The Continuing Challenges of Technology Integration for Teachers

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Abstract

Technology development in the beginning of 21st century has changed not only the way classrooms appear, but also necessitates a change in how students in the classrooms learn. However, a problem continues to exist related to teachers using technology in meaningful ways for instruction. . In this article, we suggest that school districts use a curriculum mapping process to help teachers initially understand their curriculum more deeply. We posit that once teachers have an understanding of curriculum and learning processes, technology integration is possible. Once linkages form between what students need to know and teachers' knowledge of how technology is a tool for student learning, high student engagement through inquiry occurs. Teachers will then understand the benefit of technology in teaching and learning, and find meaningful ways of technology integration.

Introduction

Meaningful technology use in the K-12 classroom presents an ongoing challenge in education. With few exceptions, most professional development programs have not provided teachers with the knowledge or experience to begin to use computer technology in their classroom in the same manner as other tools, such as the whiteboard, posters, manipulatives and text. Technology integration no longer involves only the knowing of the computer related technologies and software – it involves the way teachers and students approach learning. The amount of primary and secondary information available to the classroom and how that information can be organized, thought about and presented requires new skills for both teachers and students. The use of computer related technology provides opportunity for the construction of new knowledge from different sources, the organization of qualified information, making meaning of information for and presenting that information to a larger community (Partnership for 21st Century Skills, 2003).

Over the years in K-12 education, professional development for teachers in the area of technology integration has focused on the technology itself and the software. Unfortunately, without good technology integration models or knowledgeable leadership, teachers found themselves struggling to understand the hardware, with little energy left to integrate the technology into the learning environment. Historically, technology facilitators focused on the bells and whistles of software leaving participants with a false sense of knowledge of the potential of the software for teaching and learning. The attractions that computers initially presented for teachers were as varied those who attempted to use them. Teachers must understand the computer applications more completely to use the computer a tool for learning. The challenge becomes one of how to best prepare prospective teachers and inservice teachers for teaching and learning with technology.

Prospective teachers often come to the public or private schools with a basic understanding of computer applications and not of the big picture of the possibilities for technology integration. Further, according to the National Center for Educational Statistics survey data approximately 20% of teachers entering the educational system felt prepared to implement educational technology in their classrooms (U.S. Department of Education, 2000c). New teachers entering the educational system do not possess the depth of understanding to create classrooms as a model

of technology integration despite greater emphasis on technology learning in higher education. In addition to the challenges with technology that new teachers face, inservice teachers experience similar concerns.

According to Duhaney (2000), the results of a national survey indicated that a majority of teacher respondents had some training in technology but only 20% felt comfortable using computers. Additionally, respondents reported difficulty in understanding how to use technology to support an engaging and meaningful learning environment. Therefore, the burden of educating teachers to a more global understanding of technology literacy falls to the school system itself.

The National Association of State Boards of Education (2001) highlighted the critical need for adequate professional learning in technology use in order to achieve enhanced learning opportunities for students. Yet, many K-12 school organizations continue to fall short of providing comprehensive training for the classroom teacher beyond the software applications.

Inhibitors of Technology Integration

There are many reasons for the lack of deeper knowledge of technology integration by teachers, including teacher apathy, district budget limitations, lack of leadership, and lack of availability of training. Yet, the greatest inhibitor to technology integration is time. It takes many hours of use and planning to learn the possibilities of a computer software application and have time to explore possibilities for integration.

Teachers' knowledge of the software application is limited consequently; applying it to a meaningful learning context in the classroom is a difficult task. This process needs direction and support and must be a collaborative effort using the combined knowledge base of classroom teachers, administrators, curriculum support personnel and technology facilitators. Therefore, lack of support, time, leadership, and collaboration and knowledge of the curriculum content leads to lack of efficacy teachers has regarding how to integrate technology into the classroom. Additionally, the evolution of technology created other challenges for teachers as they struggled to 'keep up' with the speed of technology changes.

The evolution of the computer, the demands of society, the school community, and the political control of education by textbook companies blurred the teachers' conceptions of the purpose of technology in teaching. Teachers viewed computer technology as a disconnect from the curriculum. A disconnect means that teachers see no relevance between what the students need to know and what they can construct, find or ponder with computer technology. Additional challenges to technology integration occurred as educators envisioned computers as a new instructional management tool.

The emergence of networked computers and the acceptance of the textbook driven curriculum, provided a gateway for the adoption of Integrated Learning Systems (ILS). Many district superintendents viewed the ILS systems as a panacea: the answer to the community calling for more technology use as well a response to teachers resisting computer use in the classroom. The need for professional development for teachers decreased, since paraprofessionals in many cases were responsible for the labs. While students received their computer experience in the ILS labs, some teachers perceived this as a reason or excuse for not using the computer for instruction.

In the late 1980s and early 1990s, leaders in technology, such a Bank Street College, Massachusetts Institute of Technology and Seymour Papert began to focus on technology as a tool for inquiry. Programs such as *Logo*, the *Voyage of the Mimi*, and *Windows on Science* videodisks, promoted the ideas and concepts of inquiry based learning. The combinations of equipment needed to use these programs in the classroom was so complex, that teachers did not use them or abandoned them unless the teacher was "wire aware", or in other words hardware literate.

The few teachers that had an understanding of the possibilities and had a vision for the potential of

technology at that time often could not acquire shared visions of the school administration or their peers. Adding to the inhibitors of technology use was the problem of the technology in classrooms and labs failing to function. Teachers did not have the knowledge to make repairs, and computers sat lifeless. Students ultimately had limited access to computers, training was insufficient and little connection between curriculum and technology existed (Becker, 1991; Van Dusen &Worthen, 1992). Unfortunately, it is this mistreated past of 'disconnect' that remains in the minds of many teachers and administrators when technology is addressed in schools today. It was not until the availability of the Internet in K-12 education that began to increase teachers' interest in technology uses.

Those teachers, principals and curriculum leaders who saw the potential of the technology continued to gather knowledge and become evangelists of the movement to have computer technology make a difference in learning. Research conducted by Apple Classrooms of Tomorrow (ACOT) argued that students could learn better and faster when using a computer to learn According to ACOT, students could be more motivated if computers were available for use as a tool to facilitate inquiry learning and representation of their knowledge and understandings.

Educators today need to separate themselves from the past and accept technology as an integral part of the education of students in the 21st century. With resources exploding, lesson ideas available, and student activities at their fingertips teachers must embrace the accessibility of information on the World Wide Web. Many teachers are becoming more responsive to learning about the computer and its use in the classroom versus labs only. However, the largest problem that remains in education today is connecting technology to curriculum content and to the learning processes. Schools need a staff development model that assists teachers in understanding technology as a tool for connecting curriculum content to learning processes. Institutions of higher learning should consider the same model as prospective teachers are prepared to enter the teaching profession.

The next sections provide direction and specific strategies we propose using as a process approach in professional development. Using a curriculum mapping process, we can assist educators in identifying and utilizing technology that is an integral part of the student learning process. The teachers and knowledge of the curriculum and the learning processes of the student determine the potential for technology integration.

Mapping the Curriculum: Paving the Road for Technology Integration

When facing the problem of getting teachers to effectively use technology for teaching and learning in the classroom, we need to start from where the teachers are in their own understandings. We want teachers to view technology as a transparent tool in the classroom. Teachers need to recognize technology as an instrument in their tool chest for teaching and learning. According to Rudnesky (2003), computers need to be part of daily classroom activities to make technology transparent. Moreover, we believe that teachers should not have students involved with technology for 'technology's sake 'only.'

For technology integration to occur, we propose it is necessary to initially understand and organize the content of the curriculum by grade level. Teachers need to recognize what they are teaching across a yearlong curriculum. The process used for this purpose is curriculum mapping. Heidi Hayes Jacobs, a leading authority of curriculum mapping, refers to the process as putting together the big picture. Jacobs (1997) expressed the concept that teachers should organize the curriculum and connect the resulting instruction in the classroom in a way that is logical and meaningful for students. Jacobs discouraged teachers from focusing solely on the content of the curriculum, but to teach concepts that across units, even perhaps across the entire year.

One of the reasons for mapping the curriculum is to avoid the static nature of curriculum development that has plagued education historically. Teachers need to talk about curriculum through a dynamic process. The process of curriculum mapping provides a forum for substantive conversations among teachers regarding important decisions about content, instructional delivery, alignment, and pacing concerns eventually 'digging deeper' into more

conceptual understandings of learning processes and curriculum organization. This begs the argument that curriculum development should not exist within a traditional 3-5 year cycle that does not provide ongoing dialogue within professional learning forums. Teachers require continued discussions to plan effectively for the future learning needs instead of responding only to the high stakes testing demands of today.

Another reason for curriculum mapping is to improve communication among teachers, administrators, parents and community. Communication between levels, buildings and courses has become increasingly important as accountability forces us to monitor and adjust teaching to improve student learning. Accountability requirements result in tracking the students progress across years and levels, therefore, schools must pay closer attention to what, how and when they are teaching content (NCLB). Curriculum maps provide a structure to examine possible gaps and overlaps in our educational delivery systems.

Consolidation of resources, space, time and materials is another reason to map curriculum. As communication occurs regarding common themes, content, topics and assessments then teachers begin to identify resources, materials and other needs as necessary teaching tools. Teachers are better able to combine efforts in organizing and sharing their needs when the curriculum map provides instructional focus. For example, if 5th grade teachers understand that they will be teaching a unit on exploration, they are better able to collaborate on lessons and other resources. This collaboration may include but not be limited to assigning different teachers to different tasks such as organizing media center time to collect reference books, finding and bookmarking Internet sites and creating learning centers. This type of collaboration and consolidation of resources is not only limited to a building level but can expand to include other 5th grade teachers across the district. Curriculum mapping is a way to meet both the needs of the students and the requirements of the district and state as well.

We propose that the process of curriculum mapping extend beyond the basic curriculum content students must know. Teachers must correlate the learning processes students need in order to apply their acquired knowledge to more global understandings. If teachers use curriculum mapping to identify what skill students need to apply to learning, the missing process skills can be determined. For example, if first grade students need to learn about life cycles, the teachers must determine learning processes that best facilitate the students' understanding such as observation, reflection, data collection, and sequencing. These learning processes demand an inquiry approach that may involve project based learning, mini quests, distance learning experiences, an off-site extension or combination of any of these approaches. Teachers are able to map instructional delivery approaches, along with the digital age skills such as technology literacy, communication, inventive thinking and problem solving across the curriculum and grade level.

The Process of Developing Curriculum Maps

Teachers who enter into the process of curriculum mapping or content 'uncoverage' develop a better understanding of their curriculum (Wiggins & McTighe, 1998). As suggested previously, teachers must first decide what is taught and when through a series of substantive conversations. Teachers also make discoveries across grade levels that there are mismatches in curriculum alignment. Through this dialogue, realizations occur relative to content that has not been covered, hidden curriculum or pet projects, and pacing issues. Following several sessions of dialog, we posit that the next steps become critical to the curriculum mapping process.

Step 1: Look for connections within the curriculum that teachers implement throughout the year. (e.g. systems (government, body, space - connecting both science and social studies required content)

Step 2: Select a theme; or topic (e.g. communities, systems, exploration).

Step 3: Select a conceptual thread - *change over time; likenesses /differences; interdependency.* Teachers identify a

big idea or enduring understanding at this step which serves as an overarching organizer for the unit (Wiggins & McTighe, 2004). Focus on concepts beyond the 'facts' is essential for higher order thinking (Erickson, 2002).

Teachers soon discover that some concepts weave across several subject areas. For example, the concepts of change, patterns, interdependence, symmetry, system and movement can be examined in many subjects or serve to unite the subject areas. For example, the theme of *conflict* relates to the content of social studies (war), literature (among characters) and science (survival). Another example is the theme of patterns or change over time found in literature (rhyme; rhythm, repetition), math (patterns all around us), science (pattern in life cycles), music and art (patterns in style, texture, tempo rhythm).

Teachers might incorporate reading and music as they see how rhythms, harmony, repetition all relate to early reading skills. Teachers discover a similar connection as they consider how classification, patterns, likenesses and differences are interconnected in the area of math and science. As these connections emerge it becomes clear how teachers may find one or two concepts to unite a unit or theme.

Step 4: •Identify district or state curriculum standards, benchmarks and appropriate assessments Teachers should be able to determine the core knowledge expressed in the standards and benchmarks.

Step 5: Develop 2-5 essential questions based on this core knowledge. Jacobs (1997) defined an essential question as the essence of what students will examine and learn in the course of their study. The questions should be of different kinds according to Erickson (2000).

Factual – "Name the parts of a plant"
Conceptual - "What benefits are plants to the environment?"
Philosophical -" "Should rain forests be protected?"

Step 6: Determine appropriate assessments of the students learning at the conclusion of the unit/theme study. Assessment should drive instruction and allow for differentiation based on the needs of students.

Step 7: Determine the learning processes. Identify the processes needed to best learn or acquire the information (Table 1).

Table 1: Third grade example

Science

Content	Process	Technology Integration
Plants	Inquiry, prediction, problem solving, sorting/classifying	Journey North, Graph Club/Excel

Weather	Data collection, comparing/contrasting,	Data retrieval, Graph Club/Excel, video streaming
Simple Machines	Comparing/contrasting, problem solving	Tom Snyder – Science Court, Webquest

Step 8: Establish method of inquiry. Choose instructional methodology-*Project based; problem based; learning center base, collaborative project or a combination of these processes*

Step 9: Develop lessons, activities, projects that connect with the topic or theme developed. In education, teachers often start with this step. The problem with starting with lessons and activities is one of not understanding if they lead to understanding of the content and concepts.

Curriculum in general can be unrelated or fragmented. However, through the curriculum mapping process, teaching for meaning and understanding occurs. Students focus on 'big ideas' and use higher-level thinking and problem solving skills. This approach helps teachers focus on essential learning and promote active, inquiry learning. In these classrooms, teachers encourage students to explore substantive learning from a variety of perspectives and sources. Additionally, curriculum integration through the curriculum mapping processes can make the content more understandable to students and more meaningful.

Teachers begin to see how technology supports inquiry learning contrary to methods that are more traditional. Student and teachers use of technology begins to develop into a third dimension of the initial curriculum map Teachers not only have their yearly curriculum mapped through this process, but also identify technology integration possibilities. The identification of meaningful technology connections to the curriculum must come from their own experiences gained from professional development sessions, professional reading and research or a more knowledgeable other such as a technology consultant.

For example, a second grade teacher may begin to see that it is a natural for his/her students to use *Kidspirations* to compare and contrast a variety of topics in the curriculum. This level of teacher knowledge and process may seem a small step forward in the development of technology integration. However, it is a needed step for teachers to understand the functions that technology potentially serves. Once teachers begin to acknowledge the learning processes that technology can facilitate and locate additional resources they continued to develop their related maps.

Conclusion

We theorize that the curriculum mapping process we presented is an effective staff development model leading to meaningful technology integration. This departure from the more traditional curriculum development cycle has many benefits. Some of the benefits include:

Collaboration, risk-taking, and sharing of resources are critical to the change process.

Recognition of adult levels of learning is essential to the delivery of support services to teachers Professional development must be an ongoing process and on an as-needed basis.

The curriculum mapping process, an understanding of what students must know, and best practice methodologies are all critical to the teachers' understanding of the technology 'fit' and the capabilities of technology to enhance the learning process.

Technology increases the self-directed learning opportunities for both students and staff.

In the overall process of curriculum mapping and technology alignment, technology does not drive instruction; curriculum is the driving force in the application of technology and learning.

We all know that students today face rapidly changing technologies and that 'global understandings' are no longer buzzwords. Knowledge regulated to textbooks, random Internet 'research', ideas from the teachers connected to the expectation of coverage from standards and benchmarks all limit the learning possibilities of our students.

Basic skills for the students of the 21st century skills will include basic literacy in the subject areas but in addition, students also need basic scientific, economic, and digital literacy. In addition, students need to be literate in visual and informational literary, global, and cultural differences. The students of the 21st century also need to be inventive in their thinking, be able to communicate their ideas in published form and verbally, and to use the tools of the 21st century for learning, communication, and problem solving (Partnership for 21st Century Skills, 2003).

To truly understand the benefit of technology use for learning teachers need to be able to acknowledge the benefits of technology as a tool for learning. They need to view the tool, as beneficial, enabling their students and themselves to perform their jobs more effectively. Teachers need to also recognize and identify the learning processes that technology makes possible: the collection, organization, presenting, and communication of information in today's informational society. Classrooms must support learning environments that reflect an understanding of what keeps children in eager pursuit of knowledge.

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