Principals to Guide the Integration and Implementation of Educational Technology

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INTRODUCTION

The Educational Technology Integration and Implementation Principles (eTIPs) are six statements that describe the K-12 classroom and school-level conditions under which the use of technology will be most effective. The eTIPs are an example of materials that can aid teachers in designing instruction and participating in creating supportive conditions for technology supported classroom instruction.

BACKGROUND

During the last decade, the call for teachers to be better prepared to teach with technology (CEO Forum, 1999, 2000; Office of Technology Assessment, 1995) has been repeated several times. In response, there are now standards in place to which new teachers are being held that explicitly describe the technology skills all teachers should have to be prepared to teach in a 21st Century school. These include the National Education Technology Standards for Teachers (ISTE, 2000), which were adopted by National Council for Accreditation of Teacher Education (NCATE) as a part of its accreditation requirements, and the Interstate New Teacher Assessment and Support Consortium standards (INTASC, 1992) used by many states as licensing requirements. In general, these standards call for teachers to be able to use technology in the classroom to plan and design learning environments and experiences, and support teaching, learning, and the curriculum. These standards, in turn, imply that teachers must make the consideration of technology use a routine part of their instructional decision making.

Teachers' decision making has been defined as the course of action during which teachers gather, organize, and interpret information, generate alternatives, select a specific course of action, and, after its implementation, consequently evaluate the effectiveness of the decision (Clark & Yinger, 1977; Lipham, 1974). The research literature emphasizes how critical teachers' planning and interactive decisions are in determining what they do, or do not do, in the classroom (e.g., Clark & Yinger, 1977; Jackson, 1968; Peterson & Clark, 1978; Shavelson, 1976). Shavelson and Stern (1981) posit that teachers' decision-making processes are influenced by schemata that are activated from memory.

MAIN THRUST OF CHAPTER

The Educational Technology Integration and Implementation Principles (or eTIPs) are one example of a set of statements that could serve as a schema, or the basis of a schema, for a teacher to organize his or her instructional decision making about the integration and implementation of technology. Principles can assist learners in recognizing and connecting ideas and in seeing how new and old ideas relate (Marzano, 2001), which are key tasks in developing the more elaborate schemas that are characteristic of expert teachers (Carter, 1990; Fogarty, Wang, & Creek, 1983; Kagan, 1992). The six eTIPs summarize what research suggests are the conditions that should be present in order for educational technology integration and implementation to be effective (Dexter, 2002), while offering the advantage of brevity over the 23 NETS-T standards and the five technology-specific statements in the INSTASC standards.

These eTIPs are organized into two dimensions: classroom and school-wide. The classroom principles expand upon the premise that effective technology integration requires the time and attention of teachers in the role of instructional designers, planning the use of the technology so it will support student learning. They assume that educational technology does not possess inherent instructional value but that a teacher must design into the instruction any value technology adds to the teaching and learning processes. Thus, the three classroom eTIPS prompt a teacher-designer to consider what he or she is teaching, what added value the technology might bring to the learning environment, and how technology can help to assess student learning.

Classroom-Level eTIPs

eTIP 1: Learning outcomes drive the selection of technology.

In order for learning outcomes to drive the selection of technology, teachers must first be clear about their lesson or unit's student-learning outcomes. This is an important first step in determining whether or not the educational technology available can be a support to teaching and learning. It will allow teachers to be more efficient as they search for available, appropriate technologies because they will quickly eliminate those that do not support their learning outcomes. Where technology does seem to support learning outcomes, teachers must also consider the cognitive demands made by the technology and if they are well-suited to the cognitive demands inherent in the learning outcomes. For example, if a learning outcome asks students to analyze or synthesize information, a drill and practice program or reference material on a CD-ROM probably isn't going to match as well as concept mapping or database software.

eTIP 2: Technology use provides added value to teaching and learning.

Using technology to add value—meaning to make possible something that otherwise would be impossible or less viable to do—might mean that it helps to individualize instruction or make it more responsive to a student's questions and interests or provide additional resources of information so instruction is more real-world, authentic, and current. Educational technology can also aid teachers in providing "scaffolds" that support learners as they move from what they already know and can do to what they are learning. Educational technology can also help teachers to create social arrangements that support collaborative as well as independent learning by facilitating communication and interaction patterns. Teachers can also use educational technology to support additional opportunities for learners to practice, get feedback, or allow for revision or reflection; thus, it supports knowledge acquisition and practice, so learners become more fluent in their knowledge.

Educational technology can aid students accessing information or representing it in new ways. It can increase access to people, perspectives, or resources and to more current information. Many times, software's interface design allows learner interaction or presents information in a multi-sensory format. Hyperlinks can allow learners to easily connect to related information. Built-in indexes and key word searching support learners by easing their search through a large amount of information to find what is relevant. These features all add value by increasing access to data or the users' control during that access. In terms of processing information, added value might mean that the educational technology supports students learning-by-doing or aids them in constructing mental models, or making meaning, by scaffolding their thinking. For example, a database can allow students to compare, contrast, and categorize information through query features. By asking students to create products with tool software, it requires them to think more deeply about the material in order to represent it with that tool (Jonassen, 2000). Educational technology can also add value to students' ability to show and articulate to others about what they have learned.

eTIP 3: Technology assists in the assessment of the learning outcomes.

At times, teachers will want to collect and return to students formative data, to let them know about their learning progress. Some software or hardware actually collects formative data during its use, and some technologies also provide help in the analysis of the information. Generally, these are software programs designed to assess student learning, such as tutorial or drill and practice software. Some of these programs, through screens or printouts of information, or other feedback mechanisms, support student's self-assessment of their learning.

Teachers will also want to collect summative information about students' achievement of the learning outcomes. Technology can assist teachers in collecting both formative and summative data that will help them understand how students are meeting or have met the learning outcomes for that lesson or unit. Products students produce through software, whether a database, "mind map," multimedia or word-processed report, or a Web site, demonstrate what they have learned about both the content of their product, the procedural knowledge required to produce it, and their ability to communicate. The capabilities a product might demonstrate include the skills of editing, analysis, group collaboration, or the operation of the software itself.

School-Level eTIPs

Part of what makes teachers' integration activities feasible or not is the level of technology support at a school. The three school-wide principles elaborate upon the premise that the school environment must support teachers in a role of instructional designer by providing adequate technology support. The presence of high-quality technology support programs are correlated to teachers'

increased uses of educational technology (Dexter, Anderson & Ronnkvist, 2002). Thinking about the school-level principles while deciding whether or how to integrate technology can help a teacher to take an instructional design perspective while also taking the "technology ecology" of the setting into perspective. Together they will help teachers to evaluate the level of access and support available to them in their integration work, which may help to determine whether or not, given their amount of planning time, a particular integration goal is realistic.

eTIP 4: Ready access to supported, managed hardware/software resources is provided.

Teachers must have convenient and flexible access to and technical support for appropriate educational technology in order for them to utilize it in their classrooms. Perhaps of all the principles, this one is the most self-evident. Without available and working educational technology, it can hardly be utilized in a classroom. But, the two key words in this principle are ready and supported. Ready access means the technology should be close to where teachers need to use it and that it is scheduled flexibly, so that teachers have an opportunity to sign up for it when it is relevant for classroom work. Here, support specifically refers to technical support like troubleshooting help and scheduled maintenance. The idea of ready access should raise for the teacher questions about whether or not the students could be grouped together to work with the educational technology, if it could be a station through which students rotated, or if all students need to have simultaneous access to the educational technology. Ultimately, the access has to be practical. It must be ready enough that working through the logistics of providing students access to the technology does not outweigh the added value it provides.

eTIP 5: Professional development is targeted at successful technology integration.

Technology professional development is key to teachers' learning to integrate technology effectively into the classroom (CEO Forum, 1999). The learning needs can be thought of as being about1) learning to operate the software and, 2) learning to use software as an integrated, instructional tool. Too often teachers' learning opportunities are just about the operation of the software. This is necessary, but teachers must also have learning opportunities that address more than these basic skills. Specifically, these learning opportunities should guide teachers in the instructional design I have laid out in the three classroom educational technology integration principles. By having sufficient time to explore educational technology and have their technological imagination sparked by examples of it in use, teachers can identify which materials match their learning outcomes (eTIP #1). Professional development sessions should also provide frameworks or criteria that can aid a teacher in determining whether or not an educational technology resource brings any added value to teaching or learning (eTIP #2). Likewise, through examples and discussion, teachers should have opportunity to consider how educational technology might aid the formative or summative assessment of students' learning (eTIP #3)

eTIP 6: Professional community enhances technology integration and implementation.

This principle describes a professional collaborative environment for integrating and implementing technology. In such an environment, technology use would be more effective because the school organization would recognize the contribution individuals make to the collective knowledge of the school (Marks & Louis, 1999). And the entire staff would work toward consensus about the school's performance, in this case with technology, and how they could improve it (Marks & Louis, 1997). A collaborative professional community would serve as the vehicle for school-wide knowledge processing about technology integration and implementation, increasing the likelihood of reflective dialogue, sharing of instructional practices, and generally increasing collaboration on new practices.

FUTURE TRENDS

As educational technology and Internet access become ubiquitous in classrooms and new teachers headed into the classroom arrive from college already skilled in the operation of technology, it is likely that the emphasis of educational technologists will then be able to shift their research efforts to how best to develop teachers' instructional decision making about technology integration and implementation. This suggests that further research is needed about the schema of expert technology integrating teachers, and the key cognitive processes involved in designing and implementing effective technology integrated instruction. Future development efforts are needed in the area of developing instructional supports, such as cases and simulationsthat will aid novice integrators in developing the necessary knowledge and skills.

CONCLUSION

The research literature about teachers' instructional planning suggests that teacher educators working to develop K-12 educators' abilities to incorporate educational technology into the classroom should attend to the development of teachers' schema about technology integration and its implementation. By serving as a schema, or the basis of one, the educational technology integration and implementation principles (eTIPs) can help teachers recognize and plan for the effective technology use that is represented in the NETS-T and INTASC standards. The eTIPs point out two key aspects of teachers designing effective integrated instruction: the technology use must match and support teaching and learning, and the larger school environment must provide support for the logistical and learning demands technology integration puts on teachers.

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KEY TERMS

Added Value: traditional usage is as an indication that the particular packaging, delivery method, or combination

of services in a product brings extra benefits than one would otherwise receive. Applied to educational technology, it communicates that the use of technology brings added value to the teaching or learning processes when it makes possible something that otherwise would be impossible or less viable to do.

Principle: ideas that can assist learners in recognizing and connecting ideas and in seeing how new and old ideas relate.

Professional Community: collaborative activities among a school's faculty members that focus on meaningful, shared issues in a school and also emphasize how each individual staff member can take responsibility for its achievement.

Professional Development: the National Staff Development Council defines this as the term that educators use to describe the continuing education of teachers, administrators, and other school employees.

Schema: mental constructs that aid learners in categorizing problems or situations and selecting appropriate courses of action for their effective resolution.

Technology Implementation: the putting into place at a system level of a school the conditions that support the integration of technology at the classroom level.

Technology Integration: the use of technology in teaching to support learning.