**Effective Integration of Technology in K-12 Education: A Holistic Approach**

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**Thesis**

The concern about the slow or inconsistent integration of technology into classrooms is by no means a new topic of discussion (Zhao & Frank, 2003, p. 808). Researchers cite numerous factors, such as teachers’ attitudes and self-efficacy, technological competence, time, access, and technical support. Addressing these factors individually, and even systematically, will no doubt result in some limited semblance of successful technology integration. However, true success will only occur through an entirely new and holistic approach.

**Case studies**

With technology at the forefront of education today, and funding increasingly scarce, it seems incredible that numerous stories exist about administrators pumping money into cutting-edge educational technology, only to find that the investment has not paid dividends. Papers, articles, and anecdotal conversations reveal that in many schools this new technology has limited users, has fallen into disuse, or is locked away in a cupboard, or “lost” somewhere in the school.

In 2001 LA United School District spend $44 million to implement the Waterford Early Reading Program (Monahan, 2005, p. 79) district-wide. In March of 2005, the *eSchool News* cited the amount spent as $50 million and reported the decision to be at the center of controversy. Critics charged that the program failed to improve literacy, in some cases hindered achievement, and found that classroom teachers seldom used the program. Proponents cited inadequate implementation, rather than product issues.

In one school in the United Kingdom, administrators embarked on a technology integration project in order to receive free Internet access for one year. No planning was involved regarding how to integrate the technology, and therefore, not surprisingly, it dead-ended at the information technology department (Hew & Brush, 2007, p. 229).

By contrast, Kyrene School District of Arizona has, apparently, effectively integrated technology after spending an initial $33 million on state-of-the-art technology in 2005 (Richtel, 2011). However, to date, teachers remain uncertain about the effectiveness of the technology. One teacher is quoted as saying, “This is such a dynamic class…I really hope it works” (Richtel, 2011). In this district, test scores have stalled since 2005, while “statewide scores have risen” (Richtel, 2011), class sizes are increasing due to budget cuts, and teachers often have to provide their own classroom supplies such as paper. The district superintendent David K. Schauer had the following to say: “We’ve jumped on bandwagons for different eras without knowing fully what we’re doing. This might just be the new bandwagon,” he said. “I hope not” (Richtel, 2011).

**Issues contributing to ineffectiveness**

Researchers are generally united about the factors that lead to this phenomenon of big spending with seemingly little effective integration. Key barriers fall into three main categories: Teacher, technical, and access related issues (Hew & Brush, 2007; Lu & Overbaugh, 2009; Coley, Cradler & Engel, 1997; Inan & Lowther, 2010). While Lu and Overbaugh (2009, p. 97) found that in general, teachers were happy with the level of administrative interest and support regarding technology, a fourth barrier apparent in articles, news reports, and to some extent the research relates to the philosophies behind administrative decisions.

**Decision making processes**

A natural place to start is with those who are empowered to plan and purchase technology: decision makers. Depending on the educational situation, these decision makers function at various levels, such as federal, state, provincial, district and school levels. Decisions are also guided by any number of technological initiatives such as the United States National Education Technology Plan 2010, rolled out by Secretary Duncan on November 9, 2010, or the School District No. 63 (Saanich) District Technology Plan 2009-2011 (Ferrie, 2008).

Funding is at the crux of the decision-making process. Simply put, if there is no money, there will be no new technology. In the United States for example, funding is available specifically for technology through such initiatives as taxation, and federal grants. This money may be quite substantive, but due to its stipulated use, state-of-the-art technology may be incongruous to other aspects of the school, such as classroom size, supply availability, teacher salaries, and student socio-economic factors (Richtel, 2011; MacGillis, 2004).

Assuming then, that funding is available, what decisions are guiding those who have the purchasing power? In many cases, it is the mandates handed down by governments that are driving the purchase of technology. Policies and acts such as “No Child Left Behind,” create an atmosphere of fear surrounding losing control due to low scores. At the same time the policies designate “billions of dollars” (MacGillis, 2004) in technology funding as an aid to fix the trailing student performance scores. With generous federal funding grants available to bring schools up to standard, technology companies make it their business to provide the answer (Bechelmeyer & Molenda, 2006, p. 17). In 2004, the *Baltimore Sun* did a series of articles exposing the software companies who are wining and dining decision makers of poor districts, promising them results, through educationally sound software. The designation “educationally sound” is often the result of the software companies’ own sponsored studies, or in an absence of “good research about education software,” school district’s hastily prepared evaluations (MacGillis, 2004). Guided by pressure and fear, and armed with funding, decisions makers put their faith in technology, while other potential remediation solutions are eschewed, and basic school needs are undersupplied.

Coley et al., (1997) contend that education has always fallen prey to “silver bullet” (p. 9) solutions, and technology is no exception. For many decision-makers “technology du jour” (Coley et al., 1997, p. 9) trumps issues in the classroom, and often overlooks the very purpose of education: learning. In a bid to appear cutting-edge in the field of technology, or because of pressure from without, those in authority make decisions often without careful and complete planning, or consideration as to how the technology fits within theories of teaching and learning. In terms of software, designers usually focus on the technical side rather than on the learning experience. The content is often broad, rather than fitting with learners (Coley et al., 1997, p. 52).

**Teacher Issues**

The remaining barriers can all be subsumed under the category of teacher use.
There is wide recognition that successful use of computers in the classroom is dependent on positive teacher attitudes toward computers (Christenson, 2002, p. 411). While teachers are “developing more positive views of the value of technology for helping students learn” (Bichelmeyer & Molenda, 2006, p. 20), there still remain a number of key issues that directly effect teacher attitudes towards technology, and subsequently have a bearing on the effective integration of technology into the classroom.

First, teachers’ attitudes towards technologies are a major component of the success of technology in the classroom. Teachers can tend to fall into two main camps as described by Heigdegger (1997, p. 25): those who “push on blindly with technology”, and “those who rebel helplessly against it and curse it as the work of the devil.” Researchers (Hew and Brush, 2007; Lu & Overbaugh, 2009; Inan & Lowther, 2010) contend that teachers’ beliefs, determine attitudes, which in turn will affect the use of technology. Hew and Brush (2007, p. 229) found that many teachers believe that computers do not aid learning. In many cases, a negative attitude is directly related to fear, and results in a lack of self-efficacy. “Instructional self-efficacy refers to personal beliefs about one’s capabilities to help students learn (Schunk, 2008, p. 113). High self-efficacy should result in teachers being willing to plan intricate and challenging activities for student learning. Teachers with low self-efficacy will avoid preparing lessons, perceived to be beyond their ability, including the use and integration of technology.

 Research suggests that a second major barrier to successful integration of technology is teachers’ lack of necessary skills (Inan & Lowther, 2009, p. 138). Not only do teachers lack training in the hardware and software aspects of technology (Coley et al., 1997, p. 45), but also in classroom management as it relates to technology, and the integration of sound teaching philosophies and practices into the use of technology (Hew & Brush, 2007, p. 228). When training is provided, it is common for teachers to complain about unhelpful sessions (Coley et al., 1997).

Teachers themselves cited time (Lu & Overbaugh, 2009; Hew & Brush, 2007; (Bichelmeyer & Molenda, 2006) as a major barrier to their use of technology. Standardized timetables with short 45-minute periods seriously hampered teachers’ ability to use technology (Hew & Brush, 2007, p. 236). The high cost of time needed to successfully learn how to use technology and then plan integrated lessons was another concern (Lu & Overbaugh, 2009, p. 97). Additionally, focus on standardized testing in schools, required extensive time out of the curriculum, leaving little time and energy to experiment with technology (Coley et. al. 1997, p. 45). Time also becomes a factor when coupled with lack of access. Teachers competing for time in labs, and limited resources, eventually give up and resort to traditional teaching methods.

Another major barrier cited by teachers was lack of technical support. Teachers became frustrated with old and slow hardware, technology that didn’t work due to lack of “timely” (Lu and Overbaugh, 2009, p. 97) maintenance, and scarce technological staff. In most cases, studies showed that in schools, there is little onsite technical support, resulting in lengthy delays to queries (Coley et al., 1997, pg. 45).

**Suggested Practices**

**Decision Making**

Effective integration of technology goes beyond the “simple presence of computers” (Lu & Overbaugh, 2009, p. 90). Schools are about learning and the keys to effective learning are “curriculum content, instructional strategies adjusted to learner needs, along with sufficient incentive, and opportunities to learn” **(**Coley et al., 1997, p. 51). Technology can only be effective to the degree that it supports these keys. Even if adequate technology is provided, unless technology use takes into account adequate instructional content and strategies, the desired learning outcomes will be elusive. Clark (1994) argues that it is not technology itself that affects learning, but rather the instructional strategies and methods promoted through the technology. Decisions based on political initiatives, commercial companies’ recommendations, or the latest trends are likely to be uniformed by educational philosophy, and will certainly result in a lack of successful integration.

A “shared vision of learning and teaching” must be the driving force to overcome leadership barriers (Hew & Brush, 2007, p. 232), rather than mandates handed down from distant entities. Without a shared vision, technology will be limited to “boxes and wires or isolated computer skills” (Hew & Brush, 2007, p. 234) and integration will remain elusive. Most importantly, the link must be made between technology and curriculum content. In terms of software, Coley et al. (1997) recommend collaboration of private and public educators and central clearing houses, such as the California Instructional Technology Clearinghouse for the testing and recommendation of pedagogically sound software. They do note however, that research is still needed as to whether learning can occur through these recommended tools.

 Integration of technology must keep the goal of schooling in mind, that of enhancing student learning. Decision-makers would do well to heed the words of Kanuka (2008, p.111) in regards to implementing technology: “It is important to take time out from our *doing* and ask *why* it is important.”

**Teachers**

Based on the research it is clear that current policies for implementing technology in schools are inadequate. Equally obvious is that “using digital tools to personalize learning cannot be done effectively without good teachers who know how to use and integrate digital tools into learning” (*Education Week,* 2011*)*. Positive attitudes toward computers are positively correlated with teachers’ extent of experience with computer technology” (Christenson, 2002, p. 41). So, if “teachers are the main gate keepers” (Coley, 1997, p. 230) in allowing educational innovations into the classroom how can current practices be remedied?

 Disjointed, fragmentary training is not an adequate approach to help teachers become familiar with technology. A new approach is needed. The National Staff Development Council suggests a “constructivist perspective” (Coley et al., 1997, p. 47) for staff development, which could include development in the integration of technology. Rather than teachers receiving knowledge through ineffective professional development sessions, there needs to be wide-scale collaboration not just between leaders, but all stakeholders: teachers, students, administration, researchers, and interested community members. Each location needs to “make sense of the teaching and learning process in their context” (Coley et al. 1997, p. 47).

 After vision, there must develop detailed integration plans. These plans include
“just-in-time rather than just-in-case” professional development (Hew & Brush, 2007, p. 239), reward incentives, maintenance and upgrade timetables, equity of access, expectations for integration, participation in team meetings, and the formulating of monitoring activities (Coley et al. 1997).

Individual schools can benefit from setting up technological communities of practice. Within this community, teachers can participate in action research, pedagogical conversations, reflective practice, and journal keeping (Coley et al., 1997, p. 47). With staff “actively contributing to a growing body of knowledge” (Coley et al., 1997, p. 47), it is more likely that attitudes towards technology will be positive. This innovative practice will create a dialogue, allowing teachers to effectively consider their philosophies and the role of technology within those philosophies. This dialogue can play a key role in allowing teachers time to explore their own attitudes and thinking in regards to technology and its possible uses in school. Teachers can also be further encouraged to collaborate on the creation of technologically integrated lesson plans and materials.

Reducing uncertainty through a community of practice is just first step. Hew and Brush (1997, p. 230) found that a minimum of 30 hours of training and hands-on experimentation is required for teachers to effectively use technology. In lieu of typical professional development sessions which teachers find ineffective, most teachers expressed a desire to have a few hours of “one-to-one” (Coley et al., 1997, p. 47) time with a “competent teacher” where they could just ask questions. Within the community of practice, “trained master teachers” (Coley et al., 1997, pg. 48) can interact with novices to support them through individualized plans for development. Training should be needs based, and also provide much-needed training in the classroom management of the technology being used.

Administrators too, play a key role in the community. In order to encourage teachers, they need an appreciation for technology, along with adequate training (Coley et al., 1997, p. 49). Allowing for mistakes will create a positive atmosphere in the community, thus increasing teacher self-efficacy, and in turn a willingness on the part of teachers to experiment with technology. Administrators can further the success rate by, reducing overall curriculum, and class loads in order to provide time out for teachers to apply what they have learned in training (Hew & Brush, 2005, pg. 237). Further initiatives include providing for follow up support, giving teachers access to the technology they have learned (Coley et al., 1997, p. 48), and adjusting time-tables to double periods to provide adequate time for technologically sound lessons (Hew & Brush, 2007, p. 236).

 In many contexts, funding will be the major issue that hinders access and technical support. Where funds are available, Hew & Brush (2007) suggest technology be put directly into the classrooms rather than in central labs. Hybrid systems using “thin client computers” and wireless provide cost-effective options (Hew & Brush, 2007, p. 235; Coley et al. 1997). Rather than introduce technology throughout the school, a conservative approach of implementing it in one or two subjects at a time to will ensure adequate technology. Other options include mobile laptop carts, and adopting a group/station rotation approach, thus cutting down on access issues (Hew & Brush, 2007, p. 235).

 Students too can contribute as part of the community. A wealth of technological knowledge already exists within the student body, and can be utilized when technical support is lacking. Interested students can receive further training within the community of practice to “handle simple hardware and software problems” (Hew & Brush, 2007, p. 236), thus providing a cost-effective alternative to hiring many technicians.

**Conclusion**

While the barriers and suggested practices discussed in this paper in no way cover every aspect of the issues surrounding the effective integration of technology into K-12 education, it is hoped that they do highlight the major issues, and make a point for a new approach. Over the past decade, all aspects of the integration of technology into K-12 schools, has been at best “piecemeal” (Bichelmeyer & Molenda, 2006, p. 17). In order to achieve value for money and the full, meaningful implementation and integration of educational technology in schools, educational philosophies must be considered, all stakeholders must be included in a collaborative community of practice, teachers must receive robust, contextual training, and adequate technology support must be provided. In short, successful integration will require nothing less than a “holistic approach” (Hew & Brush, 2007, p. 242).

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