Rethinking Professional Development Approaches in the Digital Age:
What Does it Mean to "Teach 21st Century Skills with Technology?"
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April, 2006

Paper to be presented at the Annual Meeting of the American Educational Research Association, San Francisco, California, April 8, 2006.

With the increased use of Information Communication Technology (ICT) in both the education and business markets comes the need to ensure that students are prepared to be literate consumers and producers of this pervasive flow of information. Teachers are positioned as the ones responsible for making certain their students become ICT literate and are prepared with 21st century skills in order to function as responsible global citizens (Partnership for 21st Century Skills, 2003). However, many teachers are not yet to get up to speed on how best to teach with ICT, indicating that professional development models need to build teachers' pedagogical and content knowledge, while tapping into the affordances offered by these technologies.

Educational leaders acknowledge that new skills are necessary for students to be successful in the digital age, yet these skills are neither clearly defined nor part of learning standards or assessments (Burkhardt et al., 2003), which leaves the "21st century skills" abstract and not specifically tied to core content or learning activities. Therefore, educators face the challenge of how to move from abstract concepts associated with these skills to the creation and implementation of learning activities in the classroom that support subject-specific content.

This paper will pose a series of questions and postulate answers based on lessons learned from the ongoing development of a large-scale professional development program, and evidence gathered from the formative evaluation of this program. Drawing on our knowledge of this program, we pose the following questions: What do teachers need to know to teach 21st century skills with technology? What experiences are they likely to need to be prepared to foster these skills in their students' work? How can these skills be taught in the context of core content?

This paper will summarize findings from this formative evaluation and discuss the opportunities and challenges teacher-trainers identify when they seek to follow up on the ideas they are exposed to in this professional development program. This Workshop, created by the Intel® Innovation in Education program, helps K-12 teachers teach their students higher-order thinking skills while integrating technology into the classroom. The three tools featured in the Workshops include: *Seeing Reason*, which focuses on causal reasoning; *Visual Ranking,* which focuses on prioritizing information, exploring

perspectives, and building consensus; and *Showing Evidence*, which focuses on generating claims and evidence to support or refute arguments. The goal of these Workshops is to help teachers use these tools to cultivate their students' 21st century skills across grade levels and content areas.

The Workshops offer an interesting model for both effective professional development experiences for teachers and for addressing a challenging domain of student learning, particularly as educators are increasingly under pressure to provide quality instruction that is aligned to core content standards but also incorporates 21st century skills.

Theoretical Framework

According to the Partnership for 21st Century Skills (2003), there is a "profound gap between the knowledge and skills most students learn in school and the knowledge and skills they need in typical 21st century communities and workplaces" (p. 5). The Partnership for 21st Century Skills, a group of education and business organizations committed to improve learning in K-12 schools, has defined three broad categories of learning skills that are essential for students' success in the 21st century workplace: Information and communication, thinking and problem-solving, and interpersonal and self-directional. The Partnership's vision for education is to build upon the efforts put in place by No Child Left Behind and is based on six key elements for fostering 21st century learning:

- Emphasize core subjects;
- Emphasize learning skills;
- Use 21st century tools to develop learning skills;
- Teach and learn in a 21st century context;
- Teach and learn 21st century content;
- Use 21st century assessments that measure 21st century skills (Partnership for 21st Century Skills, 2003).

Looking at these elements in light of professional development for the 21st century is essential. As teachers are increasingly under pressure to provide quality instruction that addresses standards from areas as divergent as their particular subject area, 21st century skills and general higher-order thinking skills, knowledge of whether and how teachers can best integrate ICT to effectively meet standards is of particular relevance.

Educational researchers and developers can help bridge this knowledge gap for teachers by learning more about what exactly is needed to provide "good" training, support, and solutions for teachers who are tackling the challenge of teaching 21st century skills across grade levels and content areas, while using technology within various learning contexts. This exploration requires looking across professional development and ICT literature.

For teachers to integrate skills or concepts that may be new to them, they need time to reflect on how a new concept or technique might be useful in their classroom, when they would implement it, and what learning objectives it might address. Bransford, Brown

and Cocking (2000) articulate this belief in their work and explain how "principles of learning and their implications for designing learning environments apply equally to child and adult learning" (27). Kennedy (1999) argues that the most successful professional development programs in terms of later impact on student learning are those that focus on helping teachers understand how students learn specific content or thinking skills. She argues that teachers need an understanding of how people learn specific skills and how they are used in a given domain in order for pedagogical strategies to be meaningful. Other research on teaching thinking skills also emphasizes that to provide effective instruction, these skills must be taught in concrete ways and embedded within specific content areas (Brandt, 2001; Resnick, 1987).

For teachers to make these connections to their content areas and structure effective learning activities requires that they possess a range of knowledge. Shulman (1987) identifies knowledge of learners, pedagogical knowledge, and curriculum knowledge as important elements for educators to consider in their instructional planning. Webb and Cox (2004) recognize that teachers need to posses knowledge about the affordances offered by ICT-based learning environments. They explain that educators need to "undertake more complex pedagogical reasoning than before in their planning and teaching that incorporates knowledge of specific affordances and how these relate to their subject-based teaching objectives as well as the knowledge they have always needed to plan for their students' learning" (Webb & Cox, 2004; 235).

Teachers possessing multiple forms of knowledge also apply to teaching with technology. In exploring findings on other professional development models that employ technological teaching tools (Light, McDermott & Honey, 2002), teachers need time to develop comfort with the tool, gain an understanding of how it can be used in the classroom, and develop teaching strategies that are appropriate to teaching within their content area using that tool. To understand how teachers may successfully prepare students to learn 21st century skills requires unpacking the confluence of challenges associated with this task – the difficulties of mastering higher-order thinking skills and a range of knowledge, using technology well, and being cognizant of ICT affordances.

Modes of Inquiry and Data Sources

Over the past two years, we have worked with the Intel® Innovation in Education program as it has undergone development, and we continue to do so. Understanding how teachers perceived the online thinking tools, generated projects for their students that drew on the tools, and ultimately decided whether and how to implement their projects into the classroom setting required the examination of multiple moments throughout the training process. According to Borko (2004), it is important to use a situative perspective on researching teacher learning and professional development, which takes into account the multiple contexts where teachers learn (e.g. listening to a trainer during a professional development workshop, informal conversations with colleagues) and then implement what they have learned (e.g. teaching in the classroom, developing curriculum at home).

In order to gain such a situated perspective, the research team observed participants during the training experience, explored teachers' reactions to the training (both immediately and over time), and investigated whether and how they used the tools after the training in their classrooms. To gain a more comprehensive picture of the effectiveness of the Workshops, the research team not only elicited the participants' perspectives, but also those of project administrators and trainers as well. We continue to apply this perspective in the third year of work as well.

Accordingly, the research team has employed multiple methods – surveys, interviews and email correspondences, observations and site visits, and document analyses of curricular materials and projects – in order to examine instructional practices around the tools, document student and teacher perceptions of the tools and related materials, and examine whether and how teachers used these tools in the classrooms.

Based on these methods of inquiry, we will draw upon a combination of data sources for this paper. During 2002–2004, data collected for a larger evaluation study were obtained through online surveys, interviews, site visits, focus group interactions, email correspondences, and document analyses of curricular materials. In addition to reviewing teachers' responses to surveys and online project work of many teachers and their students, researchers collected data during interactions with educators from around the United States.

The current phase of the project builds upon data and initial findings mentioned above, and also includes both qualitative and quantitative methods, including:

- o End-of-Workshop Survey: We asked all teachers who completed the Workshop to complete a survey, which collected their experiences with the training, satisfaction with the trainer, and perceptions of the Workshop goals. Approximately 500 teachers have completed this survey to date.
- o Follow-up Survey and interviews: We sent two online surveys to teachers who had previously participated in the Workshop and had been asked to deliver the training to teachers in their local schools. A second follow-up survey is planned for September 2005. Email reflections and phone interviews with teacher-trainers are ongoing. Data collected to date in 2005 includes 21 email reflection responses and six interviews with teacher-trainers. These reflections and interviews asked them to further explore their experiences with the Workshops, their interactions with the online tools, and how (and if) they used the tools in their classrooms. We selected a diverse group of teacher-trainers who work across a range of schools, subject areas, student populations, and locations around the country. An additional set of interviews with approximately 15-20 teachers and teacher-trainers is planned for October 2005.
- o Observations and site visits: To date, we have conducted four site visits where we observed Workshop trainings and three visits to teachers' classrooms. Additionally, we interviewed district technology coordinators, local program coordinators, trainers, and participants. Ten future observations at trainings and approximately five classroom visits are planned for the 2005-2005 school year to

learn how teachers implement the projects they planned during the Workshop experience into their classroom practice.

Findings and Preliminary Conclusions

This formative evaluation is continuing, but analyses of data collected through November, 2005 have produced the following findings. Detailed presentation of the findings and associated evidence are presented in Culp, Wexler, Pasnik & Meade, 2005.

- o <u>Learning to using the tools</u>. Nearly all participating teachers acquire a basic technical understanding of the online thinking tools in the course of the workshop, and a minority master the tools' more advanced functions. Students similarly learn to use the tools quickly and easily.
- o <u>Access and infrastructure</u>. Both teachers and students encountered only minor technical obstacles to using the tools. A substantial minority of teachers reported that it was difficult to gain access to the hardware and Internet connections they needed to support whole-class use of the tools.
- o <u>Perceptions of the tools' relevance to classroom teaching</u>. When the tools are first introduced, participants commonly raise concerns about their relevance to various grade levels and subject areas. Many of these concerns are resolved through the process of developing a unit plan. Questions about the relevance of the tools for elementary-grade students, and for mathematics and foreign language teaching, persist, and these teachers exhibit lower rates of follow-up tool use in the classroom.
- o <u>Using the tools to support higher-order thinking</u>. Few trainers integrated discussion of higher-order thinking skills throughout the workshop. Participants are motivated to use the tools to support student learning, but are not fully prepared to do so by the end of the workshop. Participants are oriented to and prepared for using the tools in a project-based context, but that they do not explore in any depth how to use the tools to scaffold student use of specific thinking skills.
- o <u>Creating unit plans.</u> Most participants successfully created unit plans that linked use of the tools to their current practice and that were broadly project-based in their structure. Participants used the tools to enhance their curriculum in two ways: making student thinking more visible, and stimulating group discussion. They were unlikely to focus specifically on engaging and building students' higher-order thinking skills.
- o <u>Using the online thinking tools with students</u>. Just over half of reporting Master Teachers have used the online thinking tools since participating in a workshop. Twice as many of these teachers report using *Visual Ranking* as report using *Showing Evidence* or *Seeing Reason*. The tools are consistently used to support documentation of students' thinking, comparison of results, and discussion of ideas. They are not typically used to support sustained collection of evidence, rigorous evaluation of evidence, or drawing conclusions about the validity or strength of hypotheses or conclusions.

Implications

There is variation in participants' level of enthusiasm for and readiness to use the tools, but they generally find the tools easy to use and innovative. Many teachers go on to use *Visual Ranking* with their students, and a substantial minority are using *Seeing Reason* and *Showing Evidence* as well. Teachers' classroom use of the tools typically includes providing a project-based context for use, asking students to provide rationales for their choices, and stimulating discussion.

The workshops are generating substantial teacher enthusiasm for "making thinking visible" and for provoking lively discussion in the classroom, two crucial features of a project-driven classroom in which students build deep understanding of content and exercise their critical thinking skills. However, the workshop is not yet adequately preparing teachers to guide their students through the equally important stages of defining good questions, setting criteria and procedures for gathering evidence, and evaluating and presenting evidence, and in particular is not directing them toward using specific features and functions of the online thinking tools to support these activities.

The workshops are familiarizing teachers with the features of appropriate social scaffolding to support student learning, but are not exposing teachers to enough detailed exploration of how to deploy the available technological scaffolding to stimulate and extend students' use of specific higher-order thinking skills. Without more deliberate deployment of the tools in follow-up classroom activities, use of the online thinking tools is unlikely to have an impact on students' mastery of either content or the higher-order thinking skills the workshops seek to support.

In order to build on their existing strengths and provide even deeper learning experiences for teachers, the workshops will need to engage teachers in more active learning, particularly structured reflection on their current practice and examination of artifacts of student learning. These approaches could help teachers to move beyond using the tools to stimulate discussion in general, toward stimulating discussion that requires students to analyze, critique, compare and defend the ideas the online thinking tools have helped them to develop.

Many teachers are leaving the workshops interested in the tools, engaged with the idea of making their students' thinking visible, and motivated to use technology in a project-based context in their classrooms. But if the workshops are intended to achieve a more substantive shift in teachers' knowledge and practice of supporting student inquiry, the workshops will need to move away from the delivery of information and toward supporting teachers' own inquiry into how they, and their students, can build new knowledge through the use of these tools.

Preliminary conclusions

If 21st century skills are to be the focus for teaching, learning, and succeeding they need to be consonant with other mandates (e.g. No Child Left Behind) and aligned with the structure of core content areas, curricula, and assessments. To date, this formative evaluation suggests that teachers are enthusiastic about the *idea* of building their

students' 21st century skills, but that doing so is both challenging and not easily integrated with existing constraints including accountability pressures and curricular structures.

Ensuring that this and other professional development programs are able to help teachers instruct their students in using ICT to support active, critical learning in the 21st century exploring elements will require further understanding how best to engage teachers with both the broad outlines of a project-based teaching context and with the details of the specific features of tools like those discussed here that can help to scaffold students' use of the critical and analytic thinking skills stressed in 21st century learning frameworks.

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