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ABSTRACT

This paper describes how researchers at SRI International's Center for Technology and Learning designed and used an observation tool as part of its evaluation of a local Technology Innovation Challenge Grant program called Challenge 2000: Multimedia Project. The paper aims to present both the process and the tool that researchers, program designers, and teacher-researchers might adapt to similar programs and initiatives. Methods are discussed for observing changes in classroom processes in project-based classrooms using multimedia technology. The design of the observation tool is discussed and findings are presented about the differences in classroom processes between Multimedia Project classrooms and comparison classrooms. Findings indicated that Multimedia Project classrooms were more likely to be learner-centered and to engage students in long-term, complex assignments. Overall, the results suggest that the project is meeting its objective of transforming classroom processes so that they become more student-centered, especially while students are engaged in project-based learning using multimedia. (Contains 21 references.) (AEF)

Observing Classroom Processes in Project-Based Learning Using Multimedia: A Tool for Evaluators

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Abstract: This paper discusses methods for observing changes in classroom processes in project-based classrooms using multimedia technology. The tool was used as part of a five-year evaluation of a local Technology Innovation Challenge Grant program called Challenge 2000: Multimedia Project. In the paper, we discuss the design of the observation tool and present findings about the differences in classroom processes between Multimedia Project classrooms and comparison classrooms. Project classrooms, we found, are more likely to be learner-centered and engage students in long-term, complex assignments.

INTRODUCTION

Case studies such as from Apple's Classrooms of Tomorrow (Sandholtz, Ringstaff, & Dwyer, 1996) and from reforming schools across the country (Means & Olson, 1995) point to the potential of new technologies to support new ways of teaching. Moreover, these studies have provided rich details about what takes place in classrooms as local technology-supported reforms are implemented.

In addition to these kinds of studies of technology use in schools, in recent years there have been a number of published reports using national data that show the promise of technology to support school reform. Many of these studies rely on survey data, student achievement data, or a combination of both in their analysis. Becker (1999), for example, has published some of the results from his recent survey of teaching practice and technology use in the United States on the World Wide Web, in which he found fewer than 1/3 of teachers were having students conduct research on the Web. The Educational Testing Service has found that when students use computers to apply higher order concepts and when teachers are knowledgeable about how to use computers as productivity tools, students show significant gains in mathematics achievement (Wenglinsky, 1998).

As initiatives and programs that use technology to help drive school reform proliferate, there is an increasing need for tools that can help measure whether these programs achieve anticipated changes in teaching practice. Certainly tools used in both case study research and large-scale studies can be used or adapted for use in evaluation, but researchers must pay careful attention to local program contexts when considering how to use these tools. First, evaluators must first examine the program or initiative's specific design; that is, how interventions are expected to bring about particular changes in teaching practice. The anticipated changes must themselves be described in enough detail for researchers, other observers, and teachers themselves to be able to know when they've achieved those desired changes in teaching practice. Second, evaluators must consider a range of factors related to the opportunities and constraints of the evaluation process itself: What is the scope of the evaluation? Who are the stakeholders and partners in the evaluation? What kinds of data are needed to evaluate the design? How will the data be analyzed? How will different partners in the initiative use the data?

In this paper, we describe how researchers at SRI International's Center for Technology and Learning designed and used an observation tool as part of its evaluation of a local Technology Innovation Challenge Grant. The paper is intended to present both a process and a tool that researchers, program designers, and teacher-researchers might adapt to similar programs and initiatives. First, we describe both the program's theory of action and some of the important opportunities and constraints in the evaluation design. Next, we describe the design of the observation tool itself and how it was used over the course of two years. Finally, we present some of the key findings from the observation study, with specific attention to changes in teaching practice that were observed.

THE CHALLENGE 2000: MULTIMEDIA PROJECT DESIGN

The context of this study is a project funded through the U.S. Department of Education's Technology Innovation Challenge Grants program. The grant was awarded over four years ago to the San Mateo County Office of Education and is jointly coordinated by the county office and Joint Venture: Silicon Valley, a partnership of area businesses focused on improving the quality of life in the Silicon Valley region in northern California. The federal grant funded the Challenge 2000: Multimedia Project and was designed to support Joint Venture's larger education reform initiative, which is aimed at making Silicon Valley students among the most sought-after by employers in the region for jobs in the new workplaces of the twenty-first century.

The Challenge 2000: Multimedia Project aims to engage students in their own learning and develop students' skills of collaboration, decision-making, and complex problem solving. To accomplish these goals, the Project has adopted a model of Project-Based Learning using Multimedia (PBL+MM) and provided supports to teachers in learning how to implement projects and use technology effectively to enhance and support student learning. By implementing student-centered projects and providing supports to teachers, it is expected that classroom processes and teaching practice will change, leading to better outcomes for students.

Student-Centered Projects

The model of project-based learning using multimedia is a research-based model developed by the Challenge 2000 participants in collaboration with researchers from the Institute for Research on Learning. This model incorporates all of the dimensions that have been traditionally associated with a project approach to learning (Blumenfeld, et al., 1991; Kirkpatrick, 1918; Rawcliffe, 1925), such as having a real-world connection, but adds the practice of producing final projects in a multimedia format as a central part of the practice. Among the kinds of multimedia products that students have produced are HyperStudio stacks, Web pages or sites, PowerPoint presentations, animations and videos, and music CDs.

There are seven components of the Project Based Learning Using Multimedia model. Projects are expected to:

- Be anchored in core curriculum; multidisciplinary
- Involve students in sustained effort over time
- Involve student decision-making
- Be collaborative
- Have a clear real-world connection
- Use systematic assessment: both along the way and end product
- Take advantage of multimedia as a communication tool

It is important to note here that the seventh component, use of multimedia technologies, is not conceived as a stand-alone component. Multimedia technologies are intended to be used as tools in the planning, developing, and presenting projects. It is believed that the power of multimedia lies primarily in the extent to which it is integrated within the goals of the project and ongoing curriculum for the class. Products that students create come to serve as public artifacts (Allen & Pea, 1992; Blumenfeld, et al., 1991; Penuel, Cole, Korbak, & Jump, under review) that are part of the classroom community's memory of what it has accomplished.

Teacher Supports for Technology Use

To help teachers implement the PBL+MM model in their classrooms, Multimedia Project staff have created a number of supports and incentives for teachers. The project's theory of action has emphasized the importance of creating a learning community among participating teachers. Initially, the Institute for Research on Learning provided training on how to plan and implement projects in the classroom and on how to use multimedia technology. As the project developed, participating teachers formed a cadre (a Project name) that took on more and more responsibility for planning and conducting their own professional development. As teachers have become more practiced and skilled in implementing the model, they have refined it and shared it with new participants that join the Project.

Multimedia Project teachers establish a peer community of learners in which they gradually take on responsibility for planning and conducting their own professional development. Veteran teachers share their skills with less experienced colleagues. Many of these veteran teachers serve in special roles funded in part through the Multimedia Project. Technology Learning Coordinators in the project are skilled in both the use of technology and innovative teaching practice and are available to teachers in the project for help. Typically, a portion of the Technology Learning Coordinators' time is also spent providing technical assistance to teachers experiencing problems with specific technologies.

The Project also provides a system of recognition and rewards for project teachers. Teachers may apply individually or as partners for mini-grants, allowing them to purchase equipment, software, peripherals, and/or training if they implement multimedia projects in their classes. Providing greater access to hardware, software, and to the Internet has made it possible for students to complete projects they would never have been able to do before the grant. Teachers may also be recognized for their students' contributions to annual Multimedia Fairs held by the school teams participating within the Challenge 2000: Multimedia Project.

Classroom Processes

In the Multimedia Project design, the implementation of student-centered projects and development of a peer learning community with access to technology and technical support are expected to result in changes in what goes on inside project classrooms. Specifically, the design calls for classrooms in which:

- students engage in longer-term, more complex assignments
- teachers act as coaches and facilitators of student learning
- students engage in more small-group collaborative activities
- there is greater involvement with external resources, including heightened attention to external audiences for student work

In turn, these changes in classroom practices are expected to bring about the student outcomes described above-greater skills in collaboration, decision-making, and complex problem solving.

The changes in classroom processes can be seen as intermediate outcomes of the Multimedia Project, benchmarks that can be used to indicate that the project is progressing toward meeting its objectives for student learning. Because of the central importance of changed classroom processes and teaching practice in the program design, we chose to develop an instrument to help measure whether in fact participating classrooms were in fact more student-centered, collaborative, and engaged with external resources. In the next section, we describe the protocol and the evaluation context in which this instrument was designed.

DESIGNING AN OBSERVATION PROTOCOL TO MEASURE CLASSROOM PROCESSES

The Evaluation Context

SRI International (SRI) is under contract to conduct the evaluation of the federal grant coordinated by Joint Venture: Silicon Valley and the San Mateo County Office of Education. The evaluation is a multi-method, five-year study of the implementation and outcomes of the Multimedia Project. As the project has developed over its first four years, the evaluation has moved from a primary focus on documenting implementation (describing student-centered projects and teacher supports) to measuring outcomes of the project. Research questions evolved as the project model has crystallized: each year, evaluators are able to ask more focused questions about teaching and learning in Multimedia Project classrooms.

Throughout the project, SRI International has adopted a partnership approach to the evaluation process. Staff from SRI serve on the Multimedia Project's Coordinating Committee, which meets monthly to discuss the progress of the Project's activities. The Committee consists of representatives from San Mateo County Office of Education, JVSV, the Institute for Research on Learning, and other key program partners. At these meetings, SRI presents information about how teachers and students are participating in and responding to various project activities. Other members of the Coordinating Committee, led by JVSV, identify their own questions that in turn shape each year's evaluation design.

SRI has used case studies, interviews, teacher surveys, classroom observations, school-wide indicators of achievement, and performance assessment data as part of the study. Each of these methods has been used either to document implementation of the project or measure progress toward outcomes.

Year 3 Study Findings

Initially, the observation protocol was adapted from one used by researchers at the National Center for Research on Evaluation, Standards, and Student Testing (CRESST) for use in the studies of Apple Classrooms of Tomorrow in the third year of the program in part to provide evidence to program stakeholders that the Multimedia Project was making progress toward changing classroom processes in project classrooms.

In this first study, 19 classrooms were chosen from among Challenge 2000 classrooms across grade levels for observation in the fall of 1997 and the spring of 1998. Principals from schools where SRI was conducting case studies nominated three technology-using and three non-technology-using classrooms for participation. In most cases, these schools had three teachers participating in the project, or otherwise engaged in technology use, but some did not. In those cases, additional non-technology-using classrooms were observed for the study. The original observation protocol examined variables such as the dominant classroom activities, teacher and student roles, the nature of ongoing student work, and the level of student engagement.

The results of the study showed significant changes in classroom processes from fall to spring, with differences between technology-using and non-technology-using classrooms (Means & Golan, 1998). For example, in the fall students in technology-using classrooms were only slightly more likely than students in comparison classes to be engaged in long-term projects at the time of the observation. By spring, that gap was very wide, with 67% of technology-using classrooms versus 14% of non-technology using classrooms involved in extended projects at the time of observation. Similarly, teachers from both sets of classrooms were equally likely to be engaged primarily in questioning students, a traditional role for teachers, in the fall. In the spring, far fewer technology-using teachers used questioning as their dominant way of relating to students (7% versus 49% for non-technology-using teachers). Instead, technology-using teachers were much more likely to be in a helping or monitoring role within the classroom (43% in the spring versus 18% of non-technology-using classrooms).

Similarly, students in technology-using classrooms were much more likely than their peers in non-technology-using classrooms to be engaged in constructing products and working in small groups in collaborative activity. Again, the differences were much greater in the spring than in the fall. In the fall, 56% of technology-using classrooms involved students in constructing products compared to 39% of non-technology-using classrooms. By the spring, that gap widened: 73% of technology-using classrooms engaged students in constructing products versus 38% of non-technology-using classrooms. While in the fall, few classrooms from either sample engaged students in small-group collaboration, nearly a quarter of technology-using classrooms involved small-group collaborative activity in the spring (compared to 0% of non-technology-using classrooms).

Adaptation of the Protocol for Year 4

A multi-year evaluation affords the opportunity to revise instruments and processes based on what is learned from using them and based on the purposes the instruments serve in the overall evaluation design for that particular year. At the beginning of Year 4, we made some revisions to the observation protocol itself and to the data collection and analysis process.

In Year 4, the evaluation data collection activities focused increasingly on measuring outcomes from the

Multimedia Project. A performance assessment task was created to measure student skills in design, collaboration, and mastery of content. We decided to link the planned replication of the observation study with the performance assessment task. In this way, we could test the design or conceptual framework of the model by answering the question: Do changes in classroom processes lead to different levels of student performance? At the time of writing, performance assessment data are still under analysis. In this paper, we describe the design changes to the observation protocol and report results from Year 4, which continue to point to the promise of the design in changing classroom processes.

Selection of Classrooms

In Year 4, the classrooms were selected using a different method in order to ensure that a large number of veteran teachers would be included in the sample of Multimedia Project classrooms. For this reason, we do not use the terms technology-using and non-technology-using classrooms to characterize the two samples (though the two samples of classrooms can be distinguished in this way). Rather, the study is comprised of 12 project classrooms and 9 comparison classrooms. As in Year 4, observations were conducted once in the fall and in the spring, both times within a three-week window.

Project classrooms selected for the study were a combination of experienced and novice teachers within the Multimedia Project who were funded with mini-grants for the 1998-99 school year. Principals from the project teachers' schools selected comparison classroom teachers. Principals were given instructions to select a teacher in the same grade who was not a part of the project but who taught in a subject area similar to the project teacher. Because the project encouraged partnerships within schools, finding a comparison teacher at the same grade level was not always possible. In two cases, classrooms from the same grade level at a comparable school in the same district were chosen. Still, the resulting classrooms were similar in size and in demographic composition (Table 1).

Table 1.
Composition of Classrooms in the Study

	MM Project Classrooms	**Comparison Classrooms**
Average attendance	27.5 %	28.4 %
Ethnic composition		
White	56 %	61 %
Asian/Pacific Islander	20 %	17 %
Latino	15 %	16 %
African American	2 %	4 %
Other	7 %	2 %

Classrooms did differ on one significant measure, namely the number of computers that were in their classrooms. On average, Multimedia Project classrooms had 6 computers, while comparison classrooms had only 2.

In addition, both samples included only 6th and 7th grade classrooms. We selected classrooms from these two grades because the performance task designed to measure the impact of the project on student learning was targeted to middle grades students.

Addition of Items to Protocol

In Year 4, we added two sets of items to the protocol that have been emphasized by sociocultural researchers (Cazden, 1988; Lemke, 1985; Mehan, 1979; Wells, 19xx; Wertsch, 1991) as important for sustaining extended student inquiry. We asked observers to characterize the different forms of discourse that students and teachers used in the classroom. For example, observers looked for "instructional questions" (Mehan, 1979; see also Heath, 1983) in which teachers ask brief questions of students, to which the answer is already known, to test students knowledge of isolated facts. In general, we were interested to know whether Multimedia Project classrooms engaged in what have been called more *dialogic* (Bakhtin, 1981) forms of discourse than comparison classrooms. By dialogic, we mean forms of discourse that engage students and teachers in discussions that are not always teacher-controlled. By contrast, we anticipated that comparison classrooms might be more likely dominated by a *monologic* or lecture-oriented form of discourse.

We also wanted to be able to analyze better the extent to which teachers allowed students to work independently with limited strategic assistance (Wertsch, 1985). We expected teachers in project classrooms be more inclined than those in comparison classrooms to allocate more time than comparison classrooms to having students practice learning skills on their own, rather than simply demonstrating the skills to students or telling them about what they need to know. We predicted that teachers would provide assistance as needed in project classrooms, but students would be given primary responsibility for their own learning.

Activity as Unit of Analysis

Consistent with a sociocultural approach to observing classroom practice, we also chose to use *activity* rather than observation time as the primary unit of analysis for our Year 4 observations. For purposes of the study, an activity is defined as student engagement in some kind of educationally relevant product. Those products include: a story written, a reading completed, a topic discussed, science observations made and recorded, a set of related problems at the board worked through, a pre-writing activity completed, a painting painted, et cetera. Sometimes an activity produces no tangible product (students listen to a lecture) but the activity is nonetheless organized to produce a definable outcome-e.g. coverage of a particular topic.

Operationally, we defined the activities as different when two or more of the following changes took place in the classroom:

- A new product or *objective* is introduced by the teacher or other students that is followed by new patterns of thinking, communicating, and acting.
- The *topic* changes, whether signaled by movement from one subject area to another or to a different domain within a particular subject.
- The *activity or participant structure* changes; in other words, the way roles are assigned among students or the ways students and teachers are interacting shifts (e.g., from whole group lecture to small group collaboration).
- The *spatial arrangements* in the room shift, in that either people change places or physical objects in the room are re-configured to afford a different kind of activity.
- The teacher (or students) makes a *bid to close* a segment of classroom activity, signaled by specific instructions to students about "wrapping up" or by teachers beginning to review just finished work

or instructing students about re-arranging space in the classroom.

Multiple Levels of Analysis

By selecting activity as the unit of analysis and recording the amount of time spent on each activity, additional avenues for data analysis were opened up. Whereas in Year 3, observers recorded what was happening in three fifteen-minute intervals throughout their observations, in Year 4, observers recorded anywhere from between 1 and 4 different activities across a forty-five minute observation period for each classroom. The Year 4 data permit analysis of the amount of *time* spent in various activities, by the dominant *activities* within classrooms, and by *classroom teacher*. In this paper, we present analyses from the first two dimensions, time and activity.

OBSERVED DIFFERENCES BETWEEN PROJECT AND COMPARISON CLASSROOMS

In this section, we report a number of significant differences we found between Multimedia Project classrooms and comparison classrooms. We consider the extent to which project classrooms were more focused about long-term projects, learner-centered, collaborative, and oriented toward people and communities outside the classroom.

Engagement in Long-Term, Complex Assignments

Time Spent on Long Term Assignments. Students in Multimedia Project classrooms engaged in significantly longer activities ($p<.05$) than students in comparison classrooms. Moreover, they were more likely to be engaged in long-term activities-that is, activities that spanned more than a week of class time-than their counterparts in the comparison classrooms. Moreover, both in the fall and the spring, students spent more time in project classrooms engaged in long-term activities that lasted a week or more (an average of 84% of the time in project classrooms versus 49% of the time in comparison classrooms).

Analysis of the Complexity of Activities. For the Multimedia Project to be successful, it would not be enough to say that students are engaged in long-term activities. Something of the quality of their activity would need to be observed and understood to argue successfully that projects were transforming classroom processes. An analysis of student actions reveals that in fact, students are engaged in complex, cognitively challenging tasks in project classrooms.

Students were observed to be engaged in more of what might be called the *cognitive activities of design.* In other words, they were engaged in the kinds of higher-level cognitive activities characteristic of multimedia design as described by Lehrer (1993): deciding on the structure of a presentation; creating multiple representations, models, and analogies; arguing about or evaluating information; thinking about one's audience; and revising or editing work. Table 2 shows the differences between Multimedia Project and comparison classrooms for those activities marked "dominant" by observers.

Table 2.
Dominant Activities Observed

	MMP Classrooms	Comparison Classrooms

Teacher-directed solo activities (e.g., reading silently, listening to teacher)	13	23
Cognitive activities of design (e.g., deciding on structure of a presentation)	13	3

c2=9.03, df=1, p<.01

Teachers as Coaches and Facilitators

Time Spent in Independent Activity. In Multimedia Project classrooms, more time was spent having students practice skills on their own (whether independently or as a group) with strategic assistance provided by teachers as needed, than having students watch or listen as teachers performed a task for them or explained a process to them (See Figure 2). This difference was particularly pronounced in the spring, when teacher-led activities comprised 29% of time in project classrooms versus comparison classrooms (62%). It is clear from these data that project teachers are more likely to give major responsibility to students for their own learning than do comparison teachers.

Dominant Roles of Teachers. Teachers in Multimedia Project classrooms were much more likely to be engaged in facilitative roles within classroom activities than were teachers from comparison classrooms. In other words, they were more likely to be engaged in assisting or helping students by moving about the classroom and responding to student questions or providing help when they see a need for it. This facilitative role is evident in the greater extent to which teachers help to organize the process by which students can work productively on their own, whether in groups or individually. By contrast, the dominant role of teachers within comparison classrooms was more directive. Teachers were more likely to be explaining concepts, providing information, or questioning students about their understanding of material (see Table 3).

Table 3.
Dominant Teacher Roles Observed

	MMP Classrooms	Comparison Classrooms
Directive Role (e.g., explaining concepts, providing information, questioning students)	11	17
Facilitative Role (e.g., assisting or helping, managing the organization of the task, monitoring as students work on their own)	13	7

c2=7.81, df=1, p<.05

Engagement in Small-Group Collaborative Activity

Time Devoted to Small Group Activity Students in Multimedia Project classrooms were more likely than comparison students to spend time engaged in small group collaboration. This collaboration was supported, moreover, by discourse patterns that allowed students to direct discussion among their peers about the content of the class.

While in the fall, students spent roughly the same amount of time in project and comparison classrooms engaged in small-group discussion, by the spring, project classrooms devoted much more time to this form of discourse. A corollary finding is that by the spring time, only 3% of the time in project classrooms was devoted to "instructional" or known-answer questions compared to 72% of the time in comparison classrooms.

Analysis of Dominant Activities. An analysis by activity yields similar results. There was a more dialogic pattern of discourse within project classrooms than within comparison classrooms in the spring. By dialogic, we mean forms of discourse that engage students and teachers in discussions that are not always teacher-controlled (e.g., lecture). By contrast, comparison classrooms were much more likely to be observed as having a monologic or lecture-oriented discourse dominate classroom time (c2=7.88, df=1, p<.01).

Involvement with External Resources

Time Spent Using the Internet. One of the most valuable tools for connecting classrooms to wider communities is the Internet. By the spring, students in project classrooms spent half of the time observed using the Internet, searching for information, graphics, pictures, sounds, and other material to use for their multimedia presentations. The Internet was not used at all in comparison classrooms, either in the fall or the spring.

Attention to an External Audience. Yet another way that classrooms are connected to broader communities is through the student-led projects themselves, which typically have an audience outside the classroom. In this respect, project classrooms differ significantly from comparison classrooms in the likelihood that students will be engaged in discussion about how their audiences would respond to aspects of a product being produced (Fisher Exact Test, p<.001). In spring, 35% of the activities in project classroom involved students considering the audience of their work, whereas none of the activities observed in comparison classrooms found students attending to the audience of their work (beyond the teacher-as-audience).

Discussion and Implications

In each of the dimensions we observed and analyzed, Multimedia Project classrooms distinguished themselves from comparison classrooms by being significantly more student-centered and organized about the collaborative construction of complex products. These findings not only constitute evidence of the projects success in stimulating desired changes at the classroom level at classroom, but also measure power of our instrument to measure and capture these changes.

At the same time, this effect was not evident throughout the whole school year on all dimensions. As in

Year 3, classrooms were much more likely to be engaged in focused efforts to complete student projects in the spring than in the fall, even though care was taken to select only Multimedia Project teachers for the sample. The only dimension in which project teachers differed from comparison classrooms throughout the school year was in the amount of time students spent engaged in small-group collaborative activity.

There are a number of possible reasons why we observed this time-of-year effect. First, one could argue that project teachers are among the most innovative teachers within their schools and were predisposed to become a part of the Multimedia Project. The project, therefore, might not be the cause of the difference in classroom processes. This interpretation is not consistent with case study and interview data, however, in which many project teachers describe how the project has changed their view and practice of teaching.

Another possible interpretation of these data are that even among project teachers, there is a natural building of component skills for projects that takes place in the fall. In the fall, many project teachers use time to teach students research skills or how to use different multimedia software packages. The teachers are still focusing on projects, but their work requires much more direct, teacher-led instruction at this stage.

One third possible reason why we have observed this time-of-year effect is the timing of the Multimedia Fairs. The fairs are held in the spring each year and motivate much of the activity of the project teachers and their students throughout the spring months. At the time of our observations in April, many of the project classrooms were in the middle of working on projects they would show at the fairs. These fairs, in turn, motivate students' attention to an external audience, since people from other schools and the community will see their work.

Even with this school year effect, a convincing case can be made that project teachers are more likely to engage students in small-group collaborative activity, regardless of whether they are working on their multimedia projects. In some cases, it may be that small group work is part of the school's philosophy, and the emphasis on collaboration cannot be attributed solely to the work of the Multimedia Project (see Penuel, Cole, Korbak, & Jump, under review). Still, the success of previous student projects appears to contribute to teachers' eagerness to use collaborative learning as a tool to promote greater mastery of content and skill in working well with others.

Overall, the results suggest that the project is meeting its objective of transforming classroom processes so that they become more student-centered, especially while students are engaged in project-based learning using multimedia. The results suggest a strong role for the projects themselves and for the Multimedia Fair in contributing to these changes, since differences between project and comparison classrooms are much more evident in the spring than in the fall. Indeed, it may be that events like the fairs, which provide concrete links between the classroom and other classrooms and the community, deserve a more important place as levers for changing classroom practice.

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