Professional Development, Cognitive Tools, and Thinking Skills

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Abstract: This poster shares findings from an on-going, formative evaluation of a professional development workshop for K-12 teachers that is designed to engage teachers in creating classroom projects that use cognitive tools to foster higher-order thinking and 21st century skills across the disciplines. Findings show teachers used the tools to "make students' thinking visible," help students compare ideas, and to stimulate group discussions; the remaining challenge is to explicitly target students' higher order thinking skills.

Introduction

This poster presents findings from a formative evaluation of a program that provides guidance for educators on how to use web-based, cognitive software programs that engage students in higher-order thinking (Beyer, 2001), and 21st century skills (Partnership for 21st Century Skills, 2003). Specifically, the Intel Workshop on Teaching Thinking with Technology presents three tools that help students visualize and represent their thinking: (1) *Seeing Reason* focuses on cause and effect relationships through the construction of causal maps; (2) *Visual Ranking* focuses on prioritizing information, exploring perspectives, and building consensus through ranking items in a list; and (3) *Showing Evidence* focuses on generating claims and evidence to support or refute arguments by using an interactive visual organizer. This poster provides findings related to the research question: How do participants who have gone through the training make use of the Workshop resources? Specifically, to what extent is participants' classroom follow-up (such as using the online thinking tools with students) consistent with the instructional practices and learning goals the resources are intended to support?

Theoretical Framework

With the distinction between *social scaffolding* and *technological scaffolding,* Pea (2004) points to the relationship between student learning and technology. A Workshop participant, then, needs to envision, understand, and enact the simultaneous management of a particular instructional context (a classroom focused on project-based learning, at least for a particular time period) and a particular set of interactions with the technology (effective use of the online thinking tools). The professional development literature (Garet, Porter, Desimone, Birman & Yoon, 2001; Kennedy, 1999) suggests that in order to have an impact on student learning the concrete ideas and materials teachers take back to the classroom with them need to embody both the instructional ideas (in the case of this project, facilitating a project-based approach to learning) and the ideas about student learning (the higher-order thinking skills the online thinking tools are intended to scaffold) that are communicated in the Workshop.

Research Methods and Data Sources

The research design for the larger study from which this poster is drawn included a range of data collection strategies: online surveys, interviews, classroom observations, email correspondences, document analyses of curricular materials, observations at trainings and curricular planning meetings, and an analysis of unit plans generated at the professional development training. Both qualitative and quantitative analysis methods were employed.

Findings

This poster presents two of the study's major findings.

Finding #1: Participants primarily employed 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. Both trainers and participants expressed a particular interest in the idea of "making student thinking visible." In addition, in the unit plans analyzed, one or more tools were chosen to make "students' thinking visible" to themselves or to their peers. However, project descriptions and procedures suggested that teachers anticipated using the tools would organically lead students to communicate with one another in meaningful small and large group discussions. Teachers did not include in their unit plan documentation questioning strategies to prompt student discussions nor any focus or goals for the discussions, but instead, noted

that students' use of the tools will lead to sharing and communicating about similarities and differences among students' representations of their thinking. Additionally, few unit plans focused explicitly on building students' "information and communication skills," which would indicate an intention to address the quality or strength of students' use and articulation of the information involved in the project. Only seven of the thirty unit plans identified developing students' information and communication skills.

Finding #2: 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. Classroom observations, a review of unit plans, and responses to the Follow-Up Survey all indicated that teachers use the online thinking tools in a project-based context, although the scope and depth of projects varied widely. Projects and activities typically provided significant structure for students, guiding them step-by-step through a process but inviting them to construct unique responses to the driving prompt or question. Both observed classes and sample unit plans suggest that while teachers often include the collection and presentation of evidence as a part of a project that involves the tools, this portion of the activity is not typically emphasized. For example, in observed classrooms teachers did not spend a significant amount of time discussing the process of selecting or evaluating evidence to include in the tool space, and in none of the observed classes or the sample unit plans was the collection of evidence tied to any larger inquiry process beyond populating the student space within a given tool. Teachers instead placed their emphasis on the idea that students should construct and present a perspective or a belief, and then share their representation and compare it with others.

Conclusions and Implications

Most teachers responded positively to the Workshop experience and the tools, and thought these tools had the potential to foster positive classroom practices such as student collaborative work, research, and discussion among students. Moreover, most participants are successfully creating unit plans that link the use of the tools to their current classroom practice and that are broadly project-based in their structure. However, not all teachers developed projects that were aligned with the learning concepts the tools were designed to address. Creating projects that brought together tool use, higher-order thinking skills, project-based learning approaches and facilitated student learning around these concepts proved challenging for teachers. The distinction between *social scaffolding* and *technological scaffolding* (Pea, 2004) points clearly toward the critical qualities of effective instruction and effective use of technology in the classroom. In each case, resources need to be designed and deployed to support students by extending their reach — by bringing their cognitive skills and ability to ask and answer questions into broader, deeper, and more complex territory than they could navigate on their own. From a professional development perspective, this means that teachers need to develop both instructional skills as well as an understanding of how to deploy specific features of technology effectively to support students' emergent learning. If teachers are able to use the tools effectively in a project-based context, students will have the opportunity to build up a deeper understanding of the conceptual material and cognitive skills the tools are intended to support, and, by extension, to understand new aspects of academic content.

References

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