SUCCESSFUL TECHNOLOGY INTEGRATION: CRITICAL THEMES AND PRACTICAL ILLUSTRATIONS

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Abstract

In 1990, classroom technologies like the Internet, Distance Learning Environments, and Wireless Networks were emerging. During that time, the National Center for Effective Schools published a report identifying and describing four general themes associated with high performing schools. Effective schools, “schools that work” employ best practices for teaching and learning that utilize technology appropriately. Today, in an increasingly technological era, federal administration promises an education reform movement in which “No child [will be] left behind” (Bush, 2001). The No Child Left Behind American Education Agenda set by President George Bush, stresses that educators use proven strategies that help students achieve. In this study, the authors review critical themes associated with effective schools and provides examples of successful technology-infused programs. Findings indicate that schools who successfully integrate technology into the curriculum mirror identical themes present in effective schools literature. Successful technology integration is consistent with what we already know about high performing schools. Effective schools and effective technology-using schools demonstrate: shared responsibility, commitment to high standards, movement forward despite obstacles, and coordinated and coherent program implementation.

Introduction

School improvement movements of the 1970s and 1980s resulted in an abundance of literature on the characteristics of effective schools. Effective schools literature focused on learning environments that were successful regardless of student socio-economic backgrounds. Important characteristics of high performing schools include: productive school climate and culture, outstanding leadership and acquisition of resources, faculty collaboration, and emphasis on multicultural instruction and sensitivity as well as the personal development of students. Interest in educational technologies for the purpose of improved classroom instruction is based on research and practice suggesting that computer and network-based technology, when
implemented appropriately, can contribute significantly to improved educational outcomes (Glennan & Melmed, 1996). Discussions surrounding appropriate uses of educational technologies include the natural integration of technology and curriculum. Today, classroom technologies such as the Internet, Distance Learning Environments, and Wireless Networks provide all schools the opportunity to develop the attributes traditionally associated with effective schools.

In 1990 at the time classroom technologies were emerging, Levine (1990), in conjunction with the National Center for Effective Schools, published an update on effective schools evaluating and expanding on earlier findings. Clearly related to literature on successful technology integration, the updated effective schools study identified four general themes or prerequisites that continue to be associated with high performing schools. Successful schools demonstrate: (1) faculty, students and stakeholder responsibility for improvement, (2) commitment to high standards, (3) ability to move forward despite discouraging obstacles, and (4) implementation of coordinated and coherent programs of instruction (Levine, 1990). The four themes mentioned above are present in current research on successful technology integration and serve as the framework for this article.

A Shared Responsibility for Technology Integration

Technology integration is defined in the literature as the use of educational technologies as a tool to support the teaching and learning process (Sianjina, 2000). Technology infusion refers to a system-wide integration of technology—the introduction and use of technology at all levels in a school and a school district simultaneously with multiple initiatives from changes in instruction, curriculum, and assessment to the reorganization of school structure and roles for the
Successful Technology Integration

purpose of improved schools (Fulton, Wasser, & Rubin, 1996). The primary goal of technology infusion is to make schools better learning environments for all students. Technology infusion is desirable because it can promote learning, facilitate constructivist teaching practices, support instructional goals, symbolically represent complex ideas, and expand human potential (Becker & Ravitz, 1999; Yildirim, 2000). Technology-infused educational settings promote high standards for academic achievement by encouraging joint responsibility rather than isolated and singular approaches for successful student learning.

Since high standards and an improved learning environment utilizing technology may promote learning and give all students a better experience, one may ask, what prevents all schools from equipping themselves with the latest technology? There are many barriers to technology integration and infusion. One is the inability to move technology from introductory applications to content-oriented lessons (Stewart, 1999). Many times, teachers introduce a tool and “scratch the surface” of its capabilities, but are unable to apply the tool or technology in detail to a specific content area. Time to adequately prepare and level of teacher proficiency play a part in this barrier. Other barriers include the lack of adequate hardware and software, limited resources, and a lack of interest, knowledge, or technical competence on the part of instructors. Still other barriers include the lack of technology-using role models (Stewart, 1999), limited technology integration experience, limited time to learn, practice, create, and implement lessons applying technology, and isolated rather than distributed technology course content (Levin & Buell, 1999). All these factors can be overcome with comprehensive staff development and support, clear visions demonstrating the uses of educational technology, time to plan, develop, create, and implement curriculum using technology tools, access to adequate resources, support from administration, peer collaboration, positive reinforcement (Ennis, III & Ennis, 1995-6).
Successful technology integration in increasingly diverse classroom settings requires that teachers consider cultural differences in learning and encourage students to perceive educational technology within their own values, preferences, and world views (Sianjina, 2000). Wang, Hinn, & Kanfer (2001) found collaborative computer environments supportive of diverse students and their learning styles. Sianjina (2000) notes “cultural relevance in child-centered classrooms focuses educational technology, topics, activities, programs, and resources on children’s background, prior experience, knowledge and interests” (p.27). Further, Sianjina describes effective multicultural classrooms as those demonstrating instructional flexibility, equitable access, cultural awareness, a favorable multicultural environment, and technology integration.

Technology integration pertains to the use of technology as an essential tool in the teaching and learning process. When technology becomes an integral part of the curriculum and learning activities, learning with the computer becomes meaningful and purposeful. Using technology for rewards drills or busy work for those who finish their tasks early leads to add-on, disjointed and meaningless appreciation of instructional technology. In addition, such practices fail to tap the educational benefits technology can provide and limit children’s understanding of the capabilities of technology. (Sianjina, 2000, p. 28)

The Science, Technology, and Society Education (STS) curriculum developed at Pennsylvania State University is an exemplary technology-infused education model reflective of shared responsibility. Funded by the National Science Foundation, the STS curriculum was defined by a national task force of university faculty and K – 12 educators in science, technology, social studies, and English. The STS Project is designed to promote responsible citizenship in a technologically dominated era (Waks, 1991). The project’s aims include
Successful Technology Integration

Increased student achievement through the development of culturally responsive and relevant learning environments. Culturally responsive approaches are important because they help students make connections between their personal, community, national, and global identities (Ladson-Billings, 1994; Nieto, 2000). Building the curriculum on relevant and meaningful conceptual themes such as domination, advocacy, and empowerment, STS curriculum goals include authentic, useful learning through coordinated, collaborative learning. Research shows this type of collaborative computer environment supportive of diverse learning styles (Wang et al., 2001).

Although well intentioned, some technology integration attempts have been criticized for low-skill level technology use such as drill and practice, games, and procedural writing (Waxman & Huang, 1995). In fact, studies show poor, urban, and rural students are less likely to be exposed to higher-order technology uses than non-poor and suburban students (Wenglinsky, 1998). Science, Technology, and Society (STS) projects, however, are investigation-oriented providing opportunities for authentic student engagement and assessment, relevance, and connected learning experiences. The STS approach is consistent with education technology literature describing appropriate and effective uses of educational technology as those that use technology to support inquiry-based learning in which the power, richness, and flexibility of computers is at work (Fulton et al., 1996).

STS projects include meaningful applications of the Internet and other technologies. Students work through problem-based exercises designed to promote self-discovery, critical thinking, information analysis, and a connection to students’ own lives and family heritages. For example, STS students participate in community investigations to explore the costs and benefits associated with the use of technology. The investigation is a critical evaluation of the effects of
different technologies within their immediate environments (urban, suburban, or rural). Other activities focus on students’ use of the Internet and software to investigate historical, scientific, and technological achievements of people around the globe. For example, in the exploration of African, Caribbean, and Latin American societies, students provide solutions to problems faced by African and pre-Columbian civilizations (i.e., crop cultivation, city management, technology infrastructure and access to resources and services).

Consistent with education technology research that suggests student achievement is related to higher-order use of technology for problem solving (Fulton et al., 1996; Wenglinsky, 1998), the STS curriculum project encourages technology use to investigate and solve contemporary and culturally relevant problems. In large urban settings, students design inner-city classrooms, school cafeterias, school buildings, and local neighborhood apartments that become self-sustaining, profit generating co-ops. Through these projects, students demonstrate an understanding of the impact of science and technology on society and they cultivate the idea that they can make positive changes in their immediate environment. Possibly the most valuable lesson taught through the STS curriculum is that unique experiences shape understandings of the world and that there is value in diverse viewpoints and perspectives. Science, Technology, and Society emphasizes diversity by building learning communities that respect and illuminate different perceptions, viewpoints, and ideologies based on differing backgrounds, values, experiences, and knowledge (Waks, 1991).

Technology Integration Requires High Standards and Shared Commitments

Implementing any type of change in school districts with limited or abundant technological resources requires shared commitments. Also required are administrative support, peer collaboration, modeling appropriate technology-using behaviors, and comprehensive staff
development (Ennis, III & Ennis, 1995-6). The transformation of District Nine in South Bronx, New York to include authentic applications of technology integration required a commitment at all levels of the district. The district implemented a technology-rich curriculum innovation focusing on multidisciplinary, multi-modal learning units that use video vignettes, animation, photographs, original art, sophisticated graphics, and music to enhance the learning environment. Demographics and resources made the journey toward authentic and meaningful technology infusion challenging. In an attempt to meet the challenge, the district developed a shared vision statement, established partnerships, and encouraged teachers to assume roles as primary change facilitators.

District Nine is located in the nation’s poorest congressional district, has a student population of 30,000 students. One third of the district’s teachers are uncertified and are considered by the district as “temporary.” The first and central charge of the district was to increase teacher capacity. Recognizing the individual teacher as the most powerful entity in the educational and change process, the district formed professional development activities to increase, improve, and expand instructional abilities (Johnson, 1994). Central to the professional development training, was a three-day focus on efficacy to strengthen teacher belief in the capacity of the children to learn.

The efficacy-building component of the district’s technology reform efforts was especially critical as research studies of teachers’ beliefs and technology use show teachers’ self-efficacy beliefs to be significant predictors of teachers’ use of technology-related practices (Lumpe & Chambers, 2001). The Preparing Tomorrow’s Teachers to Use Technology (PT3) U.S. Department of Education capacity-building grants further illustrate the recognized importance of preparing teachers to use technology well to support student learning. A 1999
federal initiative, the PT3 program has awarded over 500 grants to support the professional
development of teachers in the area of technology. U.S. Department of Education support is no
surprise since one national study conducted by Educational Testing Service on educational
technology and math achievement found professional development of teachers to be positively
related to academic achievement (Wenglinsky, 1998). Other research shows effective practices
to assist teachers in technology integration include: ensuring teacher competence, positive
experiences utilizing technology, preparation and planning time, adequate resources, and
sufficient training and support (Becker, 1994; Ennis, III & Ennis, 1995-6; Schrum,
1999; Yildirim, 2000).

The district’s next major goal and commitment was connecting the curriculum to
technology by moving from “pencil-and-paper unit creation” to using and infusing technology
throughout the curriculum. Consistent with recent educational technology studies indicating that
technology and computer-based instruction have positive effects on both motivation and
achievement (Wenglinsky, 1998; McKinnon, Nolan, & Sinclair, 2000; Zhang, 2000; Butzin,
2001; Fan & Orey, 2001; Wong, 2001), the district’s technology integration efforts focused on
the development of motivating technology-enhanced learning activities to increase student
interest and participation. In addition to increased student motivation, the purpose of technology
integration was to facilitate cross-content learning and natural content integration surrounding
central themes (i.e. habitats and adaptation, consequences of waste). Through a corporate
partnership with IBM, a teacher training facility that included educational resources and a
technical support training staff was developed for the purpose of providing ongoing professional
development for educators. Consistent with the literature, the traditional model for staff
development was extended to include incentives, on-going follow-up and support (Schrum,
Successful Technology Integration

1999). More comprehensive models of staff development coupled with opportunities to learn through mentoring programs and collaboratives are often more successful than brief “one-time-only” training sessions that explore technology tools and applications. (Ennis, III & Ennis, 1995-6).

Schools determined to successfully integrate technology construct environments that are compatible with and reflective of the goals of technology infusion (i.e., school reform, improved learning environments, authentic learning activities and assessment, inclusion, resource sharing, and increased student participation). Technology infusion serves as a driver rather than a vehicle for school reform; its goals require a “coordinated shift in the culture of the classroom, the school, and the system, as well as new resources, positions, structures, and standards” (Fulton et al., 1996, p.xvii). In support of this notion, research indicates that students in non-traditional, integrated, technology-rich programs outperform students in traditional programs (McKinnon, Nolan, & Sinclair, 2000).

One California technology-infused education model completely restructured the traditional school environment for authentic technology integration and increased student success. The Center for Advanced Research and Technology (C.A.R.T) is a joint project of the Clovis and Fresno Unified School Districts in California. The C.A.R.T model is a good example of complete school restructuring in which both student environment and activity is designed around and compatible with a technology-based curriculum. Opened in the fall of 2000, the school was designed as a high-tech business facility. A senior high school model serving only high school juniors and seniors, the C.A.R.T model focuses on meaningful, technology-rich, project-based learning. The premise of the C.A.R.T high school model is critical thinking, student collaboration, and real-world applications.
Using meaningful, complex community-based projects to engage students in real-world issues and challenges, students acquire academic knowledge in Science, Math, English, Technology, and Finance. Students are encouraged to move beyond traditional learning experiences and habits by participating in a highly sophisticated, interactive, technology-based curriculum. Primary goals include integrating technology to collaborate, think critically, conduct research, and analyze relevant “real life” situations. In collaboration with C.A.R.T partners, students design projects relevant to local, national, and international communities. Technology is the vehicle for not only connecting students with local and distant community needs, but also local, national and international business partners. In addition to working with students as they identify and solve problems and make contributions to improve the functioning of diverse and distant communities, C.A.R.T partners provide unique experiences and expertise guiding students as they struggle through challenges and make their own meaningful connections to the curriculum.

The C.A.R.T curriculum is organized into four career clusters: Professional Sciences (biomedicine, environmental sciences), Engineering including product development, chemical mechanical), Advanced Communication (multimedia, design, Internet Academy), and Global Dynamics (economics, marketing, law). Through each career cluster, students select specific areas of study and create a sequence of technology-based projects for a professional public presentation. Through participation in this unique context, students complete a program of study that provides them with skills and knowledge necessary to pursue the post-secondary path of their choice whether an entry-level position in high-tech industry or university enrollment.

Demonstrated through the C.A.R.T high school model, technology infusion results in changes in social dynamics of the classroom due to a shift toward Constructivist Teaching.
Successful Technology Integration

Constructivism is built upon a central premise, “individuals construct their own understanding of the world in which they live” (Norton & Wiburg, 1998, p.42). In technology infused schools and classrooms, the focus shifts from using content-oriented computer-assisted instruction to integrating computer mind tools into the curriculum (Jonassen, 1996; Liu et al., 1998). In the C.A.R.T model, computers and other technologies serve as tools that facilitate and support a curriculum with relevant applications within immediate and global environments accessible through e-mail, chat rooms, and distance education.

Also illustrated through the C.A.R.T model, technology impacts the curriculum and requires instructional adaptations. Traditional curriculum interactions are changed through increased student-teacher communication, shift in student-teacher roles, new learning opportunities and resources, and the promotion of collaborative and cooperative learning environments (Liu et al., 1998). In addition to education technology resources, the utilization of distant human resources is more possible through telecommunications with field experts and information repositories. One of the goals of technology infusion, use of technology supported collaboration and cooperation in the C.A.R.T model extends beyond the school to local, national, and international communities. Under this reform model, technology integration provides opportunities for interdisciplinary curriculum learning experiences. Further, at the district level, technology infusion limits teaching in isolation (Heflich, 1996) and increases opportunities for team teaching and the integration of content areas. Telecommunications technology allows for classrooms to be connected via video conferencing and other technological means.

Illustrating key components of successful technology integration, the California C.A.R.T model is an example of a technology-based learning program and large-scale technology infusion. School districts throughout the nation can adapt some or all of the aspects of this
Successful Technology Integration

model. As suggested by Norton & Wiburg (1998), of primary importance is that educator’s acknowledge the impact of technology on society, schooling, and curriculum and restructure educational environments accordingly. Contemporary educational environments must be created in such a way as to afford students appropriate learning experiences needed to respond to current challenges in the present sociocultural context (Norton & Wiburg, 1998). Technology-infused projects help students “develop and hone information-age skills: gathering, assessing, and handling complex information from multiple sources; communicating in a variety of formats to broad audiences; solving challenging tasks and working collaboratively on real-world problems and cross-cultural activities” (Fulton et al., 1996, p.xxii).

Reframing Technology Integration Challenges: Problems As Possibilities

Levine (1990) describes resilient schools as those that move forward despite obstacles. One major obstacle New York’s District Nine encountered was limited time for planning. As is true of any successful academic innovation, time for teacher exploration, planning, implementation, and revision is critical (Ennis, III & Ennis, 1995-6; Lawler, Rossett & Hoffman, 1998). District Nine teachers were in need of time for individual technology-enriched lesson planning as well as collaborative, cross-disciplinary planning. The district instituted temporary rescheduling and other creative programming shifts to allow for adequate blocks of time for planning. This systematic district-wide effort reflects moving forward despite obstacles common in effective schools. Further, the district established a development center to support and model the technology applications within the curriculum. At the development center, teachers have access to a wide variety of computers and technology to create integrated units. Teachers have
access to customized software, pre-formatted templates and a central database where other teachers’ technology-enriched lessons are stored.

District Nine, like many schools, faced the problem of limited resources. Bedient, Scolari, and Randolph (2000) make practical suggestions for classroom teachers faced with too many students and not enough computers. Supportive of limited-resource classrooms, research shows that technology infusion transforms the curriculum facilitating a more collaborative rather than independent classroom environment (Liu et al., 1998). Assigning student groups to plan and demonstrate brief presentations on subjects of their choice is an appropriate instructional adaptation. Following a rotation schedule, small groups can search print, audiovisual, and Internet sources for music in a particular language of study. This allows for the limited number of computers to serve as one station while print materials (magazines, books, brochures, etc.) and audiovisual resources (audiotapes, video, etc.) serve as other stations. Students can also prepare Power Point presentations including musical program selections that have been found. In a study of high school student achievement in science and the use of presentation software, Seigle & Foster (2001) found that students benefited from the use of presentation software. To better utilize distributed group computer time, teachers can require student groups to first draft Power Point presentation slides on paper deciding content, background, and format.

Even with limited resources, technology integration across disciplines is possible. In social studies and foreign language classes there are numerous integration opportunities. When studying various cultures, students can plan menus with some students using cookbooks, magazines, or newspapers, while others search the Internet. Students can then celebrate the unit by preparing the foods they have discovered. In foreign language units, students may use the Internet to locate related newspaper articles written in the particular language. DeVoodg (1998)
recommends breaking students into groups that rotate through various stations. Students working independently at computer stations can receive assistance from computer “experts,” proficient students who move from seat or other station work to provide computer assistance to struggling students.

Implementing Coordinated Programs that Address Community, Curriculum, and Diverse Student Backgrounds

Using technology in culturally relevant and meaningful ways is a predominant theme in the literature on successful technology integration in diverse school environments (Sianjina, 2000). Technology integration efforts that are consistent with student backgrounds are important. As is the case with culturally relevant instruction (Ladson-Billings, 1994), the use of cultural referents to impart knowledge, skills, and attitudes is one way of presenting curriculum in ways consistent with student background and experience. McGee (2000) describes a novice science teacher’s efforts to authentically integrate the Internet into a weather unit. The teacher first decided on a topic that was relevant to her students in a predominantly Hispanic, South Texas community. Relevant to the geographic location and particular time of year for Texas, Hurricanes became the topic of study.

Technology infusion began simply by using the Internet for a full class presentation on current hurricane activity. A television monitor displayed a live Internet connection (http://wunderground.com) allowing the class to gather sunrise, moonrise, moon phase, and current hurricane activity. Active student engagement included class participation in the G.L.O.B.E. project sponsored by NASA (http://globe.fsl.noaa.gov). This project allows students to collect real data and send it to a real scientist at NASA via the Internet. Students’ questions
drive the curriculum as students work in teams to find answers much like scientists who work very much the same way with technology and others. In this way, the learning is relevant, purposeful, and consistent with the student’s existing knowledge-level and personal experience. Providing a real life illustration of the practical uses of technology, students also realize the importance of collaborative efforts in problem solving scenarios. This is consistent with education technology literature suggesting inquiry-based, collaborative approaches to technology integration are most appropriate (Fulton et al., 1996).

Another important theme throughout the literature on successful technology integration in schools is the importance of embracing nontraditional classroom environments--theme-based and cooperative. Snider and Foster (2000) use the acronym A.C.T.I.V.E. to describe the ideal setting for technology-rich classrooms: active, cooperative, theme-based, integrated, versatile, and evaluative. One example of this type of active and theme-based technology-rich classroom begins with the conversion of a daily class schedule. A simple electronic version of a daily schedule helps students develop computer skills necessary for a multimedia, thematic presentation. Teachers can transform simple, ritualistic practices such as posting the daily schedule into an informal, threat-free opportunity for students to use presentation software on a daily basis to strengthen student skills and competencies necessary for more advanced, multimedia presentations.

Teachers interested in authentic and simple technology integration can begin by making students responsible for running and updating a daily classroom agenda using software presentation media. Outcomes include increased student familiarity with presentation software and its practical uses in an everyday, non-threatening environment (Snider & Foster, 2000).
Eventually, students can use newly acquired knowledge of presentation software in conjunction with more advanced multimedia study projects.

One such advanced, technology-rich, thematic project is an author-study project. Project goals include technology use to develop and present a comprehensive and integrated understanding of a particular author’s motivation and style. In the initial phase of the project, students locate and read several books by an author they have selected. Students conduct an in-depth investigation of author’s motives, styles, commonalities among the works, and reoccurring themes. The culminating activity is student’s technology-rich design and theme-based, multimedia presentation of findings. The search for author “themes,” or the big ideas woven throughout the different works, is reflective and supportive of nontraditional curriculum designs in which content areas are not presented in isolation but rather integrated. Integrated curriculum approaches present content around larger concepts or themes that encourage an understanding of interrelationships and commonalities among disciplines.

Successful technology integration in schools requires coordinated, and logical approaches. Collaboration among students, teachers, schools, and community is a natural and necessary component of successful integration and infusion. The development of a consortium between an affluent, high performing suburban New Jersey school, an inner-city low-performing, urban school, and Rider University to promote equitable educational practices is an example of such a collaborative effort (Farley, 1999). While the university serves as technology integration support for both schools, the suburban, high-performing school staffed with highly trained teachers and an abundance of technology resources acts as a more direct source of support for the inner-city school. The two schools are linked in a way allowing not only for the sharing of
curriculum, resources, but also to encourage collaboration through joint participation in technology-rich learning activities and projects.

Another technology-rich collaborative approach is illustrated in the Oregon Department of Education’s “Project In Time.” In its fourth year of funding, the project offers wireless networked note taking to migrant ESL high school students. Migrant students networked through the “In Time” project attend regular classes with a bilingual note taking partner/mentor. Note takers and migrant students communicate silently using a collaborative word processing and graphics package on networked laptop computers. Migrant students can read their note takers translation of key words as information is presented during class.

Finally, logically coordinated and cohesive connections are fundamental in effective schools (Levine, 1990). Successful technology integration in schools also requires coordinated efforts and recognition of the importance of collaboration and connections with community, family, and diverse student cultures. In recent years, technology integration literature concerning low socio-economic and ethnic minority populations has included discussions on the use of technology to facilitate an understanding of diverse cultural backgrounds (Sianjina, 2000) which lead to students’ different ways “ways of knowing.” Cultural experiences result in unique “ways of knowing” which in turn, influence knowledge construction.

One approach to using technology to foster an understanding of diverse student backgrounds is the use of technology to improve children’s literacy and parent participation through oral histories (Samaras & Wilson, 1999). As part of an oral history and technology project in two low-income, predominantly African-American elementary schools, students and parents work together to merge technology and family history. Consistent with the tradition of oral history in African American culture, students and parents use computer technology to
generate a written record and pictorial representation of their family histories. Students show and
tell their computer skills by teaching family members about technology. One outcome of this
culturally relevant, technology-based teaching approach is a strong sense of efficacy. Project
goals include: (1) promotion of families’ advocacy for their children’s learning and their own
learning through dialogue, writing, reading, and technology; (2) facilitation of documentation of
families’ oral histories; (3) provision of opportunities for children to show their families what
they were doing in school with computers; and (4) exploration of ways to connect teachers with
families, enabling them to hear about the environmental forces that have shaped families’ lives,
school experiences, and dreams of their children’s education. The project has proven to increase
teachers’ notions of family involvement and the associated needs. Parents have reported positive
feelings toward the school’s invitations to participate in both their child’s academic and personal
development (Samaras & Wilson, 1999). This type of culturally relevant, technology-based
project as well as others presented in this paper is important on multiple levels. It reflects
technology uses encouraged by the Office of Technology Assessment and supports goals and
benefits of technology infusion which include improved links between school and home and
movement toward broader community involvement in school learning projects (Fulton et al.,
1996).

Conclusion
As the goal of this paper was to illuminate effective pedagogical approaches to successful technology integration in schools, it is important to visit briefly notions related to pedagogy. Pedagogy is not limited to instructional techniques and strategies. In *Affirming Diversity: The Sociopolitical Context of Multicultural Education*, Sonia Nieto (2000) reminds us “pedagogy also refers to how teachers perceive the nature of learning and what they do to create conditions that motivate students to learn and become critical thinkers” (p.101). The educational technology approaches presented here highlight culturally relevant teaching and curricula that encourage critical thinking, student engagement, and motivation by building on student culture and interest. These technology integration models of instruction reflect exemplary pedagogical practices for all schools. Captured in each of the technology-infused and technology-based approaches presented in this paper, Haberman (1991) and others suggest exemplary pedagogical practices for diverse students include: (1) student involvement with issues they perceive as vital concerns, (2) student involvement in applying ideals such as fairness, equity, and justice to their world, (3) active, heterogeneous cooperative groups, (4) helping students see major concepts, big ideas, and general principles rather than isolated facts, (5) students involvement with explanations of differences in race, culture, religion, ethnicity, and gender, (6) students involved in planning their education, and (7) creation of learning environments that encourage students to question widely accepted assumptions.

Finally, the pedagogical practices illustrated in these classrooms demonstrate successful, appropriate technology integration and reflect the four themes present in high-performing schools. Shared responsibility, unwavering commitments, forward movement, and coordinated programs of instruction are evident in the classroom environment presented here and throughout research and literature on technology integration and infusion in successful schools. Despite the
obstacles, students, teachers, administrators, and communities are joined by a shared vision and commitment to technology-rich environments for authentic and meaningful learning opportunities and increased student achievement.
References


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