meaningful engaged learning. It allows students to work on authentic, meaningful and challenging problems that are similar to tasks performed by professionals in various disciplines, interact with data in ways that allow student-directed learning, build knowledge collaboratively, and interact with professionals in the field. Teachers in a one-to-one computing environment can take full advantage of the Internet in identifying objectives for student achievement. They can more closely match the learning styles and abilities of their students to resources (Sternberg, 1999). The central goals of teaching and learning do not change with the medium in which they are

[20] http://ed.fnal.gov/doe/

delivered. The new computing is about users accomplishing complex interactive tasks instead of machines executing commands (Shneiderman, 2003).

Teachers at Appleton have embraced this idea. They have worked together to create an atmosphere of teamwork and cooperation. They have leveraged the one-to-one computing environment to enhance the educational experience of their students. They have employed Internet resources, both in the form of teacher-created material, but also commercially available curriculum, as well as classroom management sites that enable them to take learning out of the classroom, and into the cloud.[21]

The staff at Appleton has enlarged the size of their classrooms, not just metaphorically, but in real sense, physically, as well. By taking strategic advantage of the technology that they have, teachers have been able to make the entire world a part of their classrooms.

Recommendations

In 2005, Appleton High School, part of a school district south of Tucson, Arizona, opened to much fanfare and national media attention. When administrators looked at the budget for the new school, they realized that they had enough money to buy textbooks or technology, but not both. They were faced with a choice: They could design the new school and it's curriculum as every other school in the area had done, with textbooks from established publishers that came with conventional curriculum grounded on state standards. Or they could take the less traveled new route of becoming a technology-savvy campus that both delivered its instruction and collected student work digitally.

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[21] Cloud computing is Internet (cloud) based development and use of computer technology (computing). The cloud is a metaphor for the Internet and is an abstraction for the complex infrastructure it conceals (Scanlon & Wieners, 1999). It allows users to access technology resources from the Internet (in the cloud) without having those resources available on their local computer.

This was not an easy choice. The former was a tested and validated course of action. The most successful schools in the state had made this choice countless times. The latter had not been attempted in Arizona. It would be an experiment where success would be lauded, but failure would be devastating to administrators and students alike. The former was a sure thing, while the latter was a calculated risk. And while there was much anecdotal evidence that one to one computing enhance the educational experience for the students, there was little hard data that supported the idea.

Appleton High School is a model of student, and teacher, engagement. They have shown that one-to-one computing, combined with a dedicated staff, meaningful professional development, and district support can succeed. Yes, they have technology, but more importantly, they have a staff willing to risk a venture away from a traditional teaching role to use techniques that they may well be learning themselves for the first time. The staff came to the school on a leap of faith, not because there was a working program. The teachers were promised things by the school and the district, but promises can be elusive things when the time comes for them to be fulfilled. In this case, promises from the school and the district were kept. The school's test scores are higher, not incredibly higher, than their neighboring schools. They have students actively engaged, using the provided technology, all through the school day, and well into their after-school time.

Many districts across the country have embraced a one-to-one model (Kinlaw, 2003; Clark, 2006; Mara, 2006). According to a New York Times story in 2007, some have been successful initially, and then leveled off, some have continued their success, while others are giving up. "Those giving up on laptops include large and small school

districts, urban and rural communities, affluent schools and those serving mostly low-income, minority students, who as a group have tended to underperform academically." Districts in California, New York, Virginia, and Massachusetts have given up on one-to-one because they didn't see measurable test score increases[22].

In an educational system girded by No Child Left Behind, it seems that schools only care about making test score increases. It's not surprising. Districts see their funding tied to test score increases, and need to raise scores by whatever means they can in order to survive. In some ways, those districts that took a chance on one-to-one computing are the pioneers, to be congratulated, but the congratulations wear thin when students cannot raise test scores enough to justify the expense of technology to a school board that has to answer to the public that has been conditioned to see test scores as a realistic metric for student achievement. So schools that take on the task of integrating technology have, in some ways, a double burden. They must blend the technology seamlessly into their program while at the same time raise student achievement in ways that the public is used to seeing.

That is a shame, because education is so much more than the score of a single high-stakes test. It is about an experience that enriches the lives of students that prepares them for life after high school. It is about preparing students to succeed in a world where 21st Century Skills will be required for them to succeed.

Appleton High School has shown that one-to-one computing, combined with a dedicated staff, meaningful professional development, and district support can succeed. Yes, they have technology, but more importantly, they have a staff willing to risk a

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[22] http://www.nytimes.com/2007/05/04/education/04laptop.html

venture. Test scores are higher, not incredibly higher, than their neighboring schools. They have students actively engaged, using the provided technology, all through the school day, and well into their after-school time, by means of accessing teachers' blogs and resources posted online.

Specific Recommendations

Appleton is an example of what can be accomplished if that happens, even though they are still working under limitations of No Child Left Behind. Other districts and schools can learn from the experience of Appleton High School, where achievement is determined by students' ability to embrace a constructivist education, and teachers' ability to deliver one. Districts need to provide a 21st Century education to students that includes, but is not limited to, immersion in technology that incorporates teachers designers of the curriculum that best fits the needs of their students.

Further Study

I have already begun to use the findings of this study to create a new program at the high school that I am working at currently. I want to equip every incoming ninth grade student with a netbook[23], a small (8.5 inch screen) laptop with a solid-state hard drive and limited storage space. Then, every teacher will be trained on the MOODLE learning management system, and given an account. Every classroom that the students will be using will be supplied with wireless Internet access. Finally, every student will be trained in the use of the netbook, MOODLE, and Web 2.0 applications such as GoogleDocs, Photoshop Express, and other "cloud" applications.

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[23] A netbook is a light-weight, low-cost, energy-efficient, highly portable laptop that achieves these parameters by offering fewer features, less processing power and reduced ability to run resource-intensive operating systems.

The implications of this study directly point to this idea. Equipment is obviously necessary, but as this study demonstrates, no amount of hardware is sufficient if initial and ongoing training are not part of the mix. Part of what was so successful at Appleton was the initiation given to incoming students. Echoing that idea, we will have a summer "boot camp" prior to students entering their freshman year to familiarize them with equipment, protocols, and web resources. We will also spend a week training teachers on how to leverage their students' new technology by utilizing the MOODLE learning management system. As with the other software we want to use, MOODLE is free, open-source software. The fact that we will be able to institute a one-to-one program without significant software expense should help persuade district officials to support us. It should allow us to launch the program for about $500 per student.

Summary

The study addressed these questions. To what extent do teachers use computer tools to design curriculum that supports distributed learning and cognition and enhance learning in a classroom environment? Do teachers work collaboratively to design and produce content? How do teachers use the Internet as a resource in lieu of state approved textbooks? How do teachers rate the quality of Internet resources as compared to textbooks? Is student achievement positively influenced by the use of technology?

The data indicated that, the majority of teachers were successful in creating their own curriculum by using Internet resources, and receiving critical support from the school. Teachers engaged in curriculum planning in collaborative groups, teachers found that the use of Internet resources provided information that is as good or better than that provided by state-approved textbooks. While students have access to the Internet and

their laptop computers throughout the school day, only about half of the teachers are using the computers as part of their daily classroom routine. Technology was generally judged by teachers to have a positive influence on students, and student achievement is positively influenced by the use of technology.

The central implication that immerged from the data is that teachers who have developed a collaborative "open door" culture and share a focus on collective professional development can use 21st century tools if given adequate resources and the support. The recommendations of this study are that districts embrace 21st Century Skills, giving teachers the flexibility to use Internet resources in the design of their curriculum and provide the resources and support to be able use it effectively; that districts and schools adopt the model of teacher and student engagement, adequate and ongoing training and support, and district and school administration support demonstrated by the experience of Appleton High School.

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Appendix A:
Principal Interview Protocol

Ron Smith

Pepperdine University

Distributed Learning in Designing Curriculum in a One-to-One Computing Environment

Principal Interview Protocol

Empire High School, Vail, Arizona

March 2008

Principal Questions

Do teachers plan in groups?

Do teachers participate in teacher communities beyond the classroom?

Are there formal structures for teachers to work together?

What periods during the day, week or month are set aside for teacher meetings?

What information structures are available for collective action?

How are students grouped for instruction? (90min blocks, 2-hour blocks or some other more flexible arrangement)

Does the principal see changes in indicators like school attendance or graduation rates?

Can you name 3-5 teachers who have a special or unique knowledge of instructional design at Empire who might consent to be interviewed about it?

Appendix B:
Teacher Interview Protocol

Ron Smith

Pepperdine University

Distributed Learning in Designing Curriculum in a One-to-One Computing Environment

Teacher Interview Protocol

Empire High School, Vail, Arizona

March 2008

Design of Curriculum

Tools

- What did you bring to the table? (Knowledge, experience, equipment)
- What were you given by the school/district? (Knowledge, experience, equipment)
- What is missing?
- What do you use to create curriculum?

Collaboration and structure

- Do teachers plan in groups and are their outside partnerships that have been formed?
- Are there formal structures for teachers to work together?
- What periods during the day, week or month are set aside for teacher meetings?
- What information structures are available for collective action?
- How are students grouped for instruction? (90min blocks, 2-hour blocks or some other more flexible arrangement)

Training

- Were you provided training by the school/district?
    - What was it?
    - Was it effective?

- Is it ongoing?
- Do you need/want more training?

Support

- Do you feel supported by the school? District?

  Ongoing training

  Professional development

  Collegial support

  Seminars & workshops

Curriculum Design

- How do you develop your curriculum?

  Standards

  Media

  Realia

  Software solutions

Implementation Process

- Integrating tech seamlessly
- How do you access and implement Internet resources in your classroom?
- How do you decide on what resources to use?
  - What Internet resources do you use first? Always? Never?
- Do you seek out specific resources or let students find them on their own?
- Do you encourage mentorship relationships through online resources?
- Do students use Wikipedia or engage in 21st century skill development?
- How do you deliver your curriculum?
  - Online (procedure?)
  - In class (procedure?)
  - Homework (procedure?)
  - Do you think it works?

- Strengths
- Weaknesses

Evaluation

- Has it increased comprehension in your class? (explain)
- Have student achievement gone up? (explain)
- Has it affected attendance in your classes? (explain)
- Has it affected discipline in your classes? (explain)
- Is there a qualitative improvement in instruction?
- Is there a qualitative improvement in the student learning experience?
- How has the presence of laptop computers changed the environment for teachers? (explain)
- How has the presence of laptop computers changed the way teachers construct and deliver curriculum? (explain)
- What have been the most significant benefits for you, thus far, with laptop use? (explain)
- What have been the most significant benefits for you in creating your own curriculum? (explain)
- What have been the most significant challenges in creating your own curriculum? (explain)
- What one question do you feel the researcher should ask about the your role in curriculum creation and how would you answer it? (explain)

Process vs. outcome

- Can the "tech" process obscure outcomes the teacher is hoping to reach for your students?
- How is tech playing a role in teaching and learning experience?

- How is student learning different with tech?

Thinking skills vs. Content

- Thinking skills are important, but how is content grasped by students?
- Does tech enable the process? How?
    - Tech influence on discipline? Are there disruptive behavior in tech ways?
    - How does tech affect primary source based research?
    - How does tech affect reading comprehension?
    - How long does it take for new students to get up to speed with the tech in school?
    - Is exposure to tech positive?
- Can tech classes create websites and other digital products for teachers or businesses as class projects?
- English teachers must teach 5-paragraph essay format for standardized tests, so how does that affect others kinds of writing when using tech?
- What one question do you feel the researcher should ask about the your role in curriculum creation and how would you answer it?

Appendix C:
Teacher Survey

Distributed Learning in a High School

1. Introduction

Thank you for participating in this survey. This survey is designed to explore how teachers use computer tools to design curriculum in a one-to-one computer environment. The goal is to understand the formal and informal supports for teacher learning and teacher development of curriculum, paying close attention to relationships and partnerships that have evolved.

The survey is divided into sections — collaboration and training, curriculum delivery and content, thinking skills, and outcomes. This is an exploratory research project and I value your thoughtful reflections. As such, be assured that there are no wrong answers to the questions. It should take you about fifteen minutes to complete.

This survey is voluntary and your participation indicates that you are giving me permission to collect and analyze the results and present them in a way that protects your identity and the identity of your school.

Again, thank you for your participation.

Distributed Learning in a High School

7. The resources I need to develop curriculum are available to me at my school.

- ◯ 1 – strongly agree
- ◯ 2 – agree
- ◯ 3 – disagree
- ◯ 4 – strongly disagree

Distributed Learning in a High School

3. Curriculum Design continued

1. My most valuable resources in designing my curriculum come from (choose all that apply)

- [ ] 1 – my local school
- [ ] 2 – my district
- [ ] 3 – the Internet
- [ ] 4 – colleagues

Other (please specify)

2. Industry partners and vendors provide useful resources for my curriculum design.

- ◯ 1 – strongly agree
- ◯ 2 – agree
- ◯ 3 – disagree
- ◯ 4 – strongly disagree

3. When I plan, I anticipate goals for

- ◯ 1 – today
- ◯ 2 – this week
- ◯ 3 – this month
- ◯ 4 – this semester
- ◯ 5 – this school year

4. Describe the most important resources you use in designing the curriculum for your classes.

5. Describe a problem with resources that you have encountered in designing the curriculum for your classes.

Distributed Learning in a High School

4. Collaboration and training

1. Teachers at my school plan curriculum in groups.

- ◯ 1 – daily
- ◯ 2 – weekly
- ◯ 3 – bimonthly
- ◯ 4 – monthly
- ◯ 5 – teachers never plan curriculum in groups

2. Time is set-aside for teachers to formally plan together.

- ◯ 1 – daily
- ◯ 2 – weekly
- ◯ 3 – bi-weekly
- ◯ 4 – monthly
- ◯ 5 – never

3. Staff development features training and innovations that teachers can put into practice on the next school day.

- ◯ 1 – strongly agree
- ◯ 2 – agree
- ◯ 3 – disagree
- ◯ 4 – strongly disagree

4. Staff meetings and professional development are valuable resources in planning my curriculum.

- ◯ 1 – strongly agree
- ◯ 2 – agree
- ◯ 3 – disagree
- ◯ 4 – strongly disagree

5. Teachers participate in education communities beyond the classroom that help with curriculum design.

- ◯ 1 – strongly agree
- ◯ 2 – agree
- ◯ 3 – disagree
- ◯ 4 – strongly disagree

Distributed Learning in a High School

6. Give an example of teachers participating in education communities beyond the classroom.

Distributed Learning in a High School

5. Curriculum delivery and content

1. The mixed block format at our school is an effective way to deliver my lessons.

- ◯ 1 – strongly agree
- ◯ 2 – agree
- ◯ 3 – disagree
- ◯ 4 – strongly disagree

Please explain

2. Compared to using textbooks, having students access content on the Internet overall is

- ◯ 1 – different in form, but similar in quality to textbook content
- ◯ 2 – better quality content
- ◯ 3 – not the same level of quality content found in textbooks

Distributed Learning in a High School

6. Better Quality

1. Compared to using textbooks, having students access content on the Internet overall provides better quality content in the following ways (choose all that apply)

- [ ] 1. more perspectives or views on a content
- [ ] 2. deeper treatment of the content
- [ ] 3. students can explore issues related to their interest

Other (please specify)

Distributed Learning in a High School

7. Does not provides the same level of quality

1. Compared to using textbooks, having students access content on the Internet overall does not provide the same level of quality content found in textbooks because (choose all the apply)

- [ ] 1. content is inaccurate
- [ ] 2. it is too difficult for students to find information at their level
- [ ] 3. the content is piecemeal and it is difficult for students to understand the whole

Other (please specify)

Distributed Learning in a High School

8. Curriculum delivery and content continued

1. How often do students use their laptops in the classroom?

- ◯ 1 – in every class, everyday
- ◯ 2 – in most classes, everyday
- ◯ 3 – at various times during the week
- ◯ 4 – weekly
- ◯ 5 – less then a few times a month

2. How often do students have access to the Internet in the classroom?

- ◯ 1 – they have constant access
- ◯ 2 – most of the time
- ◯ 3 – sometimes
- ◯ 4 – rarely
- ◯ 5 – never

3. I encourage outside (of school) mentorships for my students.

- ◯ 1 – for all students
- ◯ 2 – for most students
- ◯ 3 – for a few students
- ◯ 4 – I do not encourage outside mentorships for students

4. The administration at my school encourages outside (of school) mentorships for my students.

- ◯ 1 – for all students
- ◯ 2 – for most students
- ◯ 3 – for a few students
- ◯ 4 – My school does not encourage outside mentorships

5. I post class lessons on the Internet

- ◯ 1 – for every assignment
- ◯ 2 – for most assignments
- ◯ 3 – for some assignments
- ◯ 4 – a few times a year
- ◯ 5 – I don't post lessons on the internet

Distributed Learning in a High School

6. I post class resources on the Internet.

- ◯ 1 – for every assignment
- ◯ 2 – for most assignments
- ◯ 3 – for some assignments
- ◯ 4 – a few times a year
- ◯ 5 – I don't post class resources on the internet

Distributed Learning in a High School

9. Curriculum delivery and content continued

1. Students have access to school and district provided resources via the Internet.

- ◯ 1 – at school, home or anywhere with connectivity
- ◯ 2 – at school, but not outside of school
- ◯ 3 – at home, but not at school
- ◯ 4 – at special locations
- ◯ 5 – students don't have access to resources over the internet

2. Students deliver completed work to me via the Internet

- ◯ 1 – daily
- ◯ 2 – several times a week
- ◯ 3 – weekly
- ◯ 4 – monthly
- ◯ 5 – I don't have students submit work via the internet

3. The district has implemented a content filter to regulate what the students are allowed to look at on the Internet.

- ◯ 1 – this filter helps students find information that is appropriate and accurate
- ◯ 2 – this filter inhibits students from learning how to make good choices
- ◯ 3 – this filter has little affect on the learning experience as there is so much information

4. How effective is the filter in blocking information?

- ◯ 1 – too permissive allowing students to access inappropriate content
- ◯ 2 – too obstructive of the learning process as good tools and content are restricted
- ◯ 3 – about right

Distributed Learning in a High School

10. Thinking skills

This section will look at how technology helps you teach critical thinking and 21st Century skills. 21st Century skills include understanding across and among core subjects, emphasis on deep understanding rather than shallow knowledge, and engaging students with real world data, tools, and experts that they will encounter in college, on the job, and in life.

1. Digital technology (computers, printers, Internet connectivity) enhances my students' ability to access and acquire content in my class.

- ◯ 1 – in every class I teach
- ◯ 2 – in most classes I teach
- ◯ 3 – in some classes I teach
- ◯ 4 – in none of my classes

Please explain

2. Digital technology (computers, printers, Internet connectivity) hinders my students' ability to access and acquire content in my class.

- ◯ 1 – in every class I teach
- ◯ 2 – in most classes I teach
- ◯ 3 – in some classes I teach
- ◯ 4 – in none of my classes

Please explain

3. Access to Internet resources is a positive influence on my students' learning.

- ◯ 1 – strongly agree
- ◯ 2 – agree
- ◯ 3 – disagree
- ◯ 4 – strongly disagree

Please explain

Distributed Learning in a High School

4. Access to Internet resources is a negative influence on my students' learning.

- ◯ 1 – strongly agree
- ◯ 2 – agree
- ◯ 3 – disagree
- ◯ 4 – strongly disagree

Please explain

5. Enhanced communication is a benefit of access to the Internet.

- ◯ 1 – strongly agree
- ◯ 2 – agree
- ◯ 3 – disagree
- ◯ 4 – strongly disagree

Please explain

Distributed Learning in a High School

11. Thinking skills continued

1. Internet tools are an integral part of learning in my classroom.

- ◯ 1 – strongly agree
- ◯ 2 – agree
- ◯ 3 – disagree
- ◯ 4 – strongly disagree

2. Because of the technology, students are _____ in school and extracurricular work.

- ◯ 1 – highly engaged
- ◯ 2 – engaged
- ◯ 3 –neither more or less engaged
- ◯ 4 – less engaged
- ◯ 5 – not engaged

Terms referring to people as "digital natives" for whom digital technology use comes more naturally and "digital immigrants" to those who did not grow up with digital technology have been offered as a way of describing the differences between teachers and students in today's schools. The following questions explore this idea.

3. I have heard of the terms "digital native" and "digital immigrant".

- ◯ 1 – yes
- ◯ 2 – no

4. I consider myself a

- ◯ 1 – digital native
- ◯ 2 – digital immigrant
- ◯ Neither (please explain)

5. I believe that most of my students are

- ◯ 1 – digital natives
- ◯ 2 – digital immigrants
- ◯ Neither (please explain)

Distributed Learning in a High School

6. Fear of the technology is a problem for my students.

- ◯ 1 – constantly
- ◯ 2 – often
- ◯ 3 – sometimes
- ◯ 4 – rarely
- ◯ 5 – never

7. Fear of the technology is a problem for me.

- ◯ 1 – constantly
- ◯ 2 – often
- ◯ 3 – sometimes
- ◯ 4 – rarely
- ◯ 5 – never

8. I learn about technology from my students.

- ◯ 1 – constantly
- ◯ 2 – often
- ◯ 3 – sometimes
- ◯ 4 – rarely
- ◯ 5 – never

Distributed Learning in a High School

12. Outcomes

Explain how the use of one-to-one computing at your school affects the following.

1. Achievement and Engagement of students in my class.

2. Standardized tests scores of my students.

3. Attendance and/or graduation rate at our school.

4. Discipline at our school.

5. Your Learning Process

Distributed Learning in a High School

13. Thank you

Thank you for participating in this survey. Your answers are important, and your contribution is appreciated.

Appendix D:
Teacher Survey Results

The teacher survey was comprised of questions that flowed from the teacher interviews. It was not practical to interview all 36 teachers, but by gaining insight into the views of a small group of teachers, it was possible to develop categories and questions that would resonate with the faculty as a whole. The survey is divided into sections — collaboration and training, curriculum delivery and content, thinking skills, and outcomes.

Thirty-four of the 36 teachers responded to the online survey. The results are presented here, as they were collected. Questions are followed by multiple-choice answers, the percentage of each choice, as well as the raw number of responses. Open-ended questions, as well as comments on multiple-choice questions, are listed by the question, followed by all of the submitted comments.

Curriculum design

1-What prior experience and education in the area of curriculum design did you have when you came to this school?

- Before becoming a teacher, I was a programmer with a degree in Broadcast Journalism.
- Admin. College level
- I worked for one year in a middle school.
- Not much- I am a CTE (Careers & Technology in Education) teacher and I basically came right out of the industry of Interior Design and Architecture to teach level. I am now studying the methods of education.
- Masters in education, 4 years teaching experience
- I worked on curriculum alignment committees while teaching middle school and high school.
- I didn't really have very much experience in curriculum design, besides teaching swimming lessons and in my church.
- Military Curriculum Design
- Team Curriculum meetings throughout the years (20 years)
- Before coming to Empire I served two years on a committee that determined the Algebra 2 curriculum calendar for the district.
- I had taught elsewhere for three years and rarely used the materials given to me. I preferred to make my own plans and materials.
- I have always taught without a text book and have been doing so for six

years.
I had little experience with curriculum design before coming to Empire. I worked with other teachers in the district to unwrap state standards but that was the extent.
designed the language arts curriculum for grades 9-12 at a private school, created my own materials with no textbooks
I had 5 years of teaching experience and 2 years as the head of my department. I also have a masters degree in curriculum
Master Degree in Music performing and teaching.
None.
Just a semester of student teaching
I designed lessons and worked on common curriculum with other teachers
EEI -- theoretical training and student teaching experience from M.Ed program
Bachelors in Art Ed., designing art ed curriculum and specifically ceramics curriculum while I taught ceramics for two years.
Technology Certification, CTE teacher
I previously worked in a laptop learning school with very limited resources, so we had to develop much of our own curriculum materials.
None
My training is in special education.
Refined and helped expand Spanish curriculum. Served on math standards committee at previous employer.
One year of experience
Four years of teaching 9-12.
I had taught Five years prior to coming to Empire. It was always necessary in my job.
I recently graduated from the University of Arizona, so i had a number of Teaching Methods classes just before I graduated.
I have developed curriculum for Health class at the middle school and high school level. I also developed classes to teach life skills to students with severe disabilities.
I have been involved in department meetings that involve curriculum mapping.
I was just beginning to use Atlas Curriculum Mapping program
I helped align math curriculum to the standards in a previous district, summer 2003.

2-What subject(s) do you teach?
Web Development and Interactive Digital Media
Director of Student Services
I teach American history and government
Architecture & Design 1 & 2; Career Explorations
Astronomy, Earth Science, Biology, Geology, Algebra
American History, American Government
Spanish

Algebra II and Sped Math
Do not teach
Math
Spanish and history
Earth Science
AP Literature, English
Language Arts
English
PE
Theatre
History
AP Calculus, Art, ELP (gifted)
Art and Math
Special education
Algebra and Geometry
I am a Para-professional so I help students in all classes
Special education
Taught: 1st, 2nd and 3rd year Spanish, Basic Algebra, Algebra, Geometry and Algebra Support. Teach: Weights
Senior English Graphic Novels
Special Education
Special education
Physical Education and Driver's Ed.
Health, Fitness, and English. This year I am a resource teacher.
Mathematics.
English
Library and ELL

3-Describe the school/district role in providing you with resources to develop your curriculum.

1 – highly supportive	23.5%	8
2 – supportive	64.7%	22
4 – minimal support	11.8%	4
5 – unsupportive	0.0%	0

Comments

Supplying more resources would put the program in a position to deliver a top-notch education.
I had a strong staff working for me
My fellow teachers have been amazing in providing me with resources. The district provided my database that I use, but everything else I have gotten through fellow teachers or my own searches.
New teacher induction was a weeklong learning session for me, where as for the other teachers it was just review of their education.
We have access to subscription sites for content, per request. We are encouraged to find our own resources and share them.
We had a relatively (albeit standards-based) hand in identifying what we

thought would be quality content resources and vetting them within the environment we built. We were treated like professionals, and didn't have anything forced on us.

We use TPRS and have teacher manuals by Blaine Ray and by Carol Gabb

School provides the laptop program that can be used as a resource and provides a map of the objectives for each quarter

Our department budget provides for purchases of curricular resources.

We have a budget to purchase materials but that is not bottomless. There are always things we'd like but can't afford.

If I am need of assistance all I have to do is ask for it.

The curriculum maps help guide instruction. But in addition to that our in-services are centered around this particular area as well.

This school is an exception to the rule- here I am open to use and explore many different resources. I worked at a different school in the district and the admin was not as supportive.

There are not a lot of resources for them to pull from to give me curriculum for theatre. I have created most of it myself from resources accumulated through my years at the university.

There are resources available on databases and people have been helpful.

I want to keep it that way. I feel very capable in designing my own curriculum. The math department has standardized (lower level) math curricula to the point of scheduling POs on a calendar. I prefer more flexibility. I feel that the PO "a la cart" approach sacrifices the teaching of a subject as a contextual body of knowledge. For instance, Euclidean Geometry starts with three definitions (point, line, plane) and then develops an entire branch of mathematics, which rests on these definitions. It is akin to theology. The PO-based approach tends to concentrate on the bricks at the expense of the mortar.

I was provided more resources for Math, and less for Art. This could be due to the fact that Math is very standardized while Art curriculum is more open ended.

School has been very supportive about making technology work for all students.

Professional development and in-service opportunities are extremely relevant to what is going on in our classrooms and teacher input is taken into account when deciding upon what opportunities will be made available.

I have only been here a short while

Special education (inclusion) has a unique role in that we need to take the curriculum that other teachers are working with and adapt and modify it.

I am able to do what I want with my students. Administration is much less involved in the curriculum development for special education.

Vail is an amazing school district, one that supports all of its employees to the fullest.

During the first year Health was taught at the high school level, we met often

to discuss the required curriculum.
The district provides a map for us to use, but without textbook resources it can be challenging to find appropriate materials for certain performance objectives.
We are given the standards, and we design the lessons. Teachers are supportive in sharing ideas.
The ELL class was initiated this year and curriculum development is just beginning.

4-I develop curriculum on my own.

1 – strongly agree	41.2%	14
2 – agree	50.0%	17
3 – disagree	5.9%	2
4 – strongly disagree	2.9%	1

5-I develop curriculum in collaboration with other teachers.

1 – strongly agree	14.7%	5
2 – agree	64.7%	22
3 – disagree	17.6%	6
4 – strongly disagree	2.9%	1

6-State Education Standards are helpful in the design of my curriculum.

1 – strongly agree	26.5%	9
2 – agree	58.8%	20
3 – disagree	14.7%	5
4 – strongly disagree	0.0%	0

7-The resources I need to develop curriculum are available to me at my school.

1 – strongly agree	29.4%	10
2 – agree	61.8%	21
3 – disagree	8.8%	3
4 – strongly disagree	0.0%	0

8-My most valuable resources in designing my curriculum come from (choose all that apply)

1 – my local school	25.8%	8
2 – my district	12.9%	4
3 – the Internet	77.4%	24
4 – colleagues	61.3%	19

Comments

Knowledge of the industry
Conferences, professional organizations
State standards
My personal background knowledge, I am a geologist.
Professional Development Conferences
Books and classes received from the University

District Sped resources, from teachers, District office

9-Industry partners and vendors provide useful resources for my curriculum design.

1 – strongly agree	6.1%	2
2 – agree	51.5%	17
3 – disagree	39.4%	13
4 – strongly disagree	3.0%	1

10-When I plan, I anticipate goals for

1 – today	5.9%	2
2 – this week	29.4%	10
3 – this month	26.5%	9
4 – this semester	17.6%	6
5 – this school year	20.6%	7

11-Describe the most important resources you use in designing the curriculum for your classes.

On-line content providers, on-line research resources and equipment availability.

Internet

My state standards, the essential questions my department came up with and what my colleagues and I feel are the most important aspects of life.

The state standards really help me figure out what they need to learn.

Internet - mostly NASA or industry sponsored sites.

My state standards and the ABC-CLIO Social Studies databases to which EHS subscribes.

my department head provided me with a teacher manual and also a lot of visual aids that go along with the stories we use. Lesson planning is a lot easier this way.

Internet, Peers and essential standards addressed by the district

Do not design curriculum

The single most important resource is time!

Books of vocabulary and stories that I use to inspire my lessons.

Personal Background. Tool box of previous curriculum. Internet.

My most important resources come from the Internet as well as ideas from my colleagues. I also utilize curriculum provided to me from the College Board and AP institutes.

I search for ideas online from other teachers, I talk to my colleagues and I brainstorm my own ideas.

standards first- then online resources

Others in my field.

the Internet

I look at objectives and final products that i want students to accomplish and design my curriculum around those things.

multimedia resources on the web...they allow me to teach subjects freshly every year.

The Internet, my experience, the district and the state standards.
Prior curriculum provided by fellow teachers and then tweaked by me to fit the needs of each student.
N/A
The Internet is a HUGE resource. It makes it easier for my students to gain extra access to examples outside of the classroom and provides me with a wealth of examples from a variety of different resources.
Internet resources and periodicals provide the latest and most important information pertinent to my subject.
I take general education objectives and revise them into accessible objectives for students with special needs.
Old college theories and books, curriculum resources from NCTE, Textbooks, Theories of Writing
I utilize many Internet resources that contain the same content being taught in our 9-12 classrooms but at a lower level (i.e. 5-6th grade reading level)
Real life resources-banks, volunteer/job experience, grocery stores, etc.
I use other teachers as references and also state and or national standards to guild me in my planning.
Collaboration with other teachers in the school district. Discovery Health Videos.
On-line teacher's text book. Researched resources on the Internet and in text book form.
Internet, e-notes, other teachers
Most important resources are online at ELL sites.

12-Describe a problem with resources that you have encountered in designing the curriculum for your classes.

Maintenance and monetary support is a huge problem.
None
I needed a book to follow along with for pacing issues. Plus teacher books have great ideas for activities, projects and ideas for special ed and ESL kids.
I am more or less on my own, I am the only one I know teaching these classes.
Finding information at the right levels or with the right focus for my particular lesson
Periodically I've found outside websites that were useful, only to have the site content change or site disappear later.
Not any so far. Everyone here is helpful.
When i first started teaching it was difficult to find all the resources I had available.
funding, not enough for education in AZ
Few non-text resources are available for math levels above Algebra 2.
Most of my resources are not digital so it is time consuming to recreate them so that they can be manipulated with the computer.

Time
The biggest road block I encounter in designing curriculum is finding reading material that is available to use for my students. Many short stories are not published online and are not available for use via internet, which is a challenge when teaching literature without text books.
There is no central resource/location at school to find ideas etc.
sifting through all the crap
none.
technical problems
There is not a lot of resources or collegues that can help with designing my curriculum for my content area (theatre).
none.
Always come back to time.
n/a
There are occasions when it is difficult to get materials exactly how we want them for the district, so I often pull things together and make my own activities and resources.
None.
No reliability to get the resources
There are often not sufficient resources available for high school content that is applicable to students whose reading/cognitive abilities are at elementary/middle school levels.
Many of my students will not attend college. This district does not provide for vocationally geared courses. Probably due to them not being part of the AIMS test.
They have been unorganized and or non-existent
We purchased CDs to supplement the health curriculum and they frequently got stuck in the laptops (would not eject) resulting in computers needing to be shut down and loss of teaching time.
Extreme difficulty in finding engaging material for certain POs.
Not enough novels
Too many of those resources are for elementary ages.

Collaboration and training

13-Teachers at my school plan curriculum in groups.

1 – daily	0.0%	0
2 – weekly	18.8%	6
3 – bimonthly	25.0%	8
4 – monthly	50.0%	16
5 – teachers never plan curriculum in groups	6.3%	2
5 – teachers never plan curriculum in groups	6.5%	2

14-Time is set-aside for teachers to formally plan together.

1 – daily	0.0%	0
2 – weekly	9.7%	3
3 – bi-weekly	25.8%	8
4 – monthly	35.5%	11

5 – never	29.0%	9

15-Staff development features training and innovations that teachers can put into practice on the next school day.

1 – strongly agree	25.8%	8
2 – agree	61.3%	19
3 – disagree	12.9%	4
4 – strongly disagree	0.0%	0

16-Staff meetings and professional development are valuable resources in planning my curriculum.

1 – strongly agree	24.2%	8
2 – agree	54.5%	18
3 – disagree	21.2%	7
4 – strongly disagree	0.0%	0

17-Teachers participate in education communities beyond the classroom that help with curriculum design.

1 – strongly agree	21.9%	7
2 – agree	68.8%	22
3 – disagree	9.4%	3
4 – strongly disagree	0.0%	0

18-Give an example of teachers participating in education communities beyond the classroom.

Academy Village collaboration iPlant collaboration
Workshops
I am currently taking grad classes about historical research, that is helping me teach my kids how to plan and do research.
Attending conferences
I am a member of the Arizona and National Science Teacher's association and the Planetary Society. I know other teachers are members of similar professional organizations.
I know of a number of teachers at EHS who are members of their respective national content area organizations (NCSS, NCHE, etc.), attend workshops and conferences, and sometimes present at those functions.
Going to TPRS conferences.
The U of A math teacher retention program
Teacher training in and out of state
Our teachers provide in-house professional development for each other during district in-service days.
Many belong to professional associations within their content areas.
VAIL Cares. NSTA conferences. NCTM conferences. AP conferences.
Many teachers attend the National Conferences for their content area. Particularly, teachers in my department attend the National

Conference for Teachers of English yearly.
State and national English teacher associations would be one.
Unfortunately they don't
Clinics, conferences
Several teachers help with the online materials that are available to teachers
Committees formed to form lessons for Advisory based classes.
Fine ARts has periodic BBQs and meetings in which we discuss the philosophical bases which underlie our goals (e.g., advocacy, community input, etc.) I find the "community" approach most helpful at the highest (conceptual/philosophical) levels, after which I can translate these broad strokes into goals and objectives that are content-specific.
Sponsoring Academic Clubs, Participating in Curriculum development teams
Other school districts, starting to use technology, call on us to jump-start their efforts; we gladly share what we know and what we have built.
Does not apply to me
The math teachers at our school are all part of a math community through the U of A. This community offers resources, guest speakers, and a teacher fair.
In service and staff meetings provide general information needed for teachers to expand their curriculum.
Planning Parties
I find learning opportunities in the community and do many off campus activities.
Many teachers serve as coaches or after school tutors, and Vail school district also has a home visit program where the teachers make home visits to families who may need extra help or support in educating their child
Our school district has several committees that meet together to plan core curriculum in all the core academics.
I participate in a program through the U of A that supports Math teachers.
Book clubs
Listservs are available in the library world and ELL world

Curriculum delivery and content

19-The mixed block format at our school is an effective way to deliver my lessons.

1 – strongly agree	37.5%	12
2 – agree	53.1%	17
3 – disagree	6.3%	2
4 – strongly disagree	3.1%	1

Comments

I think the mixed block format works well... especially for IDM classes due to the nature of projects and labs.
Too long
Block days are good every once in awhile, but students loose focus and concentration too often during a block schedule. It is hard to plan meaningful lessons that keep the kids entertained and focused and isn't just busy work

It is easier to get more work done on the longer block days than the shorter ones.
The longer days give time for projects and labs while the shorter days are good for breaking up long lectures and discussions.
I can alternate between shorter lessons and ones that require more time to complete, and during the block I can deliver content by different means in one period. For example, I could have students read a document individually, then get together in small groups to discuss it, then we could hold a class debate over the topic -- all in one period.
Some days I have activities I want to do that are longer than others so it is good to have a block day.
Allows opportunity to have bigger projects
My previous school had two block pairs, so I only saw my students 3 times per week. With the single block pair I see my students 4 days a week. I enjoy having a single-block in the week for exploratory learning and hands-on activities.
It is nice to schedule more involved activities for block days so that you can finish. I still see my students almost everyday, which is important for language studies.
Block days are long and students tend to get restless.
It is so effective to have block days in which we can work on extended writing assignments or have Socratic seminar discussions within the class periods. The shorter class periods are used to convey information and work on smaller pieces of content.
Any block is better than a traditional schedule- the kids are bounced around enough as it is.
it allows more time for in depth lessons
In a content like theatre, a lot can be accomplished in a longer class period.
art requires blocks
The block days are great for going deeper into a classroom topic.
N/A
For classes that have a lab curriculum, yes. For some classes, esp Sped classes they are just too long.
The block day allows us to plan for extended activities without boring the kids every day with an extended lesson plan.
There are certain activities that lend well to having longer periods of time to accomplish them.
More time to focus comprehensively on a specific topic. More time to complete a learning project in one class setting rather than carry it over to the following day.
As a Math teacher, I would prefer to have 5 one-hour class periods a week instead of the block period.
Extra time allows to vary lessons.
Some tasks do require more time.

20-Compared to using textbooks, having students access content on the Internet overall is

(Responses to this question led the respondent to other questions, depending on their answer. If the respondent chose answer one, they were directed to question 23. If a respondent chose answer 2, they were directed to question 21, whose answers are listed as sub-headings under choice 2, and in the other box below. No respondents chose answer 3, which would have led them to question 22. Since none were directed to that question, it was omitted here)

1 – different in form, but similar in quality to textbook content 36.4% 12

2 – better quality content 63.6% 21

- a. more perspectives or views on a content 85.7% 18
- b. deeper treatment of the content 61.9% 13
- c. students can explore issues related to their interest 76.2% 16
- Other-
  - Sometimes having the Internet provides them with too much. It can be overwhelming for them. Plus it adds in the benefit of teaching kids how to properly use the Internet.
  - More views and more up to date content is available, also there is more information to look into that a textbook could not provide.
  - More updated information, different reading and interest levels
  - It gives teachers more to work with. Often textbooks only have a few examples or activities that go with a grammar concept I teach. So instead of having to write my own I can tell my kids to go to a website and do an activity there.
  - Only deeper treatment if students know where to find it. In general the information they find is superficial and does not get at the heart of the topic. We have to steer their surfing.
  - Wider variety of literature and literary criticism resources
  - It is hard to find a textbook for all areas of theatre. The Internet allows me to have students use resources that I normally would not be able to give them.
  - True constructed learning, more spontaneity
  - More updated information
  - It promotes self-directed learning

3-not the same level of quality found in textbooks 0.0% 0

23-How often do students use their laptops in the classroom?

1 – in every class, everyday 33.3% 11

2 – in most classes, everyday 48.5% 16

3 – at various times during the week 12.1% 4

4 – weekly 3.0% 1

5 – less then a few times a month 3.0% 1

24-How often do students have access to the Internet in the classroom?
1 – they have constant access 69.7% 23
2 – most of the time 21.2% 7
3 – sometimes 9.1% 3
4 – rarely 0.0% 0
5 – never 0.0% 0

25-I encourage outside (of school) mentorships for my students.
1 – for all students 29.0% 9
2 – for most students 22.6% 7
3 – for a few students 38.7% 12
4 – I do not encourage outside mentorships for students 9.7% 3

26-The administration at my school encourages outside (of school) mentorships for my students.
1 – for all students 40.0% 12
2 – for most students 30.0% 9
3 – for a few students 26.7% 8
4 – My school does not encourage outside mentorships 3.3% 1

27-I post class lessons on the Internet
1 – for every assignment 21.9% 7
2 – for most assignments 34.4% 11
3 – for some assignments 25.0% 8
4 – a few times a year 3.1% 1
5 – I don't post lessons on the Internet 15.6% 5

28. I post class resources on the Internet.
1 – for every assignment 18.8% 6
2 – for most assignments 37.5% 12
3 – for some assignments 28.1% 9
4 – a few times a year 9.4% 3
5 – I don't post class resources on the Internet 6.3% 2

29. Students have access to school and district provided resources via the Internet.
1 – at school, home or anywhere with connectivity 97.0% 32
2 – at school, but not outside of school 0.0% 0
3 – at home, but not at school 0.0% 0
4 – at special locations 3.0% 1
5 – students don't have access to resources over the Internet 0.0% 0

30. Students deliver completed work to me via the Internet
1 – daily 3.1% 1
2 – several times a week 28.1% 9
3 – weekly 25.0% 8
4 – monthly 25.0% 8
5 – I don't have students submit work via the Internet
18.8% 6

31. The district has implemented a content filter to regulate what the students are allowed to look at on the Internet.
1 – this filter helps students find information that is appropriate and accurate
60.6% 20
2 – this filter inhibits students from learning how to make good choices
24.2% 8
3 – this filter has little affect on the learning experience, as there is so much information
15.2% 5

32. How effective is the filter in blocking information?
1 – too permissive allowing students to access inappropriate content
3.0% 1
2 – too obstructive of the learning process as good tools and content are restricted
27.3% 9
3 – about right 69.7% 23

33. Digital technology (computers, printers, Internet connectivity) enhances my students' ability to access and acquire content in my class.
1 – in every class I teach 58.1% 18
2 – in most classes I teach 29.0% 9
3 – in some classes I teach 6.5% 2
4 – in none of my classes 6.5% 2
Comments

I teach web development and digital technology software... so my answer is obvious.

Students can get updated information and they can get information in lots of different formats and levels.

My government students learn about the concepts through the news, as it's happening -- that's a civics skill. My history students can get their hands on primary source documents unavailable in textbooks or our library.

Students keep their everyday bell work in a word document. It helps them stay organized.

I am able to better differentiate instruction using the computers

My students can use the Internet to foster independent learning. As an example, during bell work yesterday a few students accessed purplemath.com to ensure they remembered the quadratic formula

correctly.
Many times, students just need to talk to each other to learn to communicate in the language. The computers in this case are unnecessary.
Students are able to research the topics we address.
Students in my classes conduct research, complete writing assignments, and analyze literature via technology.
More resources
Some learners can't use the technology properly due to their disability. Computers are more of of distraction. Others don't do well reading off a screen, really need a hard copy.
My assignments, along with special resources are posted to my blog on a daily basis.
I only use the computers and Internet for journal work only a couple of times throughout the year in physical education class; however, For my Driver's Education class, i post most assignments online and have the students turn them in online.
When the wealth of information is broader, the ability to access content-related information is enhanced.
Post assignments on the blog.
Access to OPAC and electronic databases

Thinking skills

This section looked at how technology helps teachers teach critical thinking and 21st Century skills. 21st Century skills include understanding across and among core subjects, emphasis on deep understanding rather than shallow knowledge, and engaging students with real world data, tools, and experts that they will encounter in college, on the job, and in life.

34. Digital technology (computers, printers, Internet connectivity) hinders my students' ability to access and acquire content in my class.

1 – in every class I teach	6.7%	2
2 – in most classes I teach	3.3%	1
3 – in some classes I teach	20.0%	6
4 – in none of my classes	70.0%	21

Comments

It enhances to the point that some distractions do not prevent learning.
Sometimes kids just can't focus with all the distractions and sometimes they get overwhelmed by figuring out what content is reliable or appropriate for the assignment.
When I don't want my students to be distracted online, I tell them to shut their computers. It isn't a problem
Technology can be a distraction for some students. Also at times there are literary resources not available to students.

Sometimes it is a distraction
Technology is not appropriate for that specific student.
Have not experienced the hindrance.

35. Access to Internet resources is a positive influence on my students' learning.

1 – strongly agree	65.6%	21
2 – agree	34.4%	11
3 – disagree	0.0%	0
4 – strongly disagree	0.0%	0

Comments

The amount of information and resources that the Internet provides is amazing. It would be difficult for me to return to a non-Internet based teaching curriculum.
It can be distracting at times.
I think the benefits greatly outweigh the drawback - especially in terms of current information.
Thousands of resources, articles, games, activities in Spanish
It teaches students how to use their resources in education and opens a whole new world of knowledge
Learning how to find needed information via the Internet is an important life skill in our society.
There are a variety of ways to differentiate instruction using the Internet. Also there are so many resources that students can pull from while using the Internet.
More resources
Since there is so much info floating about, it is about sorting through and confirming accurate information. The Internet can be a great tool for this.
There are definitely times when students get off task with the Internet. But, from working in schools without laptops, it is no different than students being off task writing notes to one another.
Helps the students to learn how to research in the modern day society. In today's world it is important to learn these skills since almost every job uses computer technology and the Internet as a main resource for research.
Self-directed learning
Students have become more self-directed learners.
Allows more spontaneity in class.
Easy access

36. Access to Internet resources is a negative influence on my students' learning.

1 – strongly agree	0.0%	0
2 – agree	12.5%	4
3 – disagree	50.0%	16
4 – strongly disagree	37.5%	12

Comments

It enhances to the point that some distractions do not prevent learning.
At times it can be because it is not as concrete or credible as a text book would be. Although at the same time, that causes students to have to evaluate whether it is or is not a viable source. It can be overwhelming for a student to have to make those decisions.
They can get bogged down sometimes, but overall the Internet is a great tool.
Sometimes the kids wander, and lose focus -- though that's a character skill they need to develop.
It can be a distraction for some students, but not so much that I'd consider it a negative influence.
While I disagree that it is a negative influence on their learning, I do think there are times when it can be distracting from their learning process.
Easier for students, distraction
Students don't always filter the information that get from the web and so end up with the wrong conclusions.
The only time it has a negative influence is when they get distracted and off subject
Have not experienced a negative influence.
That easy access comes with negatives. Students must be taught to search effectively to achieve useful results.

37. Enhanced communication is a benefit of access to the Internet.

1 – strongly agree	48.4%	15
2 – agree	48.4%	15
3 – disagree	3.2%	1
4 – strongly disagree	0.0%	0

Comments

For example, up to the minute information often sparks content related communication. For instance, the launching of a new site is a great way to bring about a discussion about developing a new site.
Students will e-mail me with questions or comments
Email, blogs, access to content from home or elsewhere is great!
Blogs, email, and wikis -- they enable me to keep up with my students very easily, share information, and get their comments and work.
E-mail
Students are able to email me with homework problems
Students can discuss with one another via Internet as well as communicate with their teachers via Internet.
More opportunities
Makes turning in work, sending brief info to others a lot easier. We reach a lot more students faster using the Internet
Students can communicate with their teachers at any time.
Students email me for help from home.

38. Internet tools are an integral part of learning in my classroom.

1 – strongly agree	34.4%	11

2 – agree	56.3%	18
3 – disagree	6.3%	2
4 – strongly disagree	3.1%	1

39. Because of the technology, students are _____ in school and extracurricular work.

1 – highly engaged	18.8%	6
2 – engaged	62.5%	20
3 –neither more or less engaged	18.8%	6
4 – less engaged	0.0%	0
5 – not engaged	0.0%	0

40. I have heard of the terms “digital native” and “digital immigrant”.

1 – yes	46.9%	15
2 – no	53.1%	17

41. I consider myself a

1 – digital native	48.4%	15
2 – digital immigrant	32.3%	10
Neither	19.4%	6

Please explain

I don't know meaning of terms

I'm digitally proficient, but didn't grow up with digital technology.

I had to learn

I don't really identify with or use either of these terms. I think if people are willing to learn about technology, they will, weather they grew up with it or not.

I did not grow up with computers but I feel that over the past few years I know more than a digital immigrant.

I am somewhere in the middle. I graduated U of A in 1997. The Internet was not available on campus. I returned the next year and it was. I was young enough to adapt quickly and I feel comfortable with technology, but I use it only minimally in my personal life.

42. I believe that most of my students are

1 – digital natives	77.4%	24
2 – digital immigrants	9.7%	3
Neither	12.9%	4

Please explain

They are great at using the "fun" tools like iTunes and Google, but they have a really hard time transferring their knowledge into school related tools like Office.

They are in the process of becoming naturalized, bit-by-bit, and often times kicking and screaming. They know far less than we assume.

1/2 and 1/2

43. Fear of the technology is a problem for my students.

1 – constantly	0.0%	0
2 – often	0.0%	0
3 – sometimes	31.3%	10
4 – rarely	56.3%	18
5 – never	12.5%	4

44. Fear of the technology is a problem for me.

1 – constantly	0.0%	0
2 – often	9.7%	3
3 – sometimes	16.1%	5
4 – rarely	38.7%	12
5 – never	35.5%	11

45. I learn about technology from my students.

1 – constantly	9.4%	3
2 – often	34.4%	11
3 – sometimes	46.9%	15
4 – rarely	9.4%	3
5 – never	0.0%	0

Outcomes

46. How does the use of one-to-one computing at your school affect Achievement and Engagement of students in your class?

Engagement is big at this school. I love seeing students constantly using their laptops. Sometimes their attention may be on other subjects that are not school related... but I think more often than not, this leads to them focusing on content related subjects.

For some students it's hard to remember to turn things in on line. For others it helps them to turn in more than what they would on paper because it eliminates the loss of paper.

Students enjoy using the computers

Both are improved for MOST students but the students who have trouble staying focused already are definitely at a disadvantage

I have a wide variety of resources to teach with, so I'm not stuck with something that is inherently dry -- it keeps them more interested, which tends to lead to better learning outcomes.

They have access to more and can do more, so one might say they achieve more. they can get distracted sometimes though.

Do not teach classes

I don't think there is a difference overall. I think it makes a difference for some students' achievement, and I think engagement issues are more visible with the laptops. But I think the biggest factor is the quality of teaching.

Students are more engaged with working with computers even if they are working on simple problems. Students are able to look for help on the Internet if they get lost

Students average grade in my classes since I have been teaching have remained the same. However students are more engaged with the content at my current position

Students are constantly receiving feedback on their work via computer, which strengthens their ability to achieve in class. In addition, they are motivated by the use of computers which strengthens engagement.

I believe this will be higher with the computers.

The material is relevant and now- so it is more likely to engage students

No affect.

Students are successful in class

True constructed learning as opposed to unilateral delivery

Students see the technology as an easier, much more comfortable way to complete work.

For my math class, there are definitely activities in which there is more engagement due to the availability of one-to-one computing. There are also many great resources that are available for extra practice to encourage greater achievement.

Students are engaged in the content in and out of class.

Does not affect my students.

The computers help students stay actively engaged in the lessons that i teach by allowing them to discover the various topics and ideas for them selves through self-directed and group learning and discovering.

Many students have obtained higher achievement in their academics, and we have all observed increased engagement in our classrooms.

It can help with both of these when used appropriately, or it can become a distraction if not used properly.

Negligible.

Students can access research and info at their fingertips.

Student use of computers is instinctive. Engagement is almost guaranteed. Resources are available to students wherever they may be.

47. How does the use of one-to-one computing at your school affect the standardized test scores of your students?

My involvement with standard tests is limited; however, it appears to improve these scores... sometimes dramatically.

Not sure, as my class is not tested.

No standardized tests in my class

Improved

AZ does not have standardized social studies tests as of this point.

I do not know.

Not applicable to my role

Students have access to practice problems online that can be beneficial.

Students are able to research knowledge on their own and able to teach themselves using this knowledge
Seem to be about the same.
I feel that computers have very little to do with success on standardized test scores. My students prepare for the AIMs test and the AP test using paper and pencil writing processes. It is important for them to continue the writing process in multiple mediums. I believe our students are successful on standardized tests because of the dedication and abilities of our teachers, not the computers.
Does not really affect.

48. How does the use of one-to-one computing at your school affect attendance and/or graduation rates at your school?

We only have two classes to choose from... so at this point, the verdict is still out.
Attendance is easy
Improved
I've heard that our truancy and absentee rates are lower than other high schools, but I don't have specific facts to back that up.
I do not know yet
I do not know
It offers students a different option for obtaining knowledge, which reaches a new population of students.
Seem to be about the same.
If students are absent they are more able to access missed work, which holds them accountable in their absences. I think this increases attendance because students realize absences are not an out. Graduation rate is affected little by the computers.
I don't know but there is a waiting list.
Not sure
No affect.
It is high
N/A
Technology prepares all the students for post-secondary career goals and makes reaching those goals a lot easier. Hence graduation rates, but not necessarily attendance is better.
I'm not sure if attendance rates are any better at our school compared to others, but it does make it easier for students who are absent to gain access to assignments.
I have experienced high attendance so far in the semester.
Does not affect my students.
I feel that the computer allows students a greater access to a teacher's curriculum and thus makes it easier to stay in touch and on track in a class if they for any reason must be absent.
I do not feel it has increased either the attendance and/or graduation rate. This is still a problem at our school with the lower performing

students.
I don't know if it has any affect on daily attendance. It may have an affect on enrollment.
New to the school, unable to comment.
Parents are informed immediately if their child is absent.

49. How does the use of one-to-one computing at your school affect discipline at your school?

I am not sure how to respond to this question. So far, in my class, discipline issues are not a big problem.
It is harder to keep the kids on track, meaning that I spend a lot more time monitoring the students in order to cut down on problems.
Unknown
Better for some areas but increased for technology-related issues like proxy use, breakage, etc.
Kids are kids: good, bad, dumb, passive, whatever.
No effect
Do not know
There is less down time because the Internet can be used to provide additional work if necessary, in turn less down time means less discipline problems
Seem to be about the same.
We have different discipline challenges than other schools. We often deal with inappropriate computer use rather than physical behavioral issues. We spend more time monitoring computer usage than student conflict.
I don't know that it makes a difference.
Now the problems revolve around technology instead of other things, but they are still there.
No affect.
Not a lot of problems
The filter causes discipline problems. the filter is a joke, and retards student's self-regulation
Technology brings on a whole new level of discipline issues such as inappropriate material/sites, proxy, computer damage, theft, music at inappropriate times, IM, email all distract from the learning and have to be dealt with in the student code of conduct.
Outside of general high school discipline issues, we do have issues with students trying to get around the filter. Compared to my previous school, the discipline related to laptops is MUCH less.
I have not had any discipline problems.
Does not affect my students.
Having the computer assigned to each student gives him or her a sense of self-responsibility.
It has definitely caused new discipline issues to arise such as inappropriate use of computer.

We have a set of rules and procedures in place to deal with discipline issues related to the use of our technology.
I am new to the school, so I am unable to comment.
It creates another set of discipline issues, i.e. Internet use, games, cheating.
Improper use of the computer can be a frequent problem.

50. How has the use of one-to-one computing at your school affected your learning process?

I cannot even begin to describe how my learning process has skyrocketed with this program. I continue to learn more and more about my content areas as time goes on.
Way improved!
Increased variety of resources helps me stretch myself as a teacher.
More fun maybe. More to learn.
Helps me
I have always used a computer/laptop to teach and as a result I don't feel that being in a one-to-one environment has mush of an effect on my learning process.
My learning process is affected daily by computers. I am constantly seeking new resources on the computer and Internet. It stretches me as a teacher and as a life long learner.
It is a great resource and a huge challenge at the same time.
I think that it enhances it because it is again relevant and now.
No affect.
Smooth
It has made me grow intellectually at an exponential rate
I enjoy learning more and being on the edge of new learning using technology. Don't always use it, but it is good to know for future use.
I have found new and exciting ways to get my content to the students.
Enhances the ability to research topics given.
It helps me evaluate, collect and organize my thoughts in a more effective way so that i can better evaluate the effectiveness of my lessons.
My learning process been positively impacted by the use of one-to-one computing at our school.
There are more opportunities for research and student involvement in the learning process.
New to the school, unable to comment.
I discover new things all the time about technology and the ways it can be implemented into the class.
I learn everyday and often use the computer/Internet.

Appendix E:
Teacher Interviews

The interviews were conducted in April 2008. Teachers that might give a good cross-section of opinions were selected by the principal to be interviewed. Probably because the atmosphere at the school is so collegial, the selected teachers were eager to talk to the researcher, and when others heard of the interviews, they volunteered as well. Since the goal was to interview only a few teachers, and to try to minimize the impact on the school's normal operation, two teachers suggested by the principal were interviewed, as well as one volunteer teacher. The teachers were all asked questions from an initial script, outlining different areas that the researcher wanted to cover. Because the interviews were conversational, topics did deviate from the initial set of questions, usually resulting in a deeper understanding of the teacher as an individual and a clearer picture of the teachers' situation and circumstances at the school. Some questions needed to be skipped in each interview to stay mindful of each teacher's time.

The teachers were asked about their background and specific preparation that they had before they stated at the school.

Teacher One started off. "My background as far as curriculum is really only what I learned in grad school because I've never been a teacher, I've only been teaching for five years. So anything I know about curriculum development besides that which is intuitive, which I think a lot of it is, you know, task analysis and that kind of thing. If you have kind of an engineering background or a computer science background, you kind of start seeing the world that way as problems to be decomposed".

Teacher Two added that he/she was involved in the planning of the high school. "I was

on the Planning Committee to make the high school, so I was part of the group with the district and other teachers and administrators and community members and other people that went from “we need a new high school” to “this is what we’re going to have” in terms of the planning of it and so I had the opportunity to actually select, well go through and search for and vet different content resources and call them like backbone systems, types of things that we use here that aren’t content, that are enablers for us to do what we do with the computers. I was able to go through the process of actually looking at what’s out there and coddling together something that I, and others who opened the school, believed would enable us to do what we thought we needed to do. So it was nice to be able to do the thinking about and the planning for and then get to implement it as well”.

Teacher Three said, “Well, relatively I’m a new teacher. This is my second year. My experience came from being a programmer in the insurance industry. The experience I brought was just understanding, the professional work field for that sort of occupation. As far as the curriculum is concerned, I’ve developed a lot of that. A lot of the things I’m teaching right now I really didn’t know at the time. I’ve done a lot of research online. I have this amazing amount of resources that I use online to develop my curriculum as I go along, a lot of those I have never used before until I became a teacher. So I developed it as I was going along”.

We then talked about how the district helped with curriculum resources.

Teacher One said, “I don’t believe that our district is very strong in assisting us, giving us tools for developing curriculum. I think there’s a lot of standardization and there’s been a big move since I’ve been here toward centralization of curriculum and

standardization of curriculum within departments, but I feel that there's a lot of curricular development tools or formats for lesson planning, that kind of thing, that are better than what the district gives us. So I guess I'd have to say that there's a little bit of training on behalf of the district that I don't think it's particularly effective".

Teacher Two said, "We have the State standards and the district goes through a process of identifying what we call the "Essential Standards" because it's really not possible to teach all the standards that the State mandates. But, like you mentioned earlier with questions, by asking one question, you may end up getting the answer to several. When you look at the standards, for example with American Government, there's a lot of redundancy.

" So what we do is we go through the various, for example government, the standards for government and we identify what are the ones that cover the most territory and will enable us to accomplish what all the standards are asking for, but these are the ones we're going to explicitly say, I'm teaching this standard. I'm not necessarily teaching this one, but there's got to be a rationale for ones that you don't teach, having been covered by the fact that you're teaching the other one. So it kind of cuts down on the need within your planning to pack lessons with 'I'm going to have this standard and this standard.' All these things so you can justify and say that you're actually covering everything you're supposed to cover.

"We have a very loose semester breakdown in our district so that the other high schools in the district, their first-semester Government is supposed to cover the same topics as our first- semester Government. Beneath that, on a site level, it's entirely up to us. And since I'm the only Government teacher here, I don't have to really discuss it with

anybody. I mean I pass it by my principal and I provided the administration with the rationale as to what I'm doing and in what sequence and why I believe that that's the right way to do it, but there isn't any other coordination because it's just me.

"Let me say this. We have access to our content resources, the online databases that we use for Social Studies content. We have access to that 24/7. On a departmental level, each of the departments in the school is given a certain amount of money per year to buy classroom aids, instructional aids. I mean that heap of books over there on my table is the result of some of our departmental money this year.

"What I do is I work with the teachers, because I'm the department head, I work with the other teachers in the department here to come up with book lists. Like what do you need to know more about in order to teach your class better? We end up going into like Social Studies' catalogs and teaching catalogs and sometimes we buy simulations and things like that, classroom posters and what not, but most of the time what we buy are things like, I don't know enough about the Middle East conflict, so we're going to buy a book from Amazon about the Middle East conflict. The teacher is going to read it and they're going to apply that knowledge in the classroom. We here use our departmental money to buy more additional college-level readings that we use to supplement our own knowledge so we can teach more".

Teacher Three added, "The school has played a really big role as far as allocating the type of money that I need in order to get these resources online, for instance, subscriptions, that sort of thing. The equipment, they've provided amazing equipment. There are problems here and there when it comes to having updated software and that sort of thing, but for the most part they're supplying what I need.

"The most valuable resource that I've (used) have been online. My ability to go on and find anything I need. With a school like this and with the resources we have available as far as being able to access the Internet, it's been amazing. I can Google something and find it and be able to get whatever it takes in order to pay for that resource and they are very good about that".

Teachers were asked about planning in groups and outside (of school) partnerships.

Teacher One said, "It's mostly depending on the department. Math we do a lot of planning district-wide. For a couple of days at a time, we'll get together and align curricula and that kind of thing. Fine Arts is much more; I'm chair of the Fine Arts here and it's much more informal, basically because I think there's a resistance within Fine Arts across the district to standardize a curriculum. I think because of our different backgrounds as working artists, we're reticent to standardize because we feel that our expertise would be lost through the standardization process".

Teacher Two added, "With Social Studies, there's supposed to be an overall K-12 continuum on the district level, so that Kindergarten lays the groundwork for what is done in first grade, second all on up from there. Here, there are three separate courses. It is World History, American History, and American Government. There's overlap obviously between them, but what I've been doing this year in preparation for a very formal push in this direction for next year is we're really going to be, the three courses here on this campus, we're really going to be on the same page in terms of what is world history? What skills and what knowledge do you need from world history as a freshman to lay the groundwork? What do they need to know so that... Ditto for American History, especially as the immediate, the predecessor to, preceding American

Government. So we're really going to be more on the same page in terms of like when I get seniors, I need to know that there will be things that will have been taught and things that will have been reinforced, not just like "Oh, we did that last semester one day." You need to know certain things about American History before you can really tackle Government. We're going to become a more cohesive department, but that's what I want to do. I think that makes sense. In my experience at other schools, it really depends. It depends on the teachers.

The Principal added, "(Teachers) work together a lot and we do it much less formally than oftentimes schools try to. Most of our professional development is done by our own teachers. So other teachers know who's an expert in certain areas and who's trained them on a certain. We spend a lot of time discussing at staff meetings thoughts and ideas about teaching kids and what's the best way to get to kids and I would say that within the department, people work together very much. Most of our departments have meetings outside of just regular department meetings. They have lunchtime meetings where they discuss what they are doing, the expectations, and that sort of stuff.

"One of the things that we started last year that we're really pushing for is to get all of our departments to be able to go to the national convention for their department area. So like we sent some English teachers to the National English Convention, Social Studies to the National Social Studies Convention, Math teachers to that. So they're all a part of... First of all, they are all registered members of those organizations and then they go and they have time to work together. Then, of course, we have, it's nothing that we really structure, it just happens. We have, there's a Southern Arizona writing project

through U of A that three of our teachers are involved in and do presentations for. You know, we have a lot of different ways and it's a push that my assistant principal and I, it's one of our goals actually to have at least 50% of our staff go to a professional development outside of our school throughout the year".

The next question was whether there are formal structures for teachers to work and plan together. Teacher One stated, "I would say what really happens here is informal. There are formal structures, you know, like I mentioned departmental meetings and working groups over the summer. Math does it every year. Fine Arts is going to do it this year because we're growing to the point where I want to make sure that everything meshes, but the things that really happen here that make Appleton successful, in my mind, is the way we are is informal. It's the informal structures that are what make us what we are".

Teacher Two added, "Not lessons, not within the lessons, but what I'm more concerned with are what is the meta-goal for the entire class? What will the first semester do to serve that goal? What will the second semester to do serve that goal? What will each quarter do? What will the units within each quarter actually accomplish? What are you going to do in class? What are you going to accomplish by having done that? What will the kids have learned by having done those things? I'm less concerned with how you teach World War I or how you teach the rise of the Nazis. I want there to be more uniform outcomes". Question, "And this would be a collaborative process among you and the teachers in your department to develop this plan, this idea"? Answer, "Yeah".

Teacher Three stated, "There are (formal structures). We all work together. For instance, I'm an instructional team leader, which means I meet weekly with all the other department heads and we together determine what the general focus is for the school. I

also have the people that are in my department who I meet with in the district. For instance, Career Technical Education, we all get together probably twice a year and we determine what the direction is for that particular department, which is again CTE".

The Principal stated, "Well, we don't have like where all the English teachers have the same period off. It's too hard to do with a school this size. It's only 800 kids. It's very difficult to get all the English teachers with the same planning period and we have so many teachers in multiple departments that that is very difficult. So instead, every Friday morning we have a staff meeting before school starts and so that could be a full staff meeting where we sit around and we are all together or it could be a department meeting where they have time together and we always try to focus as much as we can on teaching and content stuff and not on there's a dance, who wants to sponsor it kind of stuff".

The next question was about how students were grouped for instruction. The Principal responded, "We have six periods a day and we have three days where they go to all six classes for, I think, it's 55 minutes and then we have two days a week where we go to block periods; so they have 95 minutes in their classes. On the block days, we have advisory base, which is an hour each of those days. So they're with like a homeroom person".

Teachers were asked if there was any training provided by the school and/or the district as far as integrating the technology into their classes or programs? Teacher One answered, "I've never seen that at the district level. Personally, I don't feel a need to be a supported by the district or the school. Like I said, they give you tools and there is training. It's effective, but it's more effective in a classroom management standpoint

than it is in curricular development and I feel like the real tools that would be more effective for like EEI-type structures and that kind of thing, I don't think that that's handled very well. So, no, I don't think that we are supported in a way that we could be".

Teacher Two added, "You know what the problem was honestly? We did so much that was new simultaneously that, and I don't like saying this because I don't want to sound like I'm patting myself on the back or patting us on the back or whatever, but I feel like two-and-a-half years ago, three years ago when we opened, we were so far ahead and I think we're still so far ahead of what most other schools that are doing things with laptops or doing things with digital content or doing things with digital presentation tools because we did all of it. And that causes significant problems I think for establishing like causal links between what worked and what didn't and why things went wrong because I think there are too many variables, but we did what we did.

"I think the problem was that we had Apple come in and provide some professional development and it was lousy. I mean that was the resounding opinion on campus was that it was really lousy. They were behind us. We kept saying we don't need to know how to work Garage Band. We don't need to know how to drag a file from iTunes somewhere on to a server so we can post it. We don't need to know that. We know that stuff already. The computer is easy to use. We want to talk about like advanced classroom applications. Apple doesn't have anyone, I don't think they have anyone working for them that actually understands how to take their tools and actually use them in the classroom. I'm less concerned with the process. I'm more concerned with the outcomes. And less concerned with what teachers do than with what that doing

actually leads to.

"I think a lot of times, and maybe I'm on a tangent here, but because I've had student teachers. They're so process-oriented. That's what they learn coming out of these universities. They're taught how to do lesson plans and have activities that are exciting and my question is what did the kids learn? "Well the kids, they had a great discussion." Did they learn anything? Did what they learn, is that applied to anything? Does that mean anything? The PD that we were able to get or rather staff development that we got through Apple, which was the only vendor that we turned to because they're the only ones that had anything, the staff development we got from them was very much fixated on the bells and whistles. Like, look what you can do with iPhoto. You can make the red eye go away. Okay, that's great. I could have figured that out myself. Like what is that going to have my kids learn and I don't think they ever got it, but I mean they're a product vendor. They deal with the thing and what it does, not what the thing accomplishes when we throw in our teaching style and our State standards and that kind of stuff".

Teacher Three stated, "Not really additional training to run the program, but just training to know what the district rules are, which is very different. They actually provide stipends for all the extra work we do, but they don't provide a lot of training on how that should be done. For instance, they'll give us 27 competencies that (we) have to cover in let's say a three-year span for the program. How those are covered is up to me as long as they're covered if that makes sense. I have to capture that information on each student. So there's this huge learning curve that goes into it because everybody does it differently. The district doesn't have one way that it has to be done. They feel

like because we all are specialists in our own field that we can determine what that is".

Next, Teacher One was asked how he/she gets started with his/her curriculum? With standards? With an idea? Something he/she saw?

Teacher One answered, "It basically starts with an idea. What I do is I start with kind of a big idea and then I figure out that supports the standards and I make sure that the standards are supported mostly on a unit level. When I do unit plan, I decompose things a lot. I'll start with a big idea that breaks down into different units that supports the standards and then break down the units into lessons and make sure the lessons are basically, you know, all the active participation and all that kind of thing. Because what I teach is so different, like the ELP class is kind of a seminar style class and every semester has a theme. So the first semester the theme was "Destiny" and we went at that through biology, through literature, through art, through math and all multiple strands kind of interweaving all semester. We read "Midnight to Children" by Salman Rushdie, which is about personal destiny and national destiny and destiny at a religious level, you know, all these different groups or things that you're associated with in what way is your personal destiny interwoven with all of those? So the big idea in that case was destiny and then you break it down into multiple strands or content units".

The teachers were then asked how they access and implement internet resources in their classrooms?

Teacher One stated, "Well every class is a little bit different. For instance, calculus, we don't use it very much because all the tools, it's very useful, for instance, to get resources. There's some good calculus animations online, especially when you're dealing with limits and when you're starting to teach them about limits, there are some

really good animations that help them conceptualize it, but, in general, calculus needs to be done on a board and struggling through the notation and everything and all the little accessories like the little writing pads and all that I think are just bogus. So far, I haven't found anything that makes sense.

"For art, it's great because you can do truly constructive learning because when we do surrealism, for instance, I never start of by saying, 'This is surrealism and surrealism was...' and no matter how inventive your anticipatory set is, you're still talking at people about surrealism or modernism, none of which really exist, I don't think. I think all of modernism, surrealism, the New York School, the Lost Generation, these are all constructs that come from critics, they are a way of economizing information and compartmentalizing it, but I don't think there ever was a New York school. There's no such thing as modernism. It's a construct. And that's just my personal view. But, that being said, that's the way knowledge is organized. So I have to pay lip service to that. So when we do 'surrealism' I say, 'Okay, go out and look at Magritte. Go out and find out who Dali was. Find out why he showed up in New York Harbor in an egg. Look at his work. Look at Magritte's work. What about Andre Berton and all these people, what did they have in common? What do they believe in?' They'll go out and they'll piece it together and they'll come back and say, "Surrealism, the universal subconscious." They'll tell you what it's all about and I think that's the power of the computers. You truly allow bottom-up, constructive learning and, granted, some of the sources are bogus, but that's life. Life is full of bad sources. So they have to learn to discriminate as well".

Teacher Two added, "You know all our kids have laptops and they all use Safari as

their browser. I have to integrate into my lessons, you know, I got to teach content and I need to teach cognitive skills. Early in the year I have to wrap in little tech skills also. So I teach them how to do things like set up their RSS feeds on their browser because this whole digital native thing is a big lie. It's a lie. I am so far ahead of my kids and most of our teachers here are so, our kids can play games, our kids can text each other on phones, and they can play with their touch iPod, but they don't know how to manage bookmarks. They're terrible at desktop file management. I'm dead serious. The whole thing about "You're going to learn from your kids" it's a big lie. So at the beginning of the year, I have to spend time teaching them the little tech skills that they're going to need to get by successfully so they can think about the content and they don't have to think about the technology.

"We have the wireless access here in the classroom. The vast majority, I don't know of any of my students now who don't have Internet access at home and they're able to use their laptop at home. So sometimes we do use the Internet in class. Sometimes we use the digital content resources, the ABC Cleo databases in class. Sometimes they use those things out of class. They access them out of class to prepare for class. Sometimes I'm asking to do homework based on what we did in class. It kind of depends. Like the idea that it's an Internet classroom and you're going to come into a classroom and the kids are always going to have their laptops open and they're always going to be on the Internet is totally fallacious. It's not that way. I mean there are days when my kids have paper out and the computers are not to be seen anywhere because we're having a Socratic seminar. We're having a debate or something where they were supposed to use the computer and the content and the resources that they accessed through the computer

to prepare for the debate, but when they're doing the debate, I want them to actually work on the fly and jot down notes on the paper and things like that. You can't do that quickly and unobtrusively while you're pecking away on a keyboard".

Question, "Are these in lieu of a textbook"? Answer, " Totally. And I feel stilted saying "digital resources" or "digital content" or whatever, but I don't like to say "text", "oh that's our text" or "we use it as our text" because when people hear textbook, we all go back to what we remember a textbook was like—even coverage, but very shallow, questions at the end, bold face terms you're supposed to know, silliness like that. The content resources we use, I mean, they give me access to primary sources, a wide variety of secondary sources, statistical information, pictures, all kinds of things. So ABC Cleo, I use constantly for all my classes. That is the frontline content resource.

"We use Turn-It-In.com for plagiarism checks and online grading and all our kids use that. Teachers use it to varying degrees. Your writing, your history and your English classes use Turn-It-In a lot, math classes not so much because it's just not made for that. We have a blog server in our district and we're actually going to enhance that for next year. We used to use a thing called Study Whiz, which is terrible. I wouldn't recommend it for anybody for anything. It's a piece of junk. It was a learning management system that we still have actually, but I don't even know how to get into it anymore. I forgot the password it's so bad.

"Using the blog is much easier to post instructions and lectures and links and whatever you need to communicate to the students. I started this year, this is the first time for the blogs and also for a site called WikiSpaces.com and that's just the Wiki server that I found to be easiest to use and use in the classroom. I've used that a lot this year as a

course website, as a means of two-way communication, as a place for student group work and collaborative work. And, I use all the mainstream news media websites for Government. We're constantly reading the news".

Teacher Three added, "We have different ways we incorporate it. We have online services for like turning in anything that's written, like research papers, thesis, that sort of thing. We use Turn-It-In.com, which is an online program that tests for plagiarism and that sort of thing. So we have that capability as far as paper-type assignments. As far as testing, we have Study Whiz which we can develop tests online that are interactive that they can take and not only does it grade them, but it pushes out statistics and tells us various patterns there might be in grading.

"The one resource that I think of and I continuously like steer them away from is Wikipedia for instance because Wikipedia as you know, I'm sure, anybody can put anything into it. A lot of times the students will take that as the Gospel. So that's the main resource I steer them away from. For the most part if I'm concerned about where they're going to be accessing a resource, I will give them the resources to look at if that makes sense. Otherwise, I'm not too concerned about it. They can use whatever resources they want, but, once again, I do always steer them away from Wikipedia".

Teachers were asked about encouraging outside mentorships.

Teacher One said, "Yeah, we have a group over here called Academy Village, which is a retirement village for academics and it's all full of MIT theoretical physicists in retirement and people from Silicon Valley and from Harvard and wherever. We set up forums where they help us mentor our science projects and they answer different questions, but the most effective interaction is always personal, one-on-one. The most

impact that that relationship has had is when they come in here and talk to us one-on-one and we have lunch with them and that beats the hell out of a computer any day".

Teacher Three added, "I have never done that. That's a great idea though. I'm not even sure what you mean".

Next, the teachers were asked if they thought that tech can obscure outcomes instead of enhance outcomes?

Teacher One stated, "Yeah, totally. For one thing because we tend to be, Vail tends to be more of I would characterize it as politically conservative and overwhelmingly white, Christian background here. So that is reflected in the filter and the choice to use a filter and the price you pay for that is that you'll... I looked up sophism one time. We were talking about logic and I said let's look up sophism. All the pages on sophism were blocked for some reason. And I've been blocked when I try to look at Diane Arbus. Yeah, it can definitely get in the way. It's absurd. I understand the liability issues, but it's crazy".

Teacher Two said, "Absolutely. It can go either way. I think it kind of depends who's leading it. If tech- oriented or tech-enabled transitions are led by teachers and administrators who are driven by educational outcomes and qualitative improvements and pedagogy and student learning, then you can end up in the right direction. If it's driven by IT people who are really excited by the bells and whistles of it, you go in the wrong direction because IT, and they hate to hear this, they're a support function. They exist to support the mission of the school. They aren't the mission of the school. I feel like we've got the balance right here. I've seen it wrong in other places where like the IT people they're like the druids, you know, you don't displease them and you go

gravel, “Oh, you can’t have access to that” or ‘You can’t use that’ or ‘We’re doing server upgrades today so you can’t access it’. So it’s like they lose focus, but I think also though that within lessons and teaching, I think it’s very easy because it’s so seductive, it’s very easy to lose sight of student outcomes and student learning”.

Teacher Three added, “So far, my experience has been that what you see is what you get. The students that have a hard time with it, they have a hard time with it and the end product looks like they had a hard time with it. The students that are pretty good, they seem to be pretty good through and through. It’s a comprehensive product that they come out with. Technology is only obscuring it in a way, it’s generational. I don’t know how to say this. Let me see if I can say this right. This is the generation of boredom. They didn’t work for any of this. They’ve always just pushed a button and it worked and they were able to go on and do this stuff. Not only does it not dawn on them sometimes that it came from somewhere, but a lot of them don’t care. Because they don’t have any idea how much hard work went into where they are at this point, they don’t appreciate it”.

Teachers were asked if the presence of all the technology had caused achievement to go up.

Teacher One said, “I think there’s something going on here that doesn’t go on in other schools that I’ve been involved with. I’ve only taught at two other schools. There’s something going on here that does not go on elsewhere, but I’m not sure I would attribute it to computers. I think it has to do with a faculty where almost everybody has some kind of little bug up their butt about something. You know, we’re very opinionated and we’re very different, each one of us, and I think that creates a spirit of

inquiry and civil discourse that the kids pick up on. So I wouldn't attribute that to the computers".

Teacher Two added, "You know we didn't open this school to get higher test scores, although they did. I think that the fact that we don't have textbooks, which I think limit the cognitive potential of a class and they limit the learning potential of a class because they are so dumbed-down. I mean your average eleventh and twelfth grade textbook is written at an eighth grade reading level and content wise it's pabulum. So the fact that we don't have that is a good thing. The fact that we have replaced textbooks with a much more diverse package of resources, means that the kids have to work harder on it. The fact that we have teachers that have really worked hard on this campus to not just change the tool that we use, but change how we teach with it has made a big difference. It's a package of things. It's not the tool in and of itself; it's what the tool enables us to do and if teachers don't choose to find ways to maximize the tools' potential to teach better, the tool will just be bells and whistles. If you have no woodworking skills, it doesn't matter how great your table saw is. You're still going to end up with something that doesn't glue together right".

Teacher Three said, "My overall feeling about it is that it's helping a lot actually. For instance, what I experienced at another high school that I taught at where there wasn't laptops, is that not only is there a culture of boredom happening, but it's really hard to get kids engaged sometimes. And it's really hard to get them engaged with a textbook that's old, maybe it's five years old or whatever the case may be. The one thing I noticed about the laptop school being here is that you can walk around campus at lunchtime or you can walk around campus after school and students are at least

participating in the process. They might not always be doing schoolwork, but they're engaged in the actual instrument and it keeps them somewhat involved in the process, which I don't think you find all the time in other high schools".

Next, they were asked if the technology had an impact on discipline and attendance.

The Principal stated, "It's hard to say because we didn't have the school without it. So there's no before-and- after data. We only have, we started like this so our best comparison is probably the schools in our area in our district and we all have pretty similar attendance. We might have a little bit less discipline (problem), but I don't know if it's because of the computers. I think it's because of the size. Our test scores are similar, within a few percentage points of each other".

Teacher One said, "In the same way that other media, they might get distracted by it. The first year, people were really like obsessed about this. Like obsessed about 'Oh my God, they're looking at a game.' Or this witch-hunt with remote desktop just drives me up the wall. The art room, 616, I let it be known to the administration and to the tech people that 616 is a remote desktop free zone. I did not want anybody remote desk-topping my students in there because I find it intrusive. There is more distraction caused by all of a sudden somebody taking over your mouse and moving it around. It's bizarre and it's intrusive and I think that's not the point. The point is, when they're in my room, it's my job to like keep them focused. It's not some big brother in the tech office that needs to be watching my kids. So I think the root issues are the same, but the technology has actually led administration, the tech people astray as much as it's led the students astray. All of a sudden, there are these tools to do the big brother number. I think it's unwarranted and it's not a good example of civil behavior".

Teacher Three added, “Well it has sort of an effect on it. The discipline problems, it’s a whole new monster when it comes to like discipline here because there are rules about what you’re accessing. There are rules about what you’re watching. They’re acting out in tech ways. In a way, for those that are savvy, it’s given them a way to be more devious, if you will. I have a fundamental difference in the way that the tech department administers to the students here. If it were up to me, there would be no filter. And then as they did things wrong, they’d get their rights taken away as opposed to the other way around where you’re trying to say ‘You can’t do this, you can’t do that, you can’t go here, whatever.’ You give them the opportunity. So we have a fundamental difference in the way that we approach it. They do run audits and stuff on websites that have been visited over the weekend and that sort of thing. You’re giving a teenage boy access to the world and you’re going to run into problems, but you have to allow for that sort of thing”.