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Learning History in Middle School by Designing Multimedia in a Project-Based Learning Experience

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Abstract
This article describes a study in which eighth grade students in one school learned to create multimedia mini-documentaries in a six-week history unit on early 19th-century U.S. history. The authors examined content knowledge tests, group projects, and attitude and opinion surveys to determine relative benefits for students who participated in a technology-assisted project-based learning experience, and contrasted their experiences to those of students who received a more traditional form of instruction. Results from content knowledge measures showed significant gains for students in the project-based learning condition as compared to students in the comparison school. Students' work in the intervention condition also revealed growth in their historical thinking skills, as many were able to grasp a fundamental understanding that history is more than presenting facts. Implications and suggestions for technology-enhanced project-based learning experiences are indicated. (Keywords: multimedia design, project-based learning, historical thinking, social studies teaching, technology integration.)

INTRODUCTION AND PURPOSE OF THE STUDY

There is a widely recognized need to identify teaching strategies in social studies, particularly in history, that will engage students in their learning and equip them with an understanding of how professionals in the discipline work to help them develop the knowledge and skills necessary to think about the past imaginatively and with integrity (National Research Council, 2005). However, often under pressure from high-stakes testing, history teachers tend to emphasize mastery of a seemingly overwhelming quantity of historical facts (Barton & Levstik, 2003; Wineburg, 2000). One consequence of this approach has been a decrease in student interest in history as a subject. In contrast, vastly different instructional strategies designed to consider problems of historical interpretation, develop analytical tools, critique sources, and learn how to construct historical interpretations (e.g., Mandell, 2008) are available to practitioners in K–12 settings. In general, they advocate increasing student achievement and enhancing the experience of learning history by promoting deeper understanding and engagement in historical thinking (Caron, 2005; Ferster, Hammond, & Bull, 2006; Stearns, Seixas, & Wineburg, 2000). Theoretical frameworks such as constructivism (Brooks & Brooks, 1999: Fosnot, 2005; Richardson, 2003) and teaching strategies such as project-based learning (Blumenfeld, Soloway, Marx, Krajcik, Guzdial, & Palincsar, 1991; Buck Institute for Education, 2003; Moursund, 2003) provide a conceptual structure with which to design learning experiences that can fulfill these goals, and offer practical guidance for technology integration across the curriculum, including history in particular.

The present article reports on a study that explored the impact of a constructivist pedagogical approach involving technology integration and project-based learning on the experience of teaching and learning history in middle school, and offers a contrast with learning that did not rely on group work or a unifying instructional activity.

Theoretical Framework

The theoretical foundation is constructivist theory (Fosnot, 2005), and the instructional strategies conceptually related and/or derived from it, such as project-based learning (PBL), that present potentially viable alternatives to lecture and recitation approaches to instruction. A core assumption of constructivist theory is that learners actively construct knowledge through activity, and the goal of the learning experiences designed by teachers is to promote a deep understanding rather than superficial (and short-lived) memorization. Additionally, constructivists consider learning to be "*complex* and fundamentally *nonlinear* in nature" (Fosnot & Perry, 2005, p.11; emphasis in original). For constructivists, knowledge is socially constructed through structured interaction and collaboration around meaningful tasks (Jonassen, Howland, Moore, & Marra, 2003). Hence classroom interactions should engage students in activities that give them a sense that their school-acquired knowledge is relevant in real-world situations (Brown, Collins, & Duguid, 1989). The Technology Assistance Program (1998) summarized constructivism's key principles and some of its implications for classroom instruction as follows:

- Learners bring unique prior knowledge and beliefs to a learning situation.
- Knowledge is constructed uniquely and individually, in multiple ways, through a variety of tools, resources, and contexts.
- Learning is both an active and reflective process.
- Learning is developmental. We make sense of our world by assimilating, accommodating, or rejecting new information.
- Social interaction introduces multiple perspectives on learning.
- Learning is internally controlled and mediated by the learner. (p. 1)

Given the above principles, it is easy to see that constructivist thinking provides a solid foundation for pedagogical practices like PBL designed to engage students in active, collaborative, reflective, and shared learning experiences (Jonassen, et al., 2003). Activity can take place in carefully structured physical or virtual environments, or in well-designed but less structured environments. Grant and Branch (2005) indicate that in PBL, students are expected to construct individual strategies to examine problems and suggest solutions, which they must then share and negotiate with collaborators. Furthermore, with the integration of technology into PBL experiences (Moursund, 2003), new possibilities for involving students in work that is meaningful and engaging become viable.

Technology in History Teaching and Learning

A distinct benefit of contemporary technologies such as Web sites, digital video, interactive programs, and hypermedia software is that they are uniquely capable of supporting rich, complex, and nonlinear representations of knowledge and understanding (Daley, 2003; O'Brien, Grill, Schwarz, & Schlicht, 2006). A growing number of researchers is now examining the effects of different types of technology (e.g., structured multimedia creation, Web site design, exposure to multimedia content) with the goal of merging students' improved acquisition of historical content information with the development of more sophisticated historical analysis and interpretation skills. For example, some evidence now exists that exposure to commercially available multimedia software has the potential to yield small but significant positive effects on student achievement when students work individually on computers, as measured by a standard multiple-choice test (Kingsley & Boone, 2008), and that long-term retention of information is better for students who are given the chance to learn by collaborating in Web-based environments (Heafner & Friedman, 2008).

A consistent focus for research in this area has been the examination of teaching practices that promote student reasoning with historical projects that aim to increase both their factual knowledge and historical thinking skills, rather than limit their explorations to the type of thinking and information that is found in textbooks (e.g., Friedman & Heafner, 2007; Lehrer, Erickson, & Connel, 1994; Saye & Brush, 2002; Tally & Goldenberg, 2005). More broadly, Lee and Hicks (2006) called for the development in students of "digital historical thinking" and ways to support the "visualization of knowledge" as two areas requiring additional attention in history and social studies teaching. Digital historical thinking skills help students access, process, synthesize, and interpret the wide range of multimedia electronic resources currently available and expanding rapidly, from well-established sources like the Library of Congress (http://www.loc.gov) to more recent projects such as History Now (http://www.historynow.org). When asked to create digital products such as presentations, movies, Web sites, and podcasts (i.e., learn by creating digital products available to wider audiences), students have the opportunity to organize, re-present, and make public (visualize) their understandings, allowing for more meaningful assessments of their learning, among other benefits anticipated by constructivist theory (e.g., Drake & McBride, 1997).

Thomas (2000) concluded his review of the PBL literature by calling for research that offered "evidence of the effectiveness of PBL in comparison to other methods" (p. 36) as a high priority. We sought to add to the existing literature by examining history teaching and learning outcomes when students in an intervention school learned to (a) construct an interpretation of a historical time period from the 1800s, with the delimiting factor that state standards were required as basic content guides; (b) collaborate in the production of a group product; (c) use computers to develop projects that demonstrated their individual and collective understanding of the topic under study; and (d) plan for a public presentation of their projects/products not just to the teacher but to all their peers and the school community at large.

Research Questions

In this article we address three research questions:

1. Do eighth grade students who learn history through technology-assisted project-based learning experiences acquire more, the same, or less content knowledge than students in a comparison condition?

The fact that all states have established subject-specific content standards, and that high stakes accountability measures (standardized tests) are linked to those standards, may lead teachers to believe that technology-supported PBL is incompatible with current schooling priorities. Therefore, we chose to address this question in the hope that positive outcomes would mitigate concerns that students who engage in technology-supported PBL do not acquire as much content knowledge compared to students in traditional settings.

2. Is historical thinking evident in the multimedia mini-documentary projects created by students, as a result of a six-week collaborative unit on westward expansion?

Given both the constraints (standards-based instruction) and learning opportunities (an instructional focus on historical thinking), we wished to find out the quality and depth of learning that could be demonstrated through students' multimedia mini-documentaries. We believed that providing students with multiple primary and secondary sources would allow them to respond to unit questions in creative ways, and hoped to see evidence of emerging historical understandings.

3. Do eighth grade students who learn history through technology-assisted project-based learning experiences develop positive attitudes and beliefs about social studies and the study of history in particular?

Among the benefits to students of technology-assisted project-based learning consistently identified in the literature (e.g., Scheuerell, 2008; Spires, Lee, & Turner, 2008; Thomas, 2000) are the development and/or improvement in the attitudes toward studying in general and the subject matter of the project in particular.

METHOD

This article presents information from a study that explored students' ability to learn historical information (focused broadly on domain-specific learning in social studies, historical understanding, and empathy) at two schools from the same district in Northern California. With specific limitations (discussed later), this was a quasi-experimental study using a pretest-posttest design, as we could not randomly assign students or teachers to schools (conditions) and could not alter the teaching arrangement at the comparison (or contrasting) school. Thus, we do not claim to have a "control" school but rather a second site against which we will contrast the experience of the students and teacher at the intervention school.

The teacher and students at the intervention site completed a unit that integrated technology-assisted PBL when studying 19^{th}-century American history, whereas the teachers and students at the comparison school addressed the same topics (within the same time), but in ways that were not influenced by specific overarching goals and without purposeful technology integration.

Participants and Setting

We chose one district in Northern California for this study because students at the middle school level received content instruction (e.g., social studies classes) in heterogeneous settings, allowing an opportunity to examine potential learning benefits for students who were academically diverse in a mainstream environment. In addition, we were aware that the district had an adequate infrastructure to support the use of technology. Finally, despite having only two middle schools (and eight K–5 schools) in the district with a little more than 4,000 students in all, veteran social studies teachers taught at both schools and agreed to participate at each school for the purpose of the project.

Demographic information for the schools in this study is presented in Table 1 (page 156). The participating teacher at the intervention school was a veteran teacher (33 years); however, only her five most recent years were at the middle school level. She taught a yearlong social studies course, which in the eighth grade corresponds with the American Revolution, the early Republic, westward expansion, the Civil War, and post Reconstruction period. A total of 100 (90%) students participated based on parent permission and complete data (i.e., they were present during both pre- and posttesting). Five students did not complete the posttest due to illness.

At the contrasting school, two female teachers—one a veteran middle school educator of 19 years, and a second who had taught for seven years—taught three "core" sections (i.e., a combined, or double, language arts and social studies section) comparable to the four history/social studies periods at the intervention school. A total of 70 students (95%) were available as participants based on parent permission and complete data (they were present during both pre- and posttesting).

General Instructional Procedures

Students in both conditions learned about westward expansion during a six-week period and had the same number of lessons for learning content. State content standards were used to guide instruction and indicated students were to learn about "the divergent paths of the American people from 1800 to the mid-1800s and the challenges they faced," in three regions—the Northeast, the South, and the West (California State Board of Education, 1998). A summary of the instructional procedures in both conditions follows; a more detailed account of the instructional procedures is reported elsewhere (De La Paz & Hernández-Ramos, 2009).

Intervention condition. Students were assigned to different groups (to study one geographic region each, allowing us to determine the extent to which they

Table 1: Summary Demographic Information for Intervention and Contrasting Schools

	Intervention	Contrast
Enrollment	746	771
Ethnic Identification	%	%
Pacific Islander	1	1
Filipino	1	1
American Indian or Alaska Native	1	1
African American	3	2
Asian	11	9
Hispanic or Latino	18	11
White	63	75
Multiple or No Response	2	1
English Proficiency		
English Learners	4.4	2.0
"Fluent English Proficient"	10.2	8.3
Reclassified Proficient	4.0	3.0
Students with Disability	11	11
Born in the United States	90	94
Free or Reduced Lunch	15.5	5.0
Parent Education (Response Rate)	98	89
Not High School Graduates	4	1
High School Graduates	16	12
Attended College	31	30
College Graduates	32	37
Completed Graduate School	17	20

learned not only about their assigned region but also the two other regions. Students knew that at the end of the unit, they would learn about the other two regions from their classmates during group presentations. We illustrate one overarching question (for the South) and related materials from the content standards in Appendix A. The teacher formed six heterogeneous groups (two for each region) within each of her four classes, including in each group students who showed a potential for leadership as well as those with learning difficulties. The researchers developed a digital set of primary and secondary sources that supported the state content standards and a sample project using the mPower software (Multimedia Design Corporation, 2005) on a previously studied topic (the Boston Massacre), which would be demonstrated during instruction. We selected this particular software tool because it appeared ideal for the creation of multimedia presentations, was relatively easy to learn by middle school students who already had some computer skills, would allow the users to easily make nonlinear connections between scenes (slides), and was a generic form of software (i.e., it does not include subject-specific content).

During the first four weeks, we taught students about the use and interpretation of different types of primary and secondary sources, note taking, and use of the software they were to use for their projects. The first and second authors were not both present at the same time; however, although we alternated when present, we were there on a daily basis (five days per week). Our relationship with the teacher was collaborative, as we co-taught the lessons on historical understanding and supported her use of technology in the computer lab. The second author was present on a daily basis for the first two weeks of instruction, and the first author was present on a daily basis during the last two weeks of instruction. Our roles were to observe and support the intervention teacher as she taught students to reason with primary and secondary sources in small groups, and then to support her use of technology in the school's computer lab.

The last two weeks of the intervention took place in the school's computer lab. Each group presented their completed project during the final three days of the intervention, reviewing each scene and all accompanying content. The students also made public presentations of all projects to the entire school and to parents and guardians at an "open house."

Contrasting condition. The social studies course at the comparison school contained the same yearlong content. We did not provide teachers in this condition with a set of materials to use in their instruction; however, the second author met with them several times before the study began to ensure that students in this condition would have an opportunity to learn the same content standards as those in the intervention condition. They taught thematically, moving from (a) civil rights and suffrage, to (b) westward expansion, to (c) civil war, with perspectives from the North and the South. Importantly, these meetings and our observations of their teaching revealed that the teaching and learning in the comparison condition was not limited to lecture and recitation, nor did teachers view history as a fixed story with established facts to be memorized (Page, 1991; Ravitch & Finn, 1987). Students in this condition often engaged in simulation, a technique that has been shown to be an effective approach for teaching empathy in social studies classrooms (Grant, 2001).

Summary. Teachers in both conditions planned instructional units after collaboratively determining the content that was to be assessed on the pre- and posttest. A veteran teacher taught students in both conditions. Students in both conditions experienced an approach to instruction that allowed them to learn from each other, and they used a variety of resources that went beyond traditional textbook, lecture, and recitation. They also used primary and secondary sources and were asked to write at least one journal entry. The essential differences between the two conditions centered on (a) whether there was a single culminating group project, (b) if group learning served as the primary means for constructing knowledge of the entire unit, and (c) whether students used technology to create multimedia projects.

Assessment Rubric: Multimedia Documentary

Criteria	1	2	3	4
Technical	Project does not run satisfactorily. There are too many technical problems to view the project.	Project runs minimally. There are many technical problems when viewing the project.	Project runs adequately with minor technical problems.	Project runs perfectly with no technical problems. For example, there are no error messages, all sound, video, or other files are found.
Navigation	Buttons or navigational tools are absent or confusing. No buttons and navigational tools work.	Moderate difficulty experienced while navigating through project.	Few difficulties experienced while navigating through project.	Users can progress intuitively throughout entire project in a logical path to find information. All buttons and navigational tools work.
Completion	Project is incomplete and contains many unfinished elements.	Project is incomplete and contains some unfinished elements.	Project is incomplete and contains several unfinished elements.	Project is completely finished.
Use of Enhancements	No graphics, video, audio, 3-D, OR other enhancements are present or use of these tools is inappropriate.	Limited graphics, video, audio, 3-D, or others enhancements are present but do not always enrich the learning experience. In some instances, use of these enhancements is inappropriate.	Most graphics, video, audio, 3-D, or other enhancements are used appropriately to enrich the experience. For example, clips are either too long or too short to be meaningful.	All graphics, video, audio, 3-D, or other enhancements are used effectively to enrich the learning experience. Enhancements contribute significantly to convey the intended meaning.

Organization	The sequence of information is not logical. Menus and paths to information are not evident.	The sequence of information is somewhat logical. Menus and paths are confusing and flawed.	The sequence of information is logical. Menus and paths to most information are clear and direct.	The sequence of information is logical and intuitive. Menus and paths to all information are clear and direct.
Branching	Project contains few choices. The design is linear.	Project contains few well-designed and age appropriate choices. The design is primarily linear.	Although project contains some well-designed and age-appropriate choices, some portions are linear.	Project is truly multimedia, rather than linear, and contains a significant number of well-designed and age-appropriate choices.
Citing Resources	No sources are properly cited within the project according to required style.	Few sources are properly cited within the project according to required style.	Most sources are properly cited within the project according to required style.	All sources are properly cited within the project according to required style.
Curriculum Alignments	No evidence of connection to target curriculum. Users are not likely to learn from this project.	Some evidence of connection to target curriculum. Users may learn from this project.	Adequate evidence of connection to target curriculum. Users are likely to learn from this project.	Clear evidence of connection to target curriculum. Frequent and clear references are made to facts, concepts, and cited resources. Users will learn from this project.
Subject Knowledge	Subject knowledge is not evident. Information is confusing, incorrect, or flawed.	Some subject knowledge is evident. Some information is confusing, incorrect, or flawed.	Subject knowledge is evident in much of the project. Most information is clear, appropriate, and correct.	Subject knowledge is evident throughout the project. All information is clear, appropriate, and correct.

Figure 1. Assessment rubric for group multimedia mini-documentaries.

Table 2: Descriptive Information of Teacher-Created Knowledge Test, High-Stakes Posttest Knowledge, and Opinion Scores by Students in the Two Conditions

		Pretest		Posttest	
Measure	N	M	(SD)	M	(SD)
Knowledge Test **					
Intervention	99	9.6	(6.0)	41.8	(5.4)
Contrasting	70	11.0	(7.1)	27.4	(7.2)
Early Republic Score+					
Intervention	100	n/a	n/a	15.85	(6.82)
Contrasting	70	n/a	n/a	13.63	(4.25)
California Social Studies Score+					
Intervention	100	n/a	n/a	376.53	(57.06)
Contrasting	70	n/a	n/a	348.56	(59.17)
Perceived Knowledge *					
Intervention	98	3.1	(0.6)	3.9	(0.6)
Contrasting	65	2.9	(0.7)	3.6	(0.7)
Test Self-Efficacy *					
Intervention	98	4.1	(0.8)	4.2	(0.6)
Contrasting	65	3.7	(0.7)	3.9	(0.7)
Social Learning **					
Intervention	98	3.4	(0.6)	3.6	(0.8)
Contrasting	65	3.4	(0.7)	3.3	(0.6)
Active S. S. Learning					
Intervention	98	3.6	(0.9)	3.7	(0.6)
Contrasting	65	3.4	(0.7)	3.3	(0.7)
Attitude toward S. S. **					
Intervention	98	3.7	(0.7)	3.8	(0.7)
Contrasting	65	3.5	(0.9)	3.3	(0.7)

Notes: + = *Significant main effects for condition.*
* = *Significant main effects for time of test and condition.*
** = *Significant interaction between time of test and condition.*

Data Sources

Knowledge tests. A 50-item multiple-choice test developed for this study was administered before and after the PBL unit. The social studies teacher at the intervention school initially created this test, and the two social studies teachers at the comparison school modified it. The final version was agreed upon after four revisions. The test was based on state content standards for the westward expansion unit. The questions and responses included released items from previous state, district, and county tests, as well as questions created from the district-adopted text.

Also, two months after the unit ended, all students took a high-stakes, state-required social studies exam covering content from the eighth grade curriculum as well as the two previous years' of social studies curriculum. We examined if students were able to generalize their knowledge on questions from the same era (using subscale information) and whether they held an advantage over students in the comparison condition for the entire test (based on the total test score). This test included questions from the Renaissance, the early Republic, and the Civil War at the eighth grade level. We used the early Republic questions and the score on the entire California social studies test to determine whether students in the intervention condition were performing at the same level or at a different level than students in the contrasting condition.

Multimedia projects. We first examined the 24 multimedia projects that the students at the intervention school generated at the group level (using the rubric shown in Figure 1, pages 158–159) to determine the overall quality and to allow us to make descriptive comparisons. The contents of individual scenes were also evaluated to determine the degree to which students' work showed evidence of historical thinking.

Opinion survey. To gauge the emotional and affective impact of the different modes of instruction at the two schools on student's attitudes toward learning, we administered a pretest and posttest survey (based on MacArthur, Ferretti, & Okolo, 2001) composed of 24 five-point Likert items. Five concepts motivated the instrument: (a) perceived knowledge (four items, Cronbach's alpha = .70; e.g., "I know a lot about early 19th-century American history"), (b) test self-efficacy (six items, Cronbach's alpha = .85; e.g., "I can do well on a test about social studies"), (c) social learning (five items, Cronbach's alpha = .73; e.g., "I like studying with others in social studies class"), (d) active social studies learning (six items, Cronbach's alpha = .85; e.g., "I would like to learn more about social studies"), and (e) attitude toward social studies (three items, Cronbach's alpha = .66; e.g., "Understanding history and social studies is very important to me"). The posttest survey at the intervention school included eight additional items measuring attitudes and opinions about the multimedia project by asking students to rate their perception of the overall value of the project, whether they thought the skills they learned would transfer to new learning situations, whether their group accomplished the goals of the project, and so on.

RESULTS

Research Question 1: Do eighth grade students who learn history through technology-assisted project-based learning experiences acquire more, the same, or less content knowledge than students in a comparison condition?

To answer this question, we looked at data from the teacher-created test and from the state-administered high-stakes test. Table 2 presents scores on the teacher-created exam at pretest and posttest, descriptive information on posttest content knowledge using the state exam, and pre- and posttest opinion scores by students in the two conditions.

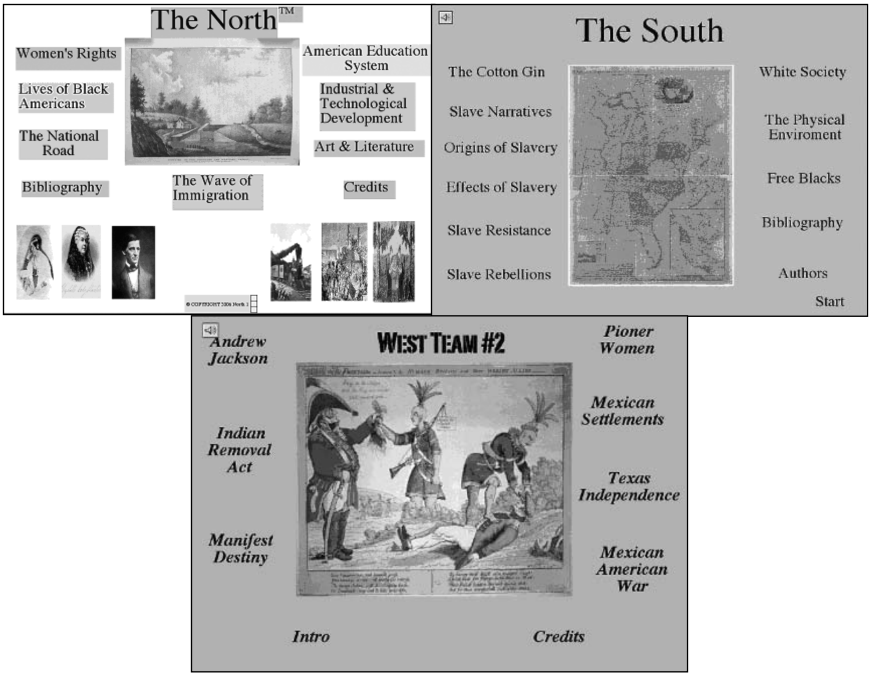

Figure 2: Screenshots of the main screens for three group projects.

Knowledge tests. A 2 (condition) x 2 (trials) repeated-measures ANOVA design was used to evaluate the relationship between students in the two conditions and content knowledge at pretest and posttest (see Table 2, page 160). Statistical analyses showed main effects for time of test, $F(1, 167) = 1500.72$, MSE = 32.22, $p = .000$ (effect size = -.19 at pretest), and condition, $F(1, 167) = 73.12$, MSE = 47.98, $p = .000$ (effect size = 1.99 at posttest). However, the main effects were qualified by a significant interaction between time and condition, $F(1, 167) = 159.27$, MSE = 32.22, $p = .000$. Therefore, whereas before instruction, students in the intervention and contrasting conditions did not differ with respect to their initial levels of content knowledge, after instruction they did. Students who completed the unit by working in cooperative groups to create multimedia projects, and who learned about content from each other, did in fact learn more than students in a comparison group who received instruction in a whole-class form of social studies instruction.

Two separate ANOVAs were conducted to evaluate the relationship between students in the two conditions and performance on the state-administered content test (at posttest only). Regarding the subtest covering comparable content from the six-week unit, the finding was significant in favor of students at the intervention school, $F(1, 168) = 5.84$, $p = .017$ (effect size = 0.52), who also outperformed students in the contrasting group on the overall test, $F(1, 168) = 9.60$, $p = .002$ (effect size = 0.47). Although there is no pretest data, the difference in favor of students at the intervention school is consistent with the results from the teacher-created test.

Table 3: Proportions of Sources Used by Region Studied

Region	North	South	West
Source			
Textbook	45	55	21
Primary Source	48	5	67
Secondary Source	8*	40	12

** Does not add to 100% due to rounding.*

Note: Average of the raters' estimates of the percentage for each type of source within each project.

Table 4: Evidence of Historical Thinking in Students' Scenes (Percentages)

Region	Level 1	Level 2	Level 3
North	5.0	12.5	14.2
South	3.5	12.5	16.3
West	3.0	19.0	14.2
Total	11.5	44.0	44.7*

** Percentages do not add to 100 due to rounding.*

Note: Level 1: Factual information presented, nothing else is in scene.
Level 2: Interprets factual information without supporting evidence.
Level 3: Supporting evidence includes one of the following: a quote to support a claim, a citation to support a claim, an example to support a claim, or demonstration of understanding of historical significance of an event.

Research Question 2: Is historical thinking evident in the multimedia mini-documentary projects created by students, as a result of a six-week collaborative unit on westward expansion?

To answer this question we looked at several forms of data from the multimedia projects.

Having the students work collaboratively to develop the multimedia mini-documentaries (Figure 2 shows the main screens from three average projects) was a distinctive aspect of the pedagogical intervention, as it afforded students opportunities to practice many of the historical thinking skills they had been instructed on (e.g., how to use primary and secondary sources, interpreting and synthesizing information, establishing connections). Trained coders (one graduate student and two undergraduates) used a four-level rubric (see Figure 1, pages 158–159) to evaluate the group projects along six formal criteria (technical, navigation, completion, use of enhancements, organization, and branching) and three history-specific criteria (citing sources, curriculum alignments, and subject knowledge).

Considering the latter three criteria only because they concern the ability to demonstrate factual content and awareness of different types of sources, coders agreed on 82 percent of their judgments (59 of 72 possible), and the overall differences were not statistically significant. (Twelve of the 13 noncoinciding judgments differed by one point, and only one differed by two points.) Differences in agreement were resolved in discussion, and final scores were used for analyses. On a scale from 1 to 4, with the higher number indicating better work, the 24 projects averaged 3.88 (SD = .34) for Citing Sources, 2.92 (SD = .50) for Curriculum Alignment, and 3.21 (SD = .42) for Subject Knowledge. If these scores were translated into grade equivalents, which is possible given a 4-point scale, these findings indicate that students earned roughly an A- for citing sources and about a B for aligning the requisite curriculum to the content in their projects and for their command of the historical content. These data provide additional evidence that students were able to learn the objectives indicated by the standards.

Use of sources. We also analyzed group projects for the type of sources that students used to determine the relative importance of the role of the textbook as compared to the primary and secondary sources available. To do this, we averaged the raters' estimates of the percentage for each type of source across projects: textbooks, 40%; primary sources, 40%; and secondary sources, 20%; showing that when given a large database of primary and secondary sources, many student teams were willing to go beyond the textbook for a substantial portion of their resources. However, the types of sources that students used most varied somewhat depending on the region that they were studying (see Table 3, page 163). Thus, although charged with "covering" the same content standards within each region, there were some variations in emphasis on the types of sources used across regions.

Content of scenes. We analyzed each scene in the multimedia projects according to the degree to which students engaged in sourcing, contextualization, and interpretation of primary and secondary sources. We defined three levels, ranging from simple presentation of factual information (Level 1), in which students did not engage in historical thinking, to a second level, in which students provided an interpretation of factual information without supporting evidence (Level 2). At the third level, the student demonstrated an understanding that claims in history are evidence based, and as such, this could be demonstrated in any of the following ways: use of (a) a quote to support a claim or an idea, (b) a citation to support a claim or an idea, (c) an example to support a claim, or (d) demonstrating understanding of the historical significance of the event. We coded only content scenes. We did not analyze the introduction, table of contents, bibliography, or credits scenes required of all projects. We assigned some scenes more than one code (e.g., when a scene included a quote and also showed understanding of the historical significance of an event). Table 4 (page 163) presents the percentage of each level of historical thinking across regions.

The results indicate that most students did not limit themselves to merely reporting facts, regardless of the region (or unit problem) that they were assigned. Only 11.5% of the total scenes had no interpretation of information. The remaining scenes were evenly split (about 44%) between those in which students attempted to interpret information (but gave no supporting evidence) and scenes in which students provided some means of evidence in the form of a quote, example, citation, or by demonstrating understanding of the historical significance of the event, all of which are indications of emerging historical reasoning in secondary students (Lévesque, 2009; Monte-Sano, 2008).

One student's scene was titled, "What were Jackson's thoughts on the Bank of the United States?" The student wrote:

> Jackson thought the Bank of the United States was absurd. He thought the bank was unconstitutional. He believed only states, not the federal government, had the right to charter banks. He also felt that the bank helped aristocrats at the expense of the common people. He warned: 'When the laws undertake … to make the rich richer and the potent more powerful, the humble members of society—the farmers, mechanics, and laborers— … have a right to complain of the injustice of their government.

This quote demonstrates awareness by the student that her views about Jackson's beliefs are more believable when followed by an excerpt from Jackson's statements on the issue.

In contrast, we provide an example from a different scene on Horace Mann, in which another student with average abilities embeds an interpretation without supporting evidence:

> Horace Man was a man of many talents and leadership skills. He graduated from Brown University in 1819 and tutored in Greek and Latin. As a leader in Massachusetts's schools he built new schools and he also opened three new colleges to train teachers. He would hold speaking tours that would promote educational reforms. *His viewers gradually grew into interest with enthusiasm and then he finally received a strong approval from his audience* [italics added to highlight the student's interpretation].

During the1850s, most northern states had set up free tax-supported elementary schools. In this example, the student's opinion regarding the evolution of Mann's acceptance would have been validated with additional support by citing a source (such as a quote or title in which this information had been evident) or providing an example of his acceptance as evidence.

Summary. The multimedia projects varied in quality—in terms of the depth of historical thinking evident in scenes and in entire projects—as was to be expected from the fact that, for most students, this was their first time working collaboratively to create this kind of product, as well as learning history in a new way. If their work had been graded, on average they would have earned roughly an A- for citing sources, and about a B for aligning the curriculum to the content in their projects and for their command of the historical content. Students used the textbook and primary sources about 40% of the time and secondary sources about 20% of the time in the creation of their projects. Finally, students produced few scenes (about 11%) without interpreting information, whereas the remaining scenes (about 89%) included those in which students attempted to interpret information but gave no supporting evidence (about 44%) or scenes in which some means of evidence was provided in the form of a quote, example, citation, or a student's awareness of historical significance beyond an a single event (about 45%).

Table 5: Analysis of Variance Results on Opinion Survey Scales

Scale	Term	*df*	*F*	MSE	*p*
Perceived Knowledge	Time of Test	(1,161)	198.30	31.84	.000
Perceived Knowledge	Condition	(1,161)	6.89	0.632	.010
Test Self-Efficacy	Time of Test	(1,161)	6.60	0.26	.011
Test Self-Efficacy	Condition	(1,161)	13.56	0.736	.000
Social Learning	Condition	(1,161)	4.31	0.24	.039
Attitude toward Social Studies	Condition	(1,161)	4.78	0.21	.030

Research Question 3: Do eighth grade students who learn history through technology-assisted project-based learning experiences develop positive attitudes and beliefs about social studies and the study of history in particular?

To address this question, we analyzed data from the attitudes and opinion survey, first looking at both conditions and then at additional data from the intervention group.

A 2 (condition) x 2 (trials) repeated measures ANOVA analysis was conducted at pre- and posttest. Table 2 (page 160) presents descriptive information, and Table 5 the results of the analyses of variance. Of the five attitude and opinion measures, only two showed significant interaction effects, indicating a positive shift due to condition: Social Learning ("I like studying with others"), and Attitude toward Social Studies ("Understanding history and social studies is very important to me"). Two other measures—Perceived Knowledge and Test Self-Efficacy—showed main effects of time of test and condition. The remaining Active Social Studies Learning scale had no significant terms (time of test, condition, or interaction).

Seven additional opinion questions in the posttest questionnaire asked students at the intervention school to report their views using 5-point Likert items (1 = strongly disagree, 3 = not sure, 5 = strongly agree) on the following aspects of the project: (a) "I was well informed about the goals for this project" (x = 4.15, SD = .67), (b) "Working on the project helped my learning" (x = 4.19, SD = .71), (c) "I enjoyed working with my group to create the multimedia documentary" (x = 4.06, SD = .77), (d) "I will be able to use the skills I have learned working on this project" (x = 3.97, SD = .83), (e) "Doing the multimedia documentary was a good way for me to learn about my region" (x = 4.27, SD = .76), (f) "My group accomplished the goals of the project" (x = 4.35, SD = .62), and (g) "Listening to the presentations from the other teams was a good way for me to learn about the other regions" (x = 3.84, SD = 1.06).

Taken as a whole, these data suggest that most students at the intervention school had positive views about their experience working collaboratively to create a multimedia project in history. These results are consistent with other reports in the literature that also point to improved attitudes and engagement with social studies—and history in particular—as a consequence of project- or problem-based learning involving products and performances assisted by technology (e.g., Scheuerell, 2008; Spires et al., 2008).

DISCUSSION

In this article we aimed to provide evidence of the effectiveness of technology-assisted project-based learning to teach history in a middle school setting. We documented and examined how a social studies teacher and her eighth grade students completed a unit on westward expansion and contrasted their experience to that of a similar group of students in the same grade at a nearby school. Students in the intervention group demonstrated greater knowledge gains after instruction than students in the contrasting group, thus providing reasons for optimism regarding concerns among teachers and administrators that technology-enhanced PBL is not as "effective" as more traditional teaching methods. Our report also shows positive affective benefits for students in the intervention group and provides evidence that their work in the multimedia projects enhanced their historical thinking skills.

The pedagogical intervention described here combined direct instruction with a unit-focused project that required student activity and creativity, as well as ways of working (in groups rather than alone) that constructivist theory says should lead to enhanced learning. Concerning historical thinking, it was encouraging to see from the rubric data the fairly good grade equivalents on citing sources (A-) and subject knowledge (B). More importantly, we found evidence that many students engaged in the type of historical thinking expected of them, despite the multiple demands that this project made on their learning. Not only did they demonstrate their understandings through group projects that were created using a new form of software (two changes from their former learning environment), they were also were capable of learning history through primary and secondary sources. As a result, it is encouraging to note the extent to which students used these alternate sources in their projects (and the differences that occurred across regions, or unit problems). Such differentiation suggests that when given an opportunity to select these types of sources to enrich and expand on the content from their textbook, students will do so. We also noted that students in the intervention condition were able to grasp a fundamental understanding that history is more than merely presenting facts. Historical reasoning requires interpretation of facts, and a disciplinary interpretation situates evidence in support of claims, facts, or interpretations (Monte-Sano, 2008).

We also found evidence that students' attitudes toward learning history and social studies, and toward working with others, were significantly more positively affected by the PBL experience compared to students in the comparison group. In addition, intervention school students rated the experience quite favorably, agreeing that the project helped their learning, that they enjoyed working on it, and that they felt they could apply the skills learned to future projects. This type of affective or emotional benefits to students from participation in PBL experiences (e.g., Blumenfeld et al., 1991; Strobel & van Barneveld, 2009; Thomas, 2000) and from meaningful work with technology (Boethel & Dimock, 1999; Ringstaff & Kelly, 2002) have been well documented in the research, but are often not given as much weight as the results of objective or standardized tests (see also Heafner & Friedman, 2008). From our constructivist perspective, it is critical that students should want to learn about the subject matter they are being exposed to in schools, not just to pass tests but because they can recognize that history and social studies learning are critical for effective citizenship in contemporary democratic societies (e.g., Bennett & Fessenden, 2006; Cantu & Warren, 2003; Lee, 2000; Levstik, 2001).

For the teacher and for many of her students at the intervention school, working with technology was also a motivating factor (Blumenfeld et al., 1991) because they were able to recognize how access to the technology had enhanced the nature and quality of the PBL experience—for example, by enhancing the public presentation of the projects. The teacher (and quite a few of the students) recognized that having to present their projects to a variety of audiences—their peers, the school, the community during the open house—not only created some performance anxiety but was also a factor motivating them to do their best, as people other than their teacher were going to see their work. Student attendance at all their peers' presentations and the opportunity to ask questions at the end of each presentation may have combined to overcome one of the limitations that Lehrer, Erickson, and Connell (1994) encountered in their study, in which students also worked hard to create multimedia presentations but had difficulty learning from the works of their peers. It would seem that having access to the multimedia mini-documentaries in addition to making and attending the presentations do make a difference in student achievement.

Limitations

Research studies aiming to demonstrate the advantages of one type of instruction over another ideally would be able to control all the key variables in an experimental setting. In education, such designs are difficult to carry out (Sorensen, Smaldino, & Walker, 2005). Our circumstances did not allow for the random assignment of teachers and students to conditions, nor could we alter the instruction at the comparison school. Other than agreeing on the unit content and timetable, we did not ask the teachers in the contrasting condition to integrate technology or to do anything differently than they had done in the past (they did provide several hands-on learning activities and provided opportunities to work in small groups for some projects). Despite these challenges, we can report that there were other similarities—in the setting, the participants' backgrounds, and in the way instruction was delivered—that render the contrasts drawn here relevant.

A different issue is raised by the fact that the driving question for the technology-assisted PBL experience was framed strictly according to the state content standards, with no opportunity for input by the students. One may reasonably wonder how meaningful those standards were to our eighth grade students. Did they perceive it as a genuine problem? To the extent that it was not, some of the motivational benefits of project-based learning would have been diminished. How to help teachers and students come up with their own driving questions that encompass the desired content to be addressed remains a pedagogical and professional development challenge (Caron, 2005).

Due to the methodological constraints, we cannot state categorically that the differences in student performance in the knowledge assessment tests used in this study were due only to the use of technology-enhanced PBL at the intervention school. The overall learning environment (teacher-centered instruction vs. "learning by doing" with technology and PBL) and specific activities that our measures did not capture could also explain to some extent the positive results in favor of students at the intervention school. The pedagogical design, based on constructivist thinking, considered the learning experience at the intervention school as integrated activities rather than as distinct elements to be evaluated separately.

CONCLUSIONS

This study serves to highlight the potential of technology-assisted PBL to enhance middle school students' learning of history in school settings where most organizational factors remain constant (such as curriculum, time periods, etc.) and where there has been little or no prior experience working with alternative instructional strategies.

This study also points to several significant areas in need of further research. Researchers might work in collaboration with history teachers to help students integrate technology in ways that promote disciplinary thinking, as well as devise learning projects that are more meaningful for students. For instance, if given a unit problem that focused on a historical controversy or mystery, students could examine evidence in sources and construct projects that showed their understanding of an event. Second, researchers should explore how to design PBL experiences that let students create the driving/central questions—even if required to reference state content standards directly—and contribute to decisions on strategies for presentation, including software.

Future research that aims to replicate and expand upon the findings in this study is needed, as is more work designed to identify in greater detail what aspects of the instructional process are most responsible for students' demonstrated achievement. Although we recognize that it would be advantageous for future researchers to improve on our design to test the effects of technology-enhanced project-based learning, the results of this study provide at least tentative support for this type of learning in middle school history classrooms. Finally, we are reminded that, whereas a single experience in technology-assisted PBL may be effective at increasing student achievement on the specific unit under study or provide a temporary gain in their ability to think historically, regular opportunities to work with technology in PBL are more likely to result in sustained improvements in student achievement and lead to an even deeper understanding and appreciation of history.

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References

Barton, K. C., & Levstik, L. S. (2003). Why don't more history teachers engage students in interpretation? *Social Education, 67*, 358–361.

Bennett, L., & Fessenden, J. (2006). Citizenship through online communication. *Social Education 70*(3), 144–146.

Blumenfeld, P. C., Soloway, E., Marx, R. W., Krajcik, J. S., Guzdial, M., & Palincsar, A. (1991). Motivating project-based learning: Sustaining the doing, supporting the learning. *Educational Psychologist, 26*(3 & 4), 369–398.

Boethel, M., & Dimock, K. V. (1999). *Constructing knowledge with technology. A review of the literature.* Austin, TX: Southwest Educational Development Laboratory.

Brooks, M. G., & Brooks, J. G. (1999). The courage to be a constructivist. *Educational Leadership, 57*(3), 18–24.

Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher, 18*, 32–42.

Buck Institute for Education. (2003). *Project based learning handbook.* Novato, CA: Author.

California State Board of Education. (1998). *History-social science content standards for California public schools. Kindergarten thorugh Grade 12.* Sacramento, CA: Author. Retrieved on November 1, 2009, from http://www.cde.ca.gov/be/st/ss/documents/histsocscistnd.pdf

Cantu, D. A., & Warren, W. J. (2003). *Teaching history in the digital classroom.* Armonk, NY: M. E. Sharpe.

Caron, E. (2005). What leads to the fall of a great empire? Using central questions to design issues-based history units. *The Social Studies,* 51–60.

Daley, E. (2003). Expanding the concept of literacy. *EDUCAUSE Review, 38*(2), 32–40.

De La Paz, S., & Hernández-Ramos, P. (2009, April). *Learning history with project-based learning: Effects for students with and without learning disabilities.* Paper presented at the Annual Meeting of the American Education Research Association, San Diego, CA.

Drake, F. D., & McBride, L. W. (1997). Reinvigorating the teaching of history through alternative assessment. *The History Teacher, 30*, 145–173.

Ferster, B., Hammond, T., & Bull, G. (2006). Primary access: Creating digital documentaries in the social studies classroom. *Social Education, 70*(5), 147–150.

Fosnot, C. T. (Ed.) (2005). *Constructivism: Theory, perspectives, and practice* (2nd ed.). New York: Teachers College Press.

Fosnot, C. T., & Perry, R. S. (2005). Constructivism: A psychological theory of learning. In C. T. Fosnot (Ed.), *Constructivism: Theory, perspectives, and* prac*tice* (2nd ed., pp. 8–38). New York: Teachers College Press.

Friedman, A. M., & Heafner, T. L., (2007). "You think for me, so I don't have to." The effect of a technology-enhanced, inquiry learning environment on student learning in 11th grade United States History. *Contemporary Issues in Technology and Teacher Education, 7*, 199–216.

Grant, M. M., & Branch, R. M. (2005). Project-based learning in a middle school: Tracing abilities through the artifacts of learning. *Journal of Research on Technology in Education, 38,* 65–98.

Grant, S. G. (2001). It's just the facts, or is it? The relationship between teachers' practices and students' understandings of history. *Theory and Research in Social Education, 29*(1), 65–108.

Heafner, T. L., & Friedman, A. M. (2008). Wikis and constructivism in secondary social studies: Fostering a deeper understanding. *Computers in the Schools, 25*(3–4), 288–302.

Jonassen, D. H., Howland, J., Moore, J., & Marra, R. M. (2003). *Learning to solve problems with technology. A constructivist perspective* (2nd ed.). Upper Saddle River, NJ: Merrill Prentice Hall.

Kingsley, K. V., & Boone, R. (2008). Effects of multimedia software on achievement of middle school students in and American history class. *Journal of Research on Technology in Education, 41*(2), 203–221.

Lee, J. K. (2000). The e-citizen. *Social Education, 64*(6), 378–379.

Lee, J. K., & Hicks, D. (2006). Editorial: Discourse on technology in social education. *Contemporary Issues in Technology and Teacher Education, 6*(4), 414–417.

Lehrer, R., Erickson, J., & Connell, T. (1994). Learning by designing hypermedia documents. *Computers in the Schools, 10*, 227–254.

Lévesque, S. (2009, April). *"Why can't you just tell us?" The impact of digital technology and the need for technological pedagogical content knowledge: Lessons from the virtual historian with Canadian students.* Paper presented at the Annual Meeting of the American Educational Research Association, San Diego, CA.

Levstik, L. S. (2001). Crossing the empty spaces: Perspective taking in New Zealand adolescents' understanding of national history. In O. L. Davis Jr., E. A. Yeager, & S. J. Foster (Eds.), *Historical empathy and perspective taking in the social studies* (pp. 69–96). Lanham, MD: Rowand & Littlefield Publishers.

MacArthur, C. A., Ferretti, R. P., & Okolo, C. M. (2001). Technology applications for students with literacy problems: A critical review. *The Elementary School Journal, 101*, 273–301.

Mandell, N. (2008). Thinking like a historian: A framework for teaching and learning. *OAH Magazine of History, 22*(2), 55–63.

Monte-Sano, C. (2008). Qualities of historical writing instruction: A comparative case study of two teachers' practices. *American Educational Research Journal, 45*, 1045–1079.

Moursund, D. (2003). *Project-based learning using information technology* (2nd ed.). Eugene, OR: International Society for Technology in Education.

Multimedia Design Corporation. (2005). *mPower* [computer software]. Charlotte, NC: Author.

National Research Council. (2005). How students learn: History, mathematics, and science in the classroom. In M. S. Donovan & J. D. Bransford (Eds.), *Committee on how people learn, a targeted report for teachers.* Division of Behavioral and Social Sciences and Education. Washington, D.C.: The National Academies Press.

O'Brien, J., Grill, A., Schwarz, S., & Schlicht, J. (2006). Tracking current events: Using the Internet to explore unfolding stories. *Social Education, 70*(3), 160–164.

Page, R. N. (1991). *Lower track classrooms.* New York: Teachers College Press.

Ravitch, D., & Finn, C. (1987). *What do our 17-year-olds know?* New York: Harper & Row.

Richardson, V. (2003). Constructivist pedagogy. *Teachers College Record, 105*, 1623–1640.

Ringstaff, C., & Kelly, L. (2002). *The learning return on our educational technology investment. A review of findings from research.* San Francisco: WestEd.

Saye, J. W., & Brush, T. (2002). Scaffolding critical reasoning about history and social issues in multimedia supported learning environments. *Educational Technology Research & Development, 50*(3), 77–96.

Scheuerell, S. (2008). The great migration: Using a problem-based learning approach and the Internet. *Social Studies Research and Practice, 3*(1), 68–79.

Sorensen, C., Smaldino, S., & Walker, D. (2005). The perfect study: Demonstrating "what works" in teacher preparation using "gold standard" research designs in education. *Tech Trends, 49*(4), 16–19.

Spires, H. A., Lee, J. K., & Turner, K. A. (2008). Having our say: Middle grade student perspectives on school, technologies, and academic engagement. *Journal of Research on Technology in Education, 40*(4), 497–515.

Stearns, P. N., Seixas, P., & Wineburg, S. (2000). *Knowing teaching & learning history. National and international perspectives.* New York: New York University Press.

Strobel, J., & van Barneveld, A. (2009). When is PBL more effective? A metasynthesis of meta-analyses comparing PBL to conventional classrooms. *The Interdisciplinary Journal of Problem-Based Learning, 3*(1), 44–58.

Tally, B., & Goldenberg, L. B. (2005). Fostering historical thinking with digitized primary sources. *Journal of Research on Technology in Education, 38(*1), 1–21.

Technology Assistance Program. (1998). *TAP into Learning (Newsletter), 1*(1), 1–8. Retrieved on March 6, 2005, from http://www.sedl.org/pubs/catalog/items/tec99.html

Thomas, J. W. (2000). *A review of research on project-based learning.* San Rafael, CA: The Autodesk Foundation.

Wineburg, S. (2000). Making historical sense. In P. N. Stearns, P. Seixas, & S. Wineburg (Eds.), *Knowing teaching & learning history. National and international perspectives* (pp. 306–325). New York and London: New York University Press.

APPENDIX A

Unit Problem for the South

What do you know about people who lived in the southern part of America in the early to mid-1800s? What challenges did this mixed group of people face, given their differing paths throughout life? Our goal is to learn how people from the southern region of America lived from around 1800 to about 1850, and to see how they compare to people from the North and West. We are going to explore several events from the past, and use historical accounts and sources to construct our own interpretations of what it might have meant to live in this region at that time. When working on this unit, your group is going to construct a multimedia documentary that teaches other groups of students how people from the southern part of America lived from the early to mid-1800s.

Specific California state standards for this topic are: (a) describe the development of the agrarian economy in the South, identify the locations of the cotton-producing states, and discuss the significance of cotton and the cotton gin; (b) trace the origins and development of slavery and its effects on black Americans; (c) trace the effects of slavery on the region's political, social, religious, economic, and cultural development; (d) identify the strategies that were tried to both overturn and preserve slavery (e.g., through the writings and historical documents on Nat Turner, Denmark Vesey); (e) examine the characteristics of white Southern society; (f) examine how the physical environment in the South influenced events and conditions prior to the Civil War; and (g) compare the lives of and opportunities for free blacks in the North with those of free blacks in the South. (See California State Board of Education, 1998.)