Background Paper
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I. Framework for the Technology Expert Panel

Background

As the country strides toward the 21^{st} century, and the nation seeks to assure educational success for all students, it is clear that methods must be established to identify educational programs that work. The Educational Research, Development, and Improvement Act of 1994 charged the Assistant Secretary of the Office of Educational Research and Improvement with the establishment of panels of appropriate qualified experts and practitioners to identify, evaluate, and recommend promising and exemplary educational programs to the Secretary. Two pilot panels have been established, one in mathematics and science and one on gender equity. Due to the high level of national interest in their topics, three additional panels have been authorized: one on early reading; one on safe, disciplined, and drug-free schools; and this panel on educational technology.

Unlike the panels on math and science, which had nationally agreed upon content standards to guide them in developing criteria for determining promising and exemplary practices, the Technology Expert Panel does not have comparable, nationally recognized curriculum standards on which to build their recommendations. Recently, the International Society for Technology in Education published a document describing a set of National Educational Technology Standards (NETS) for Students. The NETS document outlines a set of technology foundation standards for students, divided into six broad categories (basic operations and concepts; social, ethical, and human issues; technology productivity tools; technology communications tools; technology research tools; and technology problem-solving and decision-making tools). These proposed standards provide an important starting point in helping educators plan for technology-based learning activities, but they are only the first step in what may be a long and possibly difficult process of developing national consensus. Other documents still under development in the three-year NETS project will propose standards for technology in learning and teaching; educational technology support standards, and technology assessment and evaluation standards. Furthermore, because the current NETS foundation standards cross traditional curricular and grade levels boundaries, they may be of more limited value to the expert panel on technology than were the NCTM and NSTA standards in guiding the work of the math and science expert panels.

Since the task of the Educational Technology Panel will be more open-ended and conceptually challenging than that faced by other panels, the Department convened a Technology Resource Group to provide suggestions regarding the establishment of the Technology Expert Panel. Their suggestions, along with a brief overview of research on technology effectiveness, form the basis of this paper. The paper describes the role and functions of the Technology Expert Panel, key issues for them to consider, and some lessons learned from past research on technology. It then presents suggested criteria for selection of promising and exemplary practices, with possible metrics and impacts that could be considered. While the paper has been reviewed by some of the members of the Technology Resource Group, as well as staff from the U.S. Department of Education, the views expressed are those of the authors. Furthermore, it should be noted that this paper is not intended to set the guidelines for establishing effective and promising practices; that is the work of the Expert Panel. Rather, this paper is intended to serve as a background paper to assist the Technology Expert Panel as they begin their work.

Technology Resource Group

A broad-based group representing educational organizations, associations, federal agencies, and learning institutions of all levels were invited to assist the Department of Education in planning for the Technology Expert Panel. This Resource Group met on June 16, 1998 and provided suggestions regarding key issues to consider when identifying promising and exemplary programs in educational technology. In addition, they offered a number of suggestions on ways the Department could structure the Expert Panel in order to make it most effective. A list of the resource group members is attached in Appendix A.

Responsibilities of the Technology Expert Panel

The Technology Expert Panel, selected by the Assistant Secretary for OERI, should represent the full range of stakeholders in the educational community, including teachers, administrators, higher education representatives, members of the business and foundation community, elected officials and community members. The panel will serve as a policy-making review board to establish and oversee a valid and viable process and an effective and workable set of procedures for identifying and designating promising and exemplary programs in the area of technology. This process should help educational practitioners in making informed decisions in their efforts to simultaneously apply new technologies while staying cognizant of the new research findings in this complex and evolving field. The tasks of the Panel can be divided into two phases, development and implementation.

Development

The panel will set the overall direction for the program review process as required by the guidelines of the authorizing legislation. They will establish procedures for soliciting submissions, and establish criteria, definitions, and rubrics for designating programs as promising or exemplary. They will create the review processes, and select and train reviewers.

Implementation

The panel will be responsible for overseeing the entire program, revising the review process as necessary. The panelists will also help ensure the success of the program by encouraging developers to submit their programs for review. The panel will analyze the recommendations of the reviewers and recommend to the Secretary of Education those programs designated as promising or exemplary.

Technology Program Reviewers

Approximately 30-40 reviewers will be selected from experts in the fields of education, technology, and evaluation. The Technology Expert Panel will train them in the rubrics, evaluation criteria and review procedures they have established. The reviewers will evaluate program submissions based on these criteria, discuss their individual ratings with other members of the review team in order to ensure an even review process, and present the final ratings to the Expert Panel.

II. Key Issues

The Technology Resource Group discussed some underlying issues which need to be considered by the Expert Panel as they consider the frameworks for developing definitions and measures of promising and exemplary programs. These questions, and suggestions regarding possible ways of dealing with them, are briefly reviewed below.

How will technology be defined?

The Expert Panel will need to come to a consensus on what they consider to be "technology", and whether they will use the generic term "technology" or specify "educational technology", "instructional technology", "communications technology", "learning technology" or some other preferred term. A review of several recent national reports shows a preference for the term "educational technology" or just "technology". The term has been defined in a variety of ways, including three noted below.

For its 1995 report to Congress on *Teachers and Technology*, the Office of Technology Assessment used the term "technology" to refer to:

Ö all forms of computers and their peripherals including hard disk drives, printers, CD-ROM, projection devices and networks offering telecommunication linkages. It also refers to a range of other new or more traditional technologies: telephones, video cameras, televisions and VCRs, fax machines, videodisks, cable and other one-and two-way links, small devices like electronic calculators, personal digital assistants and other hand-held devices, or combinations of these and other new technologies.(p.4)

The Illinois State Board of Education took a more poetic approach for their K-12 Information Technology Plan (1996):

Technology is the combination of human imagination, inventiveness, and the electronic tools that transform ideas into reality. (p.5)

As a third example, in their CD on "The Research on Technology for Learning", the North Central Regional Educational Lab defined "technology" and "technology application" as follows:

... we use the word "technology" to identify electronic tools that help people work faster and/or better by helping them create, store, and access information and interact with others in dynamic ways. For the most part, these tools use a computer co-processor in some aspect of their operation. Therefore, when we use the term "technology" we are referring to the computer and its ancillary components and tools that utilize computer applications in many ways. The term "technology application" refers to computer software or any operational tool that interfaces with the computer.

The Expert Panel will need to create or select a definition they find most closely matches their views.

How can effectiveness be determined when views of effective technology use change as technologies themselves change?

Technology--both the hardware and software applications--changes so quickly that it is hard to create one definition of what constitutes effective use in an educational setting. A persistent challenge for educators has been simply keeping up with the changing messages of what we believe is important for students to learn and for teachers to teach about and with technology.

For example, when computers were first introduced in schools, the prevailing wisdom around effective use of technology was that students should learn how to program computers in BASIC, both as a means of developing an understanding of how computers worked and because there was so little educational software available. Not long thereafter, however, LOGO was promoted as a computer language that was more appropriate for children because it was seen as a tool for thinking. Then, as drill and practice software packages were developed for a range of content areas, whether in stand- alone or integrated content packages, educators were encouraged to use these to individualize instruction and help students bring up their test scores, especially in basic skills. But then focus shifted to helping students learn tools that they will use in the outside world, such as spreadsheets, word processing, and databases. Soon specialized tools including science probes, specialized educational databases, timelines, and other classroom based resources began to be promoted. With the advent of rich multimedia and hypertext applications, students were encouraged to learn these so they could create products for an audience. Now the

Internet and website-based learning are seen as the most powerful instructional vehicles technology can offer.

While there may be some logic to this progression, the reality is that, just as educators get their arms around another approach, with the attendant investments in software, training and possible curricular readjustments, the messages about appropriate technology change.

The key point is that effective educational technology programs are not tied to one technology or method; they must be allowed to evolve as technology changes. Dwyer (1997) points out the challenge succinctly:

> *We look with envy at educational innovators of the past; for example, those who introduced McGuffey Eclectic Readers to the classrooms in the 1800s. Their task was somehow easier because book-based information technology evolved in the mid-15th century and had been virtually unchanged for hundreds of years. Now, we are engaged with an information technology that reinvents itself with startling rapidity.*

The panel will need to be flexible in their planning, and take an approach that recognizes the evolution of technological applications. Ideally, the questions addressed will be open-ended enough to deal with changing goals and opportunities for technology usage.

Does there need to be a separate panel on technology? Isn't technology's value as a facilitator for content learning?

The Expert Panel should not look at technology in isolation; rather, the focus will need to be on its use as a facilitator for learning in a range of curricular areas. Nonetheless, the resource group came to the conclusion that technology is not yet "invisible" enough, that is, not so naturally applied to teaching and learning, that its appropriate role is so obvious that it can fade into the background. Billions of dollars have been spent on educational technology over the last decade, but the public needs a clearer vision of what uses are most valuable, for what kinds of educational needs and populations and under what conditions. If the education community does not do a better job of articulating this, by making explicit what works and why, future funding could well come to an end as calls are made for a return to "traditional teaching". By designating certain programs and activities as promising and exemplary, the panel will play an important role in suggesting models others can adopt, places to visit, and resources to consider in gaining insight into appropriate policies and expenditures.

Although it is important for students in the information age to know "about" technology, and to be comfortable in using whatever technologies are appropriate for the tasks they find, this does not mean that technology is an end in itself. It is a means to a variety of ends, and some forms of learning are increasingly only possible with technology. Clearly, technology should fit the project, rather than be imposed from the outside because it's available, or some other techno-centric approach. Nonetheless, the role of technology in making it possible to meet learning goals must be made explicit. One technology planner (See, 1997) put it this way:

> *Effective technology plans focus on applications, not technology.* ***.*** *In other words, make your technology plan outcome-based, not input-based. Develop a plan that specifies what students, staff, and administration should be able to do with technology and let those*

outcomes determine the types and amount of technology your plan requests.

Despite the need to spotlight technology's role in a project's effectiveness, a project shouldn't be evaluated by how much technology it uses or teaches. An effective project will use technology as much or as little is needed to enhance the learning process via technology. As suggested by the Carnegie Commission on Higher Education (1995):

> *Technology should be the servant and not the master of instruction. It should not be adopted merely because it exists, or because an institution fears that it will be left behind the parade of progress without it. We also believe that sophisticated technology is not to be equated with saturation. In some courses, the use of technology may be appropriate for a few hours in an entire term. In a few, technology may be constructively used for two-thirds of the hours allotted for a term of instruction; in a very few, it may take over the entire process.*

What is the appropriate level of analysis: students, teachers, school, district, community, or state?

Just as there is no one definition of effectiveness, there is no one appropriate level of analysis. Some projects may be better suited to a single school or district for implementation. Other projects may be designed to work over a larger target audience, or a very specific student group. The scope of a project does not define its effectiveness; the project needs to be effective within its target. As discussed by the Technology Resource Group, separate levels of analysis may need to be identified and each proposal analyzed at the proper level. In some cases, projects may demonstrate different kinds of measures for students, classroom organization, teacher style, and school-level change.

The resource group suggested that the unit of analysis should be broadly defined if the goal is to recognize interventions that are sustained and sustainable, and have the potential to transform learning in a significant manner. (See the section below on criteria). For example, if individual programs are identified, they could have multiple models for implementation.

What's more important: outcomes or process?

The endpoint of a project should not be the sole subject of the analysis. While learner outcomes are critical, some of these (e.g. greater enrollments in advanced placement or high level classes; impacts on graduation, employment, college or graduate study enrollments; even test scores) may take many years to show up. Therefore, evidence of movement and progression towards goals should be valued.

Many of the technology projects the resource group considered to be the most successful have evolved over a long period of time. Simultaneously learning new technology, designing new lesson plans using the technology, and teaching the new lesson in the classroom over a short period of time are virtually impossible. Educators need time to evolve with a project as their technical fluency and comfort level rise. The opportunity to label some projects as promising, while the data has time to accumulate, may help in dealing with this issue of documenting success over the long-term. Becker (1998) noted:

> *It takes time for teachers to master computer-based practices and approaches. The Sheingold and Hadley survey shows at least 5-6 years. Teachers who have had students use computer software in a substantial way for several years are the same teachers who are most apt to report that their teaching practice has changed substantially.*

What is the distinction between " Promising" and " Exemplary" programs and practices?

The Expert Panel must establish, for the review process, criteria for judging a project as promising or as exemplary. As noted above, programs that are moving forward but still in the process of accumulating research data might be considered for the promising designation. In its simplest form, a promising program may not meet all of the rigorous tests that are required of an exemplary program. It may meet a large number of them, or it may use a unique approach to the incorporation of technology and education. A promising project should, however, be expected to transition to an exemplary project within a fixed time period.

Due to the nature of this panel, it is quite possible that initially there will be more promising projects than exemplary ones. Since technology has been evolving so quickly, identifying a greater number of promising projects may encourage more organizations, districts, and teachers to become involved with the integration of technology and education by putting a spotlight on "works in progress" as models to emulate.

III. Lessons Learned from Previous Projects

The list of research studies on individual projects, large scale interventions, and meta-analyses on technology effectiveness is vast; a full analysis of this material is far beyond the scope of this paper. (See Appendix B and Bibliography for a partial list of resources). For the purpose of providing guidance to the Expert Panel, lessons taken from a small selection of the most significant and widely recognized of these are reviewed briefly below. These projects have already resulted in some important conclusions that need to be considered by the Expert Panel.

Technology in support of school reform goals

In a national study of technology's role in education reform, in which case studies of nine schools or projects using technology as a part of their reform efforts, Means and Olson (1995) found impacts related to content, student motivation and self-esteem, use of time, school structure, and changes in teacher roles. These findings also reflect outcomes found in the Apple Classrooms of Tomorrow and other long-term studies. While not all technology projects are developed or applied with a conscious eye to school reform, we suggest that any activity given the promising or exemplary designation by the Panel would go beyond "business as usual" and focus instead on supporting school reform goals. Some of the impacts of technology on school reform are noted below and form a useful list for considering factors that promising and exemplary programs should demonstrate.

Impacts on curricular change

In these cases, technology was not used to teach the same material as before. Technology was used as a stepladder to help the students learn material that was not previously thought reachable. In their research, Means and Olson (April, 1995) reported:

> *Teachers reported that use of software tools enabled students to go farther than previous classes had without technology in a whole variety of curriculum areas... Subthemes in the area of higher-quality work are that technology increases use of outside information sources and prompts both greater consideration of multiple perspectives and an improved understanding of audience needs. Perhaps as a result of these effects, teachers felt that use of technology enhances creativity, improves design skills and the ability to present information well, and promotes better oral communication skills.(pp.6-7)*

Technology created opportunities for students to do meaningful work. The projects were designed to connect curricula studies to the "real" world. The teachers no longer needed to frame a question in such a manner that it fit the classroom setting. The questions could be more broad since technology facilitates the learning process by providing extra resources, scaffolding where help is needed, and providing new ways of organizing and displaying content and concepts.

> *When classroom activities are structured around long-term projects with an authentic purpose, the value of the project tasks is apparent, students are challenged by more complex content, and the so-called basic skills are dealt with in context, providing a motivation for mastering the mechanics of writing, computation, and so on... Our observations across sites provided opportunities to see the difference between learning skills and engaging in technology use as isolated academic tasks and addressing those same skills in the context of meaningful projects. Tasks that were grounded in activities that were challenging and made sense to students elicited a much greater level of student interest and understanding, as well as higher self-imposed standards for quality (Means & Olson, April 1995, pp. 1-2).*

Impacts on teacher and student roles

The roles of teachers, and, symbiotically, those of their students, changed. Teachers encouraged their students take a more leading role in their own education. In his study, Becker (1998) found that teachers became "skilled in managing multiple simultaneous activities during teaching." Dwyer (1994) noted that "Teachers reported and were observed to interact differently with students - more as guides or mentors and less like lecturers."

Technology changes so fast that the teachers had to work not only to teach the classroom material but also to investigate and learn how to use new technology tools and then bring them into the classroom. However, it was not necessary that a teacher become an expert on a technology before using it. Students were amazingly adept at learning quickly, without a significant amount of guidance, if they were interested in the project and/or technology. In projects like *Generation WHY* students have been specifically trained and assigned to become technology resource guides for teachers.

Impacts on classroom environment

Researchers found that the nature of the classroom changed. Sheingold and Hadley (1990) observed that classrooms became more investigatory, and students were called upon to take on learning tasks requiring more higher order thinking. Cooperative skills were also emphasized. Unlike some people feared, the computer did not cause people to work separately; the reverse actually occurred. The computer facilitated the exchange of information and ideas, since they could be accomplished via a file transfer. Students were more apt to share their work and a more social environment actually arose. Means and Olson (1995) noted in their study that in 13 of 17 case studies, teachers described an increase in collaboration and more peer teaching among their students.

Impacts on student motivation

Motivation is a central part of the learning process, and technology's impact on student motivation should not be undervalued. In study after study, enhanced motivation is listed as one of the most promising impacts of technology use. For example, in Means and Olson's case studies of 17 teachers, 16 of the 17 teachers reported that technology increased their students' motivation level, 11 said they had observed increased self-esteem, and 5 talked about improved classroom behavior. Mastering technology-based tasks, which students know are valued in society, had a positive impact on both teachers and students, as one teacher in the study noted:

> *I see more confidence in the kids here...I think it's not just computers; it's a multitude of things, but they can do things on the computers that most of their parents can't do and that's very empowering and exciting for them. It's "I can sit down and make this machine pretty much do what I want to" and there's something about that that gives them an extra little boost of "Wow, I'm a pretty special person." Elementary school teacher, (Means and Olson, April 1995, p. 10).*

Impacts when support is sustained over time

The Apple Classrooms of Tomorrow (ACOT) research team described the results of their ten-year study in a final report "Changing the Conversation about Teaching Learning and Technology. A Report on 10 Years of ACOT Research". The Expert Panel might consider the ACOT findings as guideposts in framing their expectations for exemplary and promising projects:

http://www.research.apple.com/go/acot/PDF/10yr.pdf

- Test scores indicated that, despite time spent learning to use the technology, students were performing well-and some were clearly performing better
- The students wrote more, more effectively, and with greater fluidity
- Some classes finished whole units of study far more quickly than in past years.
- Access to technology actually encouraged them to collaborate more than in traditional classrooms.
- Technology was becoming more interesting to students as they began using it for creating and communicating.
- Students became socially aware and more confident.

- Students communicated effectively about complex processes.
- Students started using technology routinely and appropriately.
- Students became independent learners and self-starters.
- Students worked well collaboratively.

IV. Criteria for Selection of Promising and Exemplary Practices

The Federal Regulations for designation of exemplary and promising programs list four criteria for determining whether an education program should be recommended as exemplary, promising, or neither. These are evidence of success, quality of the program, educational significance, and replicability. While the Expert Panel on Technology must use these four general criteria as the basis for judgments, additional specific criteria and indicators within each of these headings can be developed, and the process of evaluation can be handled in a manner of the Expert Panel's choosing. For example, the Expert Panel on Mathematics and Science organized these evaluation criteria for mathematics programs into three categories to be evaluated by Quality Review Panels; these were labeled quality of program, usefulness to others, and educational significance. The fourth criteria, evidence of effectiveness and success, will be evaluated by an Impact Review Panel comprised on experts in evaluation design and analysis. Within these four areas, eight specific criteria, each with several specific indicators, were developed.

Our review of lessons learned from past technology studies suggests considerations to be taken into account within each of the four evaluation criteria found in the Federal Regulations. We present these as food for thought as the panel develops their specific criteria, indicators, and procedures.

Quality of Program

What is the intellectual substance of the program? Does it support content standards in the curriculum areas in which it is applied? Does it focus on challenging learning goals? What audiences is it appropriate for and under what conditions? Does it support authentic learning and problem solving in a context that is meaningful to the intended student audience? Is is based upon the latest research in the content area and draw upon experts in the field? Does it encourage depth of understanding, allowing students to "grow with it" according to their level of prior expertise? Is it free of bias and stereotyping of any kind?

Significance

As discussed above, to be eligible for selection, projects and activities should use technology in a way that goes beyond automating existing practices. While technology can make it possible to do things faster, easier, with more "pizzazz", and even more cheaply in some cases, any one of these factors alone is not enough to make an application rise to the level of significance suggested by the resource group. Ideally, several of these factors should be demonstrated in a practice; even better are those activities that go beyond what is today's usage and make it possible to do entirely new things in the classroom that would not have been possible or feasible without the use of technology. While this is often a subtle distinction, it gets at the essence of the kinds of factors noted in the section above describing impacts of technology in support of school reform goals--that is, significantly changing classroom practice and interactions through the use of technology.

Replicability (and Sustainability)

A project or practice that is unique to a particular teacher or setting, while interesting, will not have the impact of one that could be used by any teacher or school, under the right conditions. These conditions, (e.g. training, resources, and time) should be specified and appear reasonable for other sites considering adoption of the program or activity.

The question of sustainability might also be considered under the replicability criterion. That is, is what is demonstrated in the application something that sets up a framework that would last beyond a particular teacher or principal’s support if that individual were to leave the school? Identified projects and activities should show evidence that they have or will become institutionalized as a new way of doing business in that school. If originally funded by outside resources, has a program provided enough promise (for promising identification) or evidence (for an exemplary designation) to move forward under local or community support?

Evidence of success

In considering metrics and impacts, multiple metrics are preferable to single measures, and both qualitative and quantitative measures should be valued. These might include:

- surveys and case studies of teachers' reports of changes in student behavior and classroom management
- similar reports from administrators on observations of teacher behavior, classroom and school environment
- reports from parents on observed changes in their children
- collections of student products and portfolios documenting change
- video records of student activity and classroom environment, and, of course
- grade cards and standardized test scores

Determining how these multiple and varied measures are correlated, validated, and equated will be a task for the evaluation and measurement specialists advising the Expert Panel. The assessment measure should be appropriate for the learning activity. For example, when assessing the impact of computers on improving writing skills, it makes no sense to conduct the test in a multiple choice pencil and paper format. (See, for example, http://olam.edu.asu.edu/epaa). Clearly, the assessment format is as important as its content.

The following outcomes are suggested as examples of the kinds of impacts the Expert Panel might consider in designating promising and exemplary practices . While not all of these are necessary in any one project, many of these outcomes have been found in what have been considered promising technology facilitated projects in the past, as described in section II above.

Is complex content mastered earlier in the curriculum by a broader range of learners?

This would be indicated by, for example, mastery of algebra, geometry, or calculus concepts earlier in the mathematics curriculum; earlier and deeper mastery of foreign language skills; or an increase in the specialized technological skills acquired by the students.

Are groups bypassed by traditional teaching approaches thriving under this activity or practice?

These groups might include low achievers, students with limited English proficiency, special education students, those with learning disabilities, gifted and talented students, or students with behavior problems.

Does the project make it possible for students to master material or develop skills that might not otherwise be taught (or understood) through traditional teaching methods?

Evidence for this could include such activities as systems thinking, computational science, research design and defense in a public forum, and working with abstract concepts and symbolic thinking.

What achievement gains can be documented?

These could be indicated by such measures as higher test scores, greater enrollment in advanced courses and a larger percentage of students going on to college.

Has the technology impacted students' attitudes and motivation?

Do they spend more time on task? Is their attendance better? Do they concentrate more in class and show a heightened interest in the material? Have discipline problems decreased? Do students work better with students from other social or ethnic groups? Do they demonstrate new or greater leadership and cooperative skills?

How has the project impacted teachers' teaching styles?

Assignments may become longer or more complex. Lesson plans may become more thematic and interdisciplinary in content, with assignments linked to activities outside the classroom. Teachers might show evidence of new or greater use of inquiry tasks requiring a depth of analysis not evident in earlier student work. They may encourage more use of collaborative learning, student independence and initiative . Teachers might demonstrate greater reflection on their teaching style and how it effects their students’ learning.

What are the personal and professional impacts on teachers?

These might include such indicators as greater retention of good teachers by a school system, or a higher percentage of teachers applying for and meeting the standards of the National Board of Teaching Standards. Do teachers demonstrate increased involvement in professional activities and make presentations at conferences? Are their teaching materials used by other teachers locally or virtually? Are they receiving professional recognition outside the school?

What are the impacts on the school environment?

Examples might include such outcomes as greater collaboration among teachers or changes in the allocation of time and resources within the school. Schools might exhibit greater involvement with reform and research organizations or improved links with higher education institutions.

Are there indicators of improved school/community interactions?

These might include such indicators as improved parental involvement (more parents involved from all sectors of the school community) and greater business involvement (contributions of time, personnel, expertise, equipment and/or expertise). Another indication could be evidence of developing collaborative relationships (summer, part-time, or graduate hiring or internships) among students and teachers with local businesses and industries. Projects might demonstrate that they provide valued service to the community in a variety of ways.

V. Conclusion

The challenges to the Expert Panel are many. To summarize several noted in this paper:

- Technology is constantly changing and the criteria must be designed to take this into account.
- Effective technology use focuses on the problem to be solved or the learning that is required, not on the technology itself. Nevertheless, the technology use must be a key element in the change if a practice is to be deemed promising or exemplary by the panel.
- Process is as important as outcomes, and must be documented as a part of consideration of the sustainability and replicability of the program or practice.
- Multiple metrics and impacts will need to be considered as evidence of success. Many of these have not been valued in the past as appropriate assessment measures.

Clearly, the Technology Expert Panel is faced with an open-ended, complex task. There are no hard and fast rules for judging technology effectiveness. Technology is changing so quickly that it is making old styles of teaching and learning, as well as assessment, out-dated. Nonetheless, it is also providing an opportunity for educators to continually re-evaluate and refine current methods.

The panel needs to establish criteria for judging exemplary and promising practices that allow the flexibility to identify and spotlight projects that may not fit previous modes of thinking about what constitutes successful teaching, learning, and school activities. In the process of this quest, the Expert Panel will advance the state of our understanding of the links between technology and learning. We wish them well in this important, challenging endeavor.

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http://www.spa.org

TERC

http://terc.edu

U.S. Department of Education

Benefits of Technology Use

http://www.ed.gov/Technology/Plan/NatTechPlan/benefits.html

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APPENDIX B

List of Suggessted Reading on Effectiveness of Technology

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