Best Practices Research Summary

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Most instructional technology implementation efforts focus their efforts around a few key areas. In our experience, these areas most often are:

- Technology Integration into the Curriculum and Instructional Environment
- Technology Access/Infrastructure
- Technology Professional Development
- Technology Literacy and Standards

As a way of establishing what's possible or ideal in each of these areas, we find that it's useful to review how the relevant research describes "best practice". Concise summaries of the research that defines best practice is presented below. There is also a bibliography for the various reports and papers cited in each section.

Finally, working on the assumption that a picture is worth a thousand words (at least for visual learners), we have highlighted a few video clips from Edutopia (www.edutopia.org) that demonstrate how different educators have implemented elements of these best practices within their schools and districts. These videos clearly demonstrate another important fact associated with the implementation of "best practice" in any of these areas; and that is that there is not just "one way" of implementing any of these practices. Practically, any implementation effort - even those flagged as exemplary -- is at best a compromise between what could be and what needs to be as based on local instructional needs, priorities, and challenges. Therefore every implementation will look somewhat different. This is a fact that all strategic planners must take care to consider.

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Best Practice in Technology Integration

Technology integration must be driven by the goals of the curriculum and by an understanding of how students can best learn the content and concepts of the curriculum.

Studies have shown that, when integrated meaningfully into curriculum and instruction, technology can positively impact student learning and achievement. Decades of research has shown drill and practice programs to be effective in reinforcing basic skills and boosting student performance in specific areas. (Boster, Meyer, Roberto, & Inge 2002) Likewise, students using simulations and video footage can gain deeper and more flexible knowledge of mathematical and scientific concepts. More recently, research has shown that, when integrated into curriculum-based student-centered classroom activities, tools such as word processors, spreadsheets, databases, modeling and presentation software can promote the development of such 21st century skills as communication, collaboration, and analytical thinking.

Key to the success of any intervention is the matching of the appropriate tool to the task at hand. If, as mentioned above, a teacher's objective is raise test scores in a discrete area such as math facts, an appropriate tool would be one that offers opportunities to memorize and be drilled on those facts until secure. If instead the curriculum calls for conceptual understanding and the ability to apply principles of physics related to force and movement, an entirely different type of tool would best meet that need. Further, the impact of being able to place that tool in the hands of the student to manipulate, explore, and discover, will contrast sharply with the impact of that same tool used by a teacher to "present" information to a whole class of students.

"Meaningful integration" of technology, then, refers to the process of matching the most effective tool with the most effective pedagogy to achieve the learning goals of a particular lesson. Each tool brings different opportunities to the learning environment and involves a different set of skills on the part of teachers and students. Each can play a unique role in the learning process when used at the appropriate time, under the most appropriate learning conditions. It is simply the degree to which a particular technology's capabilities are matched to the expected learning outcomes and supported by appropriate pedagogy that will determine the impact that technology has on learning and achievement.

When considering the range of available technologies and their potential impacts on learning, an important distinction can be made between two categories of technology tools, "Type I" and "Type II". (Maddux, Johnson and Willis, 2001) With Type I applications, students essentially learn "from" the technology. The computer acts as a tutor and serves to increase students' basic skills and knowledge, as is the case in the drill and practice reference above. Type I technologies use can be effective in helping teachers present and students acquire basic factual knowledge. They can be easily incorporated or "added on " to traditional instruction, in a whole-class setting or through individual student computer use.

Alternatively, students and can learn "with" computers—where technology provides a flexible tool that can be applied to a variety of goals in the learning process and can promote the development higher order thinking, creativity and research skills (Reeves, 1999; Ringstaff & Kelley, 2002). Type II technologies are those that engage students in communication, hypothesis testing, and interactive information sharing, as is the case with many so-called "Web 2.0" applications. More common tools such as word processors, database and spreadsheet applications can be categorized as Type II tools also, when used in ways that involve personal engagement with authentic tasks.

Also sometimes referred to as "disruptive technologies" (Christiansen 1997) Type II applications, have proven to be powerful agents of change in the classroom when teachers learn to adapt their instructional practice to the design and capabilities of these "cognitive tools" (Jonasson & Reeve 1996). Matching the tool with the most effective pedagogy means shifting teachers' role from being providers of information to being providers of opportunities. Teachers must facilitate student exploration of ideas and questions in ways that engage them actively and centrally in their own learning. Type II technology-supported classrooms have the potential to become more learner-centered, and to promote engagement with subject matter in a way that is authentic and powerful.

One instructional model that has been shown to make particularly effective use of technology to facilitate technology-supported 21st century skill development is Project Based Learning. (Boss, S. & Krauss, J., 2007) Broadly defined as a systematic teaching method that engages students in developing knowledge and skills through an extended inquiry process structured around complex, authentic questions and carefully designed products and tasks, project based instruction presents significant challenges to most teachers and requires extensive professional development to be successful. (Wiske, Sick, and Wirsig, 2001). Implications for professional development will be discussed in greater detail in later sections of this report

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Best Practice in Technology Access

> The selection of technology tools must be driven by the goals of the curriculum and an understanding of effective pedagogy.

The technology infrastructure in a district or school provides the foundation upon which all educational and administrative technology efforts must rely. By virtue of its design and functionality, a school's infrastructure largely dictates what is and is not possible for teachers, students, administrators and parents to do with the equipment they have. Likewise, the number, type, location, and flexibility of technology tools in a school building will either enable or prevent the kinds of integral uses of technology that are described in the research on 21st century learning skills.

As discussed earlier in the section on technology integration, the selection of technology tools for a particular learning task must be driven by the goals of the curriculum and an understanding of effective pedagogy. A similar statement can be made about decisions related to technology infrastructure and access. If, for example, the science curriculum's lab activities call for outdoor/off-site data collection and real-time data analysis, then adequate numbers of laptops or handheld devices are what need to be planned for. Alternatively, if students need only to be able to type as a final stage of their writing, then a lab of desktop machines may suffice. If a large high school facility needs to be able to simultaneously stream video and allow students to access distance learning courses, then its network must support high bandwidth activities.

It is increasingly common to find reports and policy papers that espouse the use of particular technology tools and enumerate the resources that "should" be available in "21st Century Classrooms" (e.g., SETDA, 2009). Generally, the lists include high bandwidth connectivity, low ratios of students to computers, various multimedia tools, and a wide array of peripherals tools. Nevertheless, the evaluators contend that it is essential that all equipment and infrastructure decisions be driven by the specific learning goals of the school, district, and overall Territory rather than by a list put together outside of the district.

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Best Practice in Technology Professional Development

> Teachers who participate in regular, hands-on training that addresses important issues of curriculum and pedagogy in addition to the typical technical “how-tos” are those most likely to use technology in ways that promote higher order thinking in the classroom.

As discussed in the Technology Integration section above, integrating technology in meaningful ways involves matching instructional tools with curricular goals, desired student outcomes and instructional practice. Choosing the “right” tool for a learning task requires not only familiarity with the kinds of tools available, but also depends upon an understanding of *how* those tools can support the development of desired knowledge and skills. As with any tool selected for any purpose, the choice of what technology to use and how to use it must be guided by a set of beliefs---a vision-- for how learning is best supported.

Over the years, many studies have documented the pivotal role of technology professional development in enabling schools to realize the value of investments in technology. (Office of Technology Assessment, 1995; Coley, Cradler, & Engel, 1997; Silverstein et al., 2000; Sandholtz, 2001) Teachers who participate in regular, hands-on training that addresses important issues of curriculum and pedagogy in addition to the typical technical “how-tos” are those most likely to use technology in ways that promote higher order thinking in the classroom. (National Center for Education Statistics 1999). Likewise, schools whose professional development program regularly exposes teachers to new ideas and ways of teaching--*with or without technology*-- are those whose classrooms exhibit evidence of research-based best practice.

Introducing Type I technologies--those that replicate the role of the teacher or serve to support the existing instructional paradigm --can be achieved with relatively straightforward “how to” training in many cases. As add-ons to the traditional teaching process, these tools don’t “disrupt” or require changes in pedagogy for their use. Type II tools, on the other hand, bring challenges and exciting opportunities for moving classrooms toward becoming more learner-centered. As such, the need for professional development around the integration of these Type II tools is tremendous.

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A necessary first step for a professional development program aimed at integrating Type II technology is to provide teachers with a vision for the kinds of learning environments they are being encouraged to create. They must be provided opportunities to see reformed pedagogy "in action" and to develop their own understanding of the value that these new (often challenging and threatening) teaching methods can bring. (Linn, Slotta, & Baumgartner, 2000) Student-centered lessons and curriculum units must be provided as samples, and the teaching of those units modeled for teachers. To be successful, technology professional development must equip teachers with the knowledge and skills to be be able to:

- Address curricular objectives in a student-centered manner
- Develop essential questions for inquiry
- Assign develop projects that fit instructional objectives, whether or not there is any technology involved.
- Facilitate team learning, provide effective feedback to students, address unexpected questions, adjust timelines in the midst of projects
- Relate students' own ideas and perspectives to curricular content

Needless to say, changing teacher pedagogy and beliefs about learning requires a sustained commitment on the part of administrators as well as from the teachers themselves. In many cases, traditional didactic forms of instruction have remained the norm in schools even after extensive professional development, primarily because of the many and varied demands on staff. (Means and Olson 1995) Recognizing the scope of the challenge associated with transforming classrooms is essential to this endeavor if technology is truly to be integrated into curriculum in ways that meaningfully impact student learning and achievement.

Best Practice in Technology Literacy and Standards

> Integration of technology skills and content area learning are at the heart of the latest revision of the ISTE-NETS standards for students.

Meeting curricular goals through authentic, student centered learning activities presents many challenges to traditional instruction. Teaching students proper and effective use of technology tools in that context can be even more difficult. Current studies suggest, however, that it is in combining the elements of reformed pedagogy and the appropriate integration of technology that students can gain valuable 21st century learning skills. (Partnership for 21st Century Schools, 2009)

Essential to the development of "technology literacy" is the ability of teachers to embed technology use into students' regular classroom work. "Computer class", where students learn to type or learn their way around the basic components of a computer is, in fact, antithetical to the way that research suggests developing students' 21st century skills. No longer must technology be a course unto itself, or be "taught" by someone other than the classroom teacher. Instead, technology use must be driven by the goals of the curriculum (be they content, concept, or skills) and must be employed by students in ways that allow for exploration, discovery and the development of understanding. As students use technology to analyze information, collaborate with peers, communicate their knowledge, and create projects, they are developing technology proficiency as part of their overall education. Integration of technology skills and content area learning are at the heart of the latest revision of the ISTE-NETS standards for students.

In recent years, in response to the creation of technology literacy standards and the NCLB mandate that all students be technology literate by the end of grade 8 (in 2012), a wide array of "solutions" have been put forth by the education technology industry. In some cases, the individualized learning system (ILS) approach has been applied to the task of teaching students the "how-to" of computer use. In other cases, entire curricula have sprung up that purport to "teach technology literacy" through achievement of framework based content. Here, the evaluators advise caution with respect to purchasing such a "solution" designed to be implemented in a lab by a computer teacher. This model truly contradicts the recommendation that teachers learn to create student-centered classroom environments that engage students actively in the development of learning, thinking, and real-world technology skills that will serve them as 21st century citizens.

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Bibliography

Boss, Suzie & Krauss, Jane (2007) *Reinventing Project-Based Learning: Your Field Guide to Real-World Projects in the Digital Age* ISTE

Boster, F.J., Meyer,G.S., Roberto, A.J., & Inge, C.C. (2002) *A Report of the Effect of United Streaming Application on Educational Performance*

ChanLin, Lih-Juan (2008) *Technology Integration Applied to Project-Based Learning in Science*

Christiansen, C. (1997) *The innovator's dilemma* Boston: Harvard Business School Press

Evaluation of the Enhancing Education Through Technology Program: Final Report (2009) U.S. Department of Education

Gooden, A. R. (1996). Computers in the classroom: How teachers and students are using technology to transform learning. San Francisco: Apple Press/Jossey-Bass

Jonassen, D. H. (1996) *Computers in the Classroom: Mindtools for Critical Thinking*. Englewood Cliffs, NJ: Prentice-Hall.

Kemker, Kate (2005) *The Digital Learning Environment: What the Research Tells Us* Bureau of School Improvement in the Florida Department of Education/ Apple Computer

Leveraging Title I & Title IID Partnerships: Maximizing the Impact of Technology in Education: A Resource Guide Identifying Technology Tools in Schools (2009) SETDA

MacKenzie, Jamie (2003) *Pedagogy Does Matter!* The Educational Technology Journal

Maddux, Cleborne and Johnson, D. La Mont *"Type II Applications of Information Technology in Education: The Next Revolution,"* Computers in the Schools 23(1/2) (2006).

Professional Development for the 21st Century, (2009) Partnership for 21st century schools http://www.21stcenturyskills.org

Reeves, T. C. (1999). *A research agenda for interactive learning in the new millennium* (ED-MEDIA 99 Keynote Address Paper).

Research Summary: Technology and Pedagogy National Middle School Association (September 2007)

Ringstaff, Cathy, & Kelley, Loretta (2002) *The Learning Return on Our Technology Investment: A Review of Findings from Research* West Ed

Summary of Project-Based Learning (2009) University of Indianapolis, Center of Excellence in Leadership of Learning

***Technology in schools: Suggestions, tools, and guidelines for assessing technology in elementary and secondary education*.** (2002) National Center for Education Statistics Washington, D.C

Twentyfirst Century Skills (2003) Metiri Group / The North Central Regional Educational Laboratory http://enGauge.ncrel.org and www.metiri.com

Wiske, M. S., Sick, M., & Wirsig, S. (2001*). **New technologies to support teaching for understanding.*** International Journal of Educational Research, 35(5), 483-501.

Best Practice Videos

Integration

Turning on Technology: Using Today's Tools to Study Yesterday's

A field trip from Ferryway School, near Boston, to the nation's oldest ironworks is captured with the latest tech.

Learning Landscape: Kids Monitor Terrain with Tech

Students at this Minnesota elementary school use new technology to study the ancient ecology of a vast prairie wetland.

A Product of Learning: Representing Their Work Through Tech

A school uses technology to help provide top-of-the-line education for all students.
YES Prep Demonstrates Successful Team Teaching

In middle school, teachers pair up in the classroom to integrate their subjects.

Transformed by Technology: High Tech High Overview

A network of K-12 public charter schools uses rigorous projects and portfolio assessments to revolutionize learning.

Common Sense: An Overview of Integrated Studies

More collaboration, critical thinking, and knowledge retention are the fruits of an integrated curriculum.

Access

Mary Scroggs Elementary School: A Wired Education

Computers and multimedia are seamlessly woven into the curriculum at Mary Scroggs Elementary School.

Professional Development

Teacher Support: A Culture of Professional Development

Sherman Oaks Community Charter School, in San Jose, California, provides an unusual amount of support for its faculty, including 90 minutes of collaborative planning time each day.

YES Prep Demonstrates Successful Team Teaching

In middle school, teachers pair up in the classroom to integrate their subjects.

An Introduction to Teacher Development

New models for preparing educators in training focus on practical tips and feedback.

Technology Literacy and Standards

Much of the literature on technology-supported curriculum is interwoven with the issues of technology literacy and standards. In particular, the video above (Turning on Technology: Using Today's Tools to Study Yesterday's) addresses ISTE NETS-S.

The ISTE website (http://www.iste.org) can provide additional examples.

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