Overcoming the Barriers to Implementing Technology Education: It Can Be Done!

By Diana Wanek

> *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)*

Alfred Bork was seen as a pioneer in the field of educational computing. Bork's statement, made 27 years ago, seems to have partially come to fruition, though some aspects are still lacking between his statement and the reality of computers in education today. What keeps Bork's statement from ringing true across our country in today's education system? At closer examination, several barriers can be indentified that hinder the integration of a quality technology program.

These barriers require defining and addressing from numerous. As our world has changed and evolved over the past quarter of a century into a society that incorporates, as well as thrives with technology at the heart of all aspects of our lives, there is now an even greater need to infuse technology education into our public schools, lest our students enter society unprepared. Even with a growing acceptance of technology one must face the facts that within the school setting, to initiate a technology program, there are and will be barriers. These barriers might be a lack of resources, a lack of qualified teachers and a lack of forethought and planning for a well-designed curriculum. These barriers must be addressed equally in order to offer an effective technology education. If resources are secured but instruction is lacking, there will be no benefit to having the resources. If quality instruction is present along with the resources, but there is no organized thought-out curriculum, the benefits are lost. In order to implement a quality technology program, all three of these barriers from resources, to instruction, to curriculum, need to be addressed and eliminated. The barriers must be removed in order to ensure a valuable and

successful technology program. In order to see Bork's statement become a reality, any and all barriers standing in the way of a technology program must be dealt with.

When addressing barriers, rather than beginning with what might seem the obvious resource, for the execution of the technology program, let's begin by looking at resources in two separate categories: 1) technology tools for instruction and learning and 2) resources of time and money to pay for teacher training. Beginning with the use of money for teacher trainings, Sanderholz & Reilly (2004), stated, "Simply increasing the number of computers available for instructional use is not likely to lead to significant changes in instructional methods" (p.488). Instead, the focusing on the purchasing of technology equipment, a focus should be on a combination of the resources. Technology equipment is key to a successful program but money also needs to be spent on teacher training and curriculum development as a first priority for creating a quality program.

In their research, Sanderholz & Reilly (2004) found that teachers often requested not more technology tools, but more time to learn to use the tools through in-service trainings. Teachers requested time to plan, prepare and experiment with the current tools for a better understanding of technology itself and the integration of its use into their instruction. As one teacher put it, "I need time to use and practice the many things I am learning" (p. 496). With less structured time spent together on computers teachers were able to collaborate and build upon their colleagues' work and learned together. Teachers were able to practice, experiment and discuss specific problems. Together, there was time to develop content for instruction as well as discover success with technology integration. One teacher noted when given the time to step out of her own classroom and visit another classroom using technology she saw how to better integrate the technology into her own classroom. Using the resource of money and spending it on

teacher training, to invest into ongoing teacher release time for observations, team-teaching, and peer coaching is cash well spent. The investment of money to develop a curriculum is a valuable investment for the success of a technology program. The first questions to be addressed by the district and staff should be: 1) in what areas are our students in need and 2) how are we going to utilize various forms of technology to met the goals of our district and the needs of our students? In building a successful program key components would include a uniform curriculum, yet not one spends time introducing the basics of applications each year. A high-quality curriculum maintains continuity from one grade to the next and builds on the previously acquired skills. A school curriculum needs to have a comprehensible plan to integrated technology into the curriculum to transform instruction, meet student needs and assist in learning. A school can have the resources and the instructors to implement the technology plan, but if there is not a designed plan for technology instruction, the success of the program is at risk and definitely not producing the maximum benefits to students or offering adequate support to the instructional staff. Teachers need to have a shared vision that empowers them to buy into the goals and to guide their instruction in technology with a scaffolding approach. Uibi and Kikas (2008), acknowledge that, "The computer is not an aim in itself, but a tool to make teaching more effective. The most important means when integrating technology into a subject area is that the technology tool help improve the methods of traditional teaching" (p. 470). For a technology program to be successful, it is imperative that individual teachers, as well as the whole staff within a building, have a clear vision for the implementation of technology into the current curriculum.

Hokanson and Hooper (2004), argue that technology integration takes place along different stages. They believe it follows Rieber and Welliver's hierarchy, beginning with familiarization, utilization, integration, reorientation and evolution. Thus, the technology

curriculum must be planned out and have a defined purpose, but must also address time for teachers to spend in familiarization, utilization, and collegial collaboration to cause teachers to improve their capabilities as well as improve their personal outlook towards integration of technology. Sandholtz and Reilly (2004) assert, "that expecting teachers to be technical experts might actually deter them from using technology in the classroom." Thus, with forethought, the school technology plan can be implemented even when teachers are not technology experts. Sandholtz & Reilly (2004) say, "Put another way, we don't require an automobile maintenance course before issuing a license to drive, so why do we expect teachers to master the ins and outs of personal computers before thinking about how to use them effectively in classrooms?" (p. 507). When establishing technology in the classroom care must be taken to create a quality program without expecting teachers to be technical experts. The expectation should be that lessons are designed in a manner for all invested parties to reap the benefits. Lessons need to be based on proper pedagogy. Technology standards need to be set and adhered to standards such as those designed by the International Society for Technology Education (ISTE). Students within an integrated technology curriculum can also become active participants in the design and outcomes of this learning process. This process of involvement can be a learning experience as well as drive students to a real world experience rather than isolated technology education within a classroom. Lessons that incorporate technology need to be designed to be meaningful, powerful, authentic and transferable to life. Smeets (2005) noted that technology curriculum should be open-ended, allowing students to transfer knowledge from the school setting to the real world (p 352-533). Open-ended lessons cause students to step beyond simply absorbing information. With a well-planned technology curriculum, students are able to reach beyond the classroom to the real world. Their curriculum is enhanced by experts beyond the classroom setting. An

appropriately-designed technology curriculum can, as Smeets emphasizes, "create a powerful learning environment in numerous ways. The incorporation of technology into the educational setting provides an abundance of information using multiple resources viewed from a wide and rich prospective" (p. 344). A well-designed curriculum adds that real world experience that students need to succeed today and in the future. With a well-designed technology curriculum, another barrier can be overcome.

At this point though we must delve deeper into the teacher as a barrier. It is hard to imagine that the teachers themselves could be seen as barriers to a quality technology program, yet indeed that is the case. As addressed previously, when teachers feel the pressure to be the "expert" ramifications can be felt. If the teacher feels inadequate or threatened, the results of technology use in the classroom are not productive. The place to begin to take a closer look is at a teacher's ability to deliver instruction incorporating technology within the lesson. Teachers need to know that their views as the teacher, in regards to technology instruction, will play a significant role in the success of the technology lessons. Therefore, it is key that all teachers be fully onboard with the implementation of a technology program in the school and in their classroom setting. It is imperative that teachers feel they played a role in the program development. When teachers have input, they begin to take ownership of the program and desire to see it flourish and succeed.

Some of the ways to assist teachers in that ownership have been addressed through the use of the funds for teacher trainings, without pressuring the teacher to feel the need to be the expert. Addressing the concerns of the teacher's philosophy and changing role within the classroom will again advance the role of technology in education. Uibi and Kikas (2008) noted that teachers needed to see the computer’s impact on the teacher-student relationship as a

positive one (p. 469). Technology instruction is a supplement to the role the teacher plays in the classroom. With technology instruction, teachers change from being leaders to seeing themselves as supporters and facilitators of education. Their jobs are not being threatened by bringing technology onboard. Rather, it will enhance their instruction and stimulate student learning and achievement. Teachers become directors of a student's education, utilizing the tools that cause the education system to evolve more into a workplace setting. Again though, time needs to be invested in professional development for teachers focusing on classroom management, hands-on activities, observation techniques when using group work, guidelines for assessment including portfolio projects, and other such areas to meet teacher's immediate needs. Time for these additional activities needs to be built into the school day. Time for teachers to collaborate and to monitor technology use is key to a successful curriculum. For teachers not as comfortable with technology integration, finding an existing teacher who is using technology instruction to be a mentor is another effective manner to assist those currently in the teaching field. Sandholtz and Reilly (2004) quote one teacher as saying,

> "Developing a support system within the 'ranks' of your colleagues is wonderful and boosts your comfort level in working with technology. It gives you a sense of confidence and willingness to try new ideas or methods. New approaches spread quickly through the collegial networks and often became topics included in the district's professional development program" (p. 505-506).

Current technology teachers need to step forward in support of technology education and integration within core subjects, leading the way to full technology integration. These teachers need to support their colleagues, and their colleagues need to see this support as a resource for them to better their instruction.

Sandholtz and Reilly (2004) believe as well, When placed in the role of technician this places additional burdens on the teacher that are counterproductive. Placing teachers in the role of curriculum development and instruction put the teachers in their element. Asking them to take on the role of understanding how technology works and how to trouble shoot when it does not work is asking teachers to go beyond their comfort level and leading many into an unfamiliar role of technicians. Sandholtz and Reilly go on to remind us, when asked to be the technician the teachers becomes overburdened and will defer to traditional teaching methods rather than incorporating the use of technology. When teachers are allowed to focus on instruction quality lessons are provided.

It is not only the current classroom teacher that can be seen as a barrier; worse yet, it is the incoming teachers, those new to the trenches of education entering the field without the experience of our modern technological society in their own educational training. Wang (2002) acknowledges that reform must begin with quality teachers going into the classrooms. As greater importance is placed on technology instruction, a greater importance needs to be placed on the education of preservice teachers at the university level. Colleges and universities need to step up in better preparing teachers entering the field of education. Teachers experiencing instruction at the preservice level, with little or no technology introduced into their own coursework, will enter into the role of a lead teacher based on what their experience was as a student. The problem lies in the teaching methods simply being recycled. Teachers bring to the classroom methods in which they were taught. Adjustments to preservice teachers' preparation need to be done to prevent new teachers from coming into the field of education as barriers to quality technology instruction. A teacher's inability to deliver technology lessons is yet again only one part of the instructional barrier. Once a plan is in place and teachers are committed and qualified or being

supported towards being highly qualified for technology education, one now can look for the necessary equipment to carry out the designated plan.

Each year our government, at both the federal and state levels, is budgeting money for education. However, there needs to be a closer evaluation of that budget to grasp how to allocate funds for an effective technology program. There needs to be a division of those funds for both the teacher trainings and ongoing support as well as for technology tools. A quality technology program is a program that includes money for today and money for the program to be sustained. One major barrier to technology education is an inadequate and unsustainable budget. Without adequate resources, integration of technology is impossible. When teachers are working with limited resources, or resources that are outdated and unreliable, the teachers' hands are tied. It is not enough to budget for a technology program on a yearly basis. Forethought needs to go into the program of the future. Technology education is a resource that demands looking to the future to keep supplies current and hardware in constant working order. The Federal Government, local states and districts need to step up to provide the whole package for a steady technology education program for all students. Collins and Halverson (2010), wrote, that one barrier to technology education is that schools are resource poor (p. 22). Noting that the lack of resources is a valid barrier to a better-quality technology program for our youth, Hew and Brush (2007) offered three possible solutions: 1). the creation of hybrid labs; 2). the introduction of technology integration into a limited number of subject areas to ensure those subjects have adequate technology before moving on to other subjects; and 3). the move away from the model of the stationary computer labs and towards the use of mobile carts, offering one-to-one computing shared between multiple classrooms (p.25).

In considering the hybrid option, Sandholtz and Reilly (2004) support the use of thin client computers with internet access and no hard drive as a viable solution to technology in the classroom. These thin client computers are more affordable than the full-size computers. The thin client computers are less costly to maintain and are a practical solution to classroom storage issues (p. 503-504). The use of the thin client computers also makes student learning mobile between school and home, thus extending the learning venue for the student beyond the scheduled school day as these computers can be easily checked-out and taken home by students.

Tearle (2004) focused on overcoming the barrier of resources by introducing technology education at its fullest in a select group of key subject areas to develop and maintain a quality education in those few core subjects before launching a full-out program that would be integrated poorly in too many subject areas (p. 236). Tearle's concept of starting small and building upon that success is key to future success in more subject areas.

Lowther, Ross, and Morrison (2003) see the creation of mobile carts as a way to insure one-on-one computing without the expensive computer labs. This third solution would offer five to eight computers in each classroom and rotate cooperative groups to these computers in these classrooms for instruction. The mobile cart could be shared between classrooms as well, until additional funding was allocated for more laptops. Though this is a viable solution to the current system, it is not recognized as the best option. The sharing of a few laptops again brings issues or additional barriers to instruction. The need to schedule groups of students or several faculty members for the few computers available hinders making the technology manageable for teachers and productive for students. Again, this solution could be seen as adding a barrier to the program.

With each of these barriers, the challenges of overcoming them will require support from both federal and state governments for funding. At the district level, the funding of technology needs to be seen as a priority. For many districts, being given the finances and the consent to start out on a small scale would be a step in the right direction. To begin by bringing technology into the education system in a slow and thoughtful manner for long-lasting results would be an improvement from the current system. All too often districts are struggling with an attempt to manage all previously-mentioned barriers at once. These kinds of attempts, though well meaning, are not often successful.

The community at large can join hands with the school in the learning experience and education of our young people. Schools could use the support of local businesses and the community. There are many ways the community can provide for the success of technology instruction in the schools. Those within the community can provide resources for school as well as places of apprenticeship for students in the areas of technology. Communities can offer a wide variety of experts in a variety of fields to enhance the learning of the students, thus enriching the field of resources available to students. Local businesses and the community can become partners in technology education. With the addition of technology instruction into the teachers' day, principals must also allow time for continuing education and professional development. Administrators will play a pivotal role in determining how well technology is used in their schools by the tone they set, as well as their example as leaders in technology awareness and use. (Nets for Administrators, 2011). Sufficient education and support should be given to school principals for education technology with participation in post-graduation programs regarding technology leadership. Eren and Kurt (2001) acknowledged principals themselves need to be highly qualified in the area of technology. When there is a vacancy at a school,

technology instruction and technology literacy needs to be at the forefront when hiring a replacement to provide leadership to the staff and students. When hiring new principals, the technology skills of a principal should also be taken into account. Parents need to be familiar with what a quality technology education program looks like for their child, and they should become proactive in seeking such an education (International Technology Education Association, 2006). The use of instructional programs that incorporate technology instruction can be beneficial to both the student and the family. The use of technologies can strengthen collaboration between school and parents.

It can be said, that technology literacy needs to be a national priority, though content and curriculum come first. Technology should be seen as a viable support to the instructional and learning goals for all students. Existing instructional methods can be strengthened with the inclusion of technology pedagogy in core subjects. It can also be said, that a quality program is not an easy task to undertake without thought and consideration. No one solution will fully bring a rich technology program into the school system. Nor is the infusion of technology education a cure-all for what ails our education system. A quality technology program is a program that includes money for today and money for the program to be sustained. Without adequate resources, integration of technology is impossible. With the infusion of money, the impact will be minimal, unless teachers are qualified to instruct with technology. Unless there is a road map driving the direction of the use of technology education in the school, the addition of technology education will see minimal results. However, the time to act is now. When a curriculum is clearly defined with a vision of the future and technology is seen as a valid subject, then technology education becomes a way of enhancing the education of all students. It is essential that we plan for the future with technology education at the forefront of a student's education.

We owe our children the best preparation for that future by overcoming all the barriers currently effecting the implementation of a quality technology program in our schools. We owe this to them now.

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