

## CHAPTER 24

# Multimedia Learning of History

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### Abstract

This chapter discusses how multimedia learning environments have been used in history instruction and when learning with multimedia is effective. For the purposes of this chapter, multimedia learning is defined as acquiring knowledge in a domain through interacting with an educational environment that presents information using multiple sources. Media here are defined as channels by which information is accessed that differ based on the document, source (e.g., newspaper, biography, political speech, textbook), or mode of communication (e.g., texts, sounds, pictures, video, animation, maps, charts, graphs). Multimedia learning environments are used in history instruction for two main purposes: (1) multiple-source environments attempt to make history learning more like the activities of real historians, and (2) graphics or archives are often used to make the context of the time under question more engaging, vivid, or personally relevant for the learner.

### Introduction

Multimedia learning usually refers to computer-based learning tools such as CD-ROMs or the Internet in which text, pictures, animation, sounds, movies, and other media can be combined in the presentation of information. However, this is a somewhat narrower interpretation of multimedia than is appropriate in the case of learning about history. The usual history textbook combines texts of historical narratives with maps, charts, timelines, pictures, diagrams, and paintings to convey the historical facts or events. Furthermore, history teachers often supplement reading assignments and lectures with films or documentaries based on historical events. Therefore, even traditional textbook or classroom instruction in history can be considered multimedia. Likewise, the sense of multimedia needs to be broadened when we consider the various information sources that historians use as they attempt to study

history by searching out, considering, and interpreting different types of historical artifacts or evidence. In reconstructing a historical event, a historian may look to original source documents such as diaries, government documents, logs, photographs, and physical artifacts, or secondary documents such as newspaper reports, magazine articles, biographies, or other historians' evidence and interpretations. Therefore, the study of history, as the historian knows it, is essentially a multimedia experience as the historian compares and contrasts information across multiple sources, even when all sources might be of the same medium. Considering the information available in multiple artifacts requires integration across the different sources of information. Therefore, in a broad sense, learning from multiple sources, as it represents a form of multiple-channel learning, can also be considered as multimedia learning.

This chapter discusses the available evidence on how features of multimedia learning environments affect history learning and when learning with multimedia is effective. For the purposes of this chapter, multimedia learning is defined as acquiring knowledge in a domain through interacting with an educational environment that presents information using multiple sources. Media here is defined as channels by which information is accessed that differ based on the document, source (e.g., newspaper, biography, political speech, textbook), or mode of communication (e.g., texts, sounds, pictures, video, animation, maps, charts, graphs). Under this definition, educational activities that present a topic using multiple sources and/or multiple modes of communication are considered multimedia learning environments. Conversely, any topic that is introduced solely through one source or mode (text or otherwise) would be considered single-media learning.

Multimedia learning environments appear to be used in history instruction for two main purposes: (1) multiple-source environments attempt to make history learning more like the activities of real historians, and (2) graphics or archives are often used to

make the context of the time under question more engaging, vivid, or personally relevant for the learner.

### Enhancing Collective Memory versus Disciplinary Knowledge

The goal of learning in history is subject to multiple interpretations by educators (e.g., Quinlan, 1999). Seixas (2000) discussed two of the potential goals of history education as either "enhancing collective memory" or the "disciplinary approach." Enhancing collective memory is the traditional view of history education, which proposes that the goal of history instruction is to provide learners with a base of historical knowledge that is deemed important by authority figures who guide educational policy. Under this goal of history education, students' primary task is the memorization of events, names, dates, and locations preferably in the order in which they occurred (Spoehr & Spoehr, 1994).

The second approach to history instruction is based on teaching the skills of inquiry used by historians, and is consistent with constructivist theories of learning. The constructivist perspective proposes that learning that is done as a form of inquiry leads to better understanding of the subject matter than learning that is transmitted through lecture or memorization. In a history classroom with this approach, rather than being simply told to believe a single story or learn what is in the textbook, students are presented with information from a variety of sources and perspectives, and taught the standards of historical inquiry, investigation, and debate. Specifically, students learn by generating their own historical accounts and by evaluating the claims of other historical interpretations. In this "disciplinary approach" (Seixas, 2000), students come to understand what makes a valid historical account, the relation between evidence and interpretation, and the importance of comparison among alternative accounts.

The goal behind such a constructivist approach is to advance learning in history

beyond the simple accumulation in memory of isolated historical facts. It could be argued that the content domain of history could span all of the seminal events in human existence. Therefore, exhaustive teaching of all historical domain knowledge would seem to be an impossible exercise. Hence, teaching the skills necessary to assimilate, judge, and apply historical information may be a more appropriate goal of history education. An additional argument for this approach is that historical thinking skills of engaging in historical inquiry and writing in the historical genre are now part of the National Standards for History (National Center for History in the Schools, 1996). Similarly, the Advanced Placement (AP) tests in history include document-based questions, which usually provide both textual and graphic documents (e.g., editorial cartoons, charts, or maps) and require students to write short essay answers that require the integration and interpretation of the evidence provided in the documents. These reasons may explain why most research in multimedia instruction in history has been based in a "disciplinary approach" to history instruction.

### Research on Multimedia Learning of History

Two exemplary studies mark the beginning of cognitive approaches to multimedia history instruction. An influential monograph by Thomas Holt, a professional historian and college educator, sparked serious interest in teaching students relatively authentic historical inquiry skills (Holt, 1990). His monograph discusses providing students with primary sources in order to learn about Reconstruction efforts in the U.S. South following the Civil War. To learn about these people and this time, students were given several primary sources including a letter from freed slaves of Edisto Island, South Carolina, eloquently arguing for their right to own land they were given by the government, and that was subsequently taken from them and returned to the former (white)

owners. The students' use of multiple primary sources was supported by the teacher through a specific inquiry question. The students then were left to reason through the available evidence and confront the task of interpretation for themselves. Holt reported that students who engaged in this sort of history lesson started to see history as much more than learning names, dates, or "someone else's" facts about historical events. History is more than ordering events into established chronologies. Instead, authentic materials such as letters and diary entries prompt thinking, questioning, and interpretation. Students gain an understanding of the history as an inquiry process. They construct their own understanding of both the subject matter and the discipline. Holt further recommends this method of instruction at both college and high school levels, based on his interviews with high school students. His intuitions as a history teacher fall very close to a constructivist learning approach that is currently favored by many cognitively oriented researchers.

Around the same time as the Holt monograph, Wineburg published his own empirical investigation of the differences between the ways historians and students approach source documents and historical problem solving (Wineburg, 1991). Again, his study involved presenting people with multiple sources, in this case related to the Battle of Lexington during the American Revolutionary War. Participants were presented with several kinds of documents, including diary entries, a letter, a newspaper report, three paintings, and excerpts from an autobiography, a formal deposition, a historical novel, and a high school textbook. Then they were asked to think aloud as they constructed historical accounts of the battle. Wineburg documented several striking differences between novices and expert historians in the way they approached the documents. First, historians were more likely to identify the source of the information, comment on it, and use it as they interpreted the content. Wineburg refers to this as a *sourcing heuristic*. Second, historians attempted to place the events noted in the sources in a temporal

context or chronology. This is referred to as a *contextualization heuristic*. Third, historians were more likely to compare across documents and to identify overlap and inconsistencies between accounts. This is referred to as the *corroboration heuristic*. Expert reasoning was marked by the use of these three heuristics as they approached sources, whereas students in general failed to use any of these three strategies in their reading of the documents. A fourth strategy that some experts used was considering what was absent from the accounts, or the "silences" (Holt, 1990). The completeness of an account (in relation to other accounts) is another metric by which historians may judge the quality of a source.

Since the publication of Holt (1990) and Wineburg (1991) there has been considerable investigation of what it means to teach students to "think historically" (Spoehr & Spoehr, 1994), how multimedia sources can be used to promote inquiry, and how such programs of instruction can produce successful learning of the subject matter. Across studies, expert historians are seen to engage in the processes of placing historical events in context, placing events along a chronology, considering different accounts, evaluating the sources for possible bias, and considering the motivation of the authors in their interpretation of events (Leinhardt & Young, 1996; Okolo & Ferretti, 1998; Wineburg, 1991; Spoehr & Spoehr, 1994). As knowledge of expert historical thinking has advanced, instructional models have been created to engage students in contexts that resemble (to some extent) these aspects of genuine historical inquiry. Many of these contexts have used technology and multimedia, including primary sources, images, and videos obtained through the Internet or embedded as nodes in a hypertext, as well as scaffolded computerized learning environments, to promote historical thinking skills, historical reasoning, and argumentation from multiple sources. Spoehr has shown that hypertext can promote historical reasoning (Spoehr, 1992). Wiley and Voss have demonstrated that learning from multiple sources with an argument-writing task

leads to better understanding of the historical subject matter than learning from single sources (Wiley & Voss, 1996, 1999). Britt and colleagues have investigated the use of a learning environment called Sourcer's Apprentice that supports students in the use of expert sourcing heuristics, and have shown that such scaffolding improves learning in multiple-source learning environments (Britt & Aglinskis, 2002).

In an ambitious project, Spoehr and her colleagues created a substantial hypermedia corpus for high school history and humanities instruction called ACCESS (American Culture in Context: Enrichment for Secondary Schools). As of 1994, the corpus consisted of 36.6 MB of primary and secondary source materials, including textual, pictorial, audio and video materials, that spanned the years 1607-1970. The two teachers who first used ACCESS in their classrooms also helped to design the corpus, including the links and labels that were included between source materials.

The corpus was designed to supplement normal textbook materials and class instruction. Students engaged in concept-mapping tasks and problem-based essay tasks as they interacted with the corpus. Several assessments of learning outcomes show that this use of multimedia was beneficial to students. First, students in classes with ACCESS outperformed students from the previous year (with the same teachers) on their AP history tests (Spoehr & Spoehr, 1994). Second, they also created richer representation of historical concepts in concept maps on historical topics than did students in non-ACCESS classrooms (Spoehr & Spoehr, 1994). Third, Spoehr also reports that students in ACCESS classes wrote better essays than students in non-ACCESS classes, with better support for their arguments, better use of evidence, and deeper lines of discussion (Spoehr, 1992).

Although these positive results are impressive, there are many differences between the ACCESS and non-ACCESS classrooms that could all be helping students to develop better historical thinking skills. The fact that the teachers had advanced degrees

in their subject areas, and played a role in constructing the hypermedia corpus may have been very important. Similarly, thinking about how to use the corpus may have changed the teachers' approach to instruction, and this in itself could have had an impact on student learning. There are also many other factors that could have played a role. As a result, we cannot definitively attribute better history learning in these contexts to the presence of multimedia or its use in the classroom. However, these studies do suggest that when multimedia is used in problem-based inquiry tasks, with teachers who are involved in the construction of a corpus and who think about the best ways to integrate the corpus into ongoing instruction, then improvements in historical understanding can be obtained.

The obvious disadvantages of the ACCESS system are the extensive amount of time and skill that are required to construct a corpus similar to ACCESS. The structure of the hypertext seemed very important, as especially the vertical links placed by the teachers seemed key toward helping students be able to navigate and reflect on the context of each new topic that they encountered. A further difficulty is that sadly this system was developed in Hypercard, and may or may not have been transitioned to use within a Web browser. Finally, the participation of teachers in the construction of the corpus may have been critical for the better learning outcomes with the corpus, and this seems a tall order for most teachers of history to engage in designing a system of this magnitude and complexity. Thus, while there are several very promising aspects of this use of multimedia in the history classroom, systems with fewer demands on the teacher may be more practical.

Another multimedia instruction program that started as a Hypercard application has successfully made the transition to a Web browser application. Sourcer's Apprentice is a computer-based tutorial and multimedia environment that teaches document-level skills of sourcing, contextualization, and corroboration in the context of researching a historical controversy. This project has a long

history of research and development and has undergone several iterations (Britt, Perfetti, Van Dyke, & Gabrys, 2000; Perfetti, Britt, & Georgi, 1995; Perfetti, Britt, Rouet, Georgi, & Mason, 1994; Rouet, Britt, Mason, & Perfetti, 1996). The final product does seem to be quite effective. Britt and Aglinskas (2002) have found that high school students who were trained using Sourcer's Apprentice to analyze documents for one topic in history improved in using historical thinking skills on a new unit with another set of sources. These studies showed that historical thinking skills of sourcing, contextualization, and corroboration can be successfully taught through a relatively stand-alone multimedia unit. Further, it is not just exposure to primary source information, but the task of engaging in understanding a set of documents that seems to lead to improvements in historical thinking and understanding. In a second experiment where the same information was presented either embedded and interpreted in a textbook-like chapter or as a set of documents on the Sourcer's Apprentice bookshelf, students wrote better essays in the latter presentation mode (Britt & Aglinskas, 2002). The important implication of this second experiment is that historical thinking skills are promoted best by actually having students engage in the relatively authentic task of constructing their own analysis and interpretation of multiple documents. Finally, students who learned from Sourcer's Apprentice wrote more integrated essays, cited more sources, and referenced more evidence from the sources in their essays than did the comparison groups. This suggests that not only did they improve in their sourcing skills, but they also developed better understanding of the subject matter. These findings are important as they represent one of the few examples that multimedia use in the classroom can lead to superior learning in history.

The results of Britt and Aglinskas (2002) are also consistent with the results of another study that more specifically looked at the role of learning tasks and multimedia use on history learning. Wiley and Voss (1996, 1999) had students learn about the

Irish Potato Famine from either the Sourcer's Apprentice environment or a textbook-like chapter. Students were presented with either eight "sources" about the potato famine, or a single chapter containing the same exact information. Additionally, there was a manipulation of the writing task that students were given. All students were told that "Historian's work from sources including newspaper articles, autobiographies, and government documents like census reports to create histories. . . . Your task is to take the role of historian and develop a historical account about what produced the significant changes in Ireland's population between 1846 and 1850." Students were either asked to write an argument or a narrative by replacing the underlined phrase with "a narrative" or "an argument." No further instruction was given on what either type of essay would require. Students relied on their own intuitions about these essay types. Several measures of learning showed that students given the argument writing instruction and a multiple source environment, learned better than students in the single text and narrative instruction conditions. Follow-up studies found that the ability to look at multiple sources at once (Wiley, 2001) was also critical and allowed students to engage in more comparison and integration across sources. The important results that have been replicated across several studies (Voss & Wiley, 1997, 2000; Wiley, 2001; Wiley & Voss, 1996, 1999) are that learning tasks that seem to prompt the integration of information across sources, such as writing an argument, lead to the best learning from multiple sources. Presenting multiple sources alone does not lead to better learning. The interaction of the task and the presentation of information is significant, and both need to be present for students to engage in active learning and construct their own understanding of the topic to be explained. The importance of using a writing task that prompts integration or explanation has also been studied by other researchers. For instance, Stahl and his colleagues (Stahl, Hynd, Britton, McNish, & Bosquet, 1996) have examined differences

in learning when students write opinion versus descriptive essays. This work is also consistent with Greene (1994), who has found that writing tasks that prompt interpretation are best for developing historical thinking.

A final related study on the benefits of learning from multiple sources in history comes from O'Neill and colleagues (O'Neill & Sohbat, 2004; O'Neill, Sohbat, Martin, Asgari, Lort, & Sha, 2003) who designed a Web-based mentorship program to complement inquiry learning at the high school level. This program, called Tracking Canada's Past (TCP), is a 10-week history unit on the construction of the Canadian Pacific Railway (CPR). Instruction began with a two-week unit in which students were instructed on the traditional "textbook" history of the CPR. Then, they began group projects on issues about the CPR that were not presented in the textbook such as economic issues, labor issues, legal issues, and how the construction affected the native peoples.

What is interesting about this project is that the nature and content of the multimedia materials used by the students in their investigations was not controlled by the researchers (in contrast to all of the studies listed previously that preselected information for students), and due to this the content varied greatly between the different schools that participated. For example, some of the schools had limited access to the Internet while others had ample access, and some were able to use the public archives in their towns, while other towns discouraged the use of public archives by school groups (O'Neill et al., 2003). Instead of controlling or tracking the sources and modes of information accessed by students, this project used an online discussion board called the Knowledge Forum, (Scardamalia & Bereiter, 1994), where each student group communicated with an expert mentor. These mentors were either history graduate students or individuals from area historical societies who were familiar with the topic. The volunteer mentors communicated back and forth with students by posting messages on the discussion board, which were accessible to

all members of a group. The mentors worked with the students to help them decide how and where to look for evidence, how to judge and interpret the evidence, and how to report their findings. In their original design study, O'Neill et al. (2003) found that although there was great variability in the use of the discussion board between and within groups, the majority of students actively posted messages to the board and the vast majority of postings were project related. In a follow-up to their original design study, O'Neill and Sohbat (2004) attempted to assess students' levels of thinking about historical evidence and methodology before and after the program using an assessment based on Shemilt's (1987) categories of understanding of history. They found that 48% of the 112 tenth-graders that participated in the program showed signs of more advanced understanding of history as compared to pre-program measures. These results are promising because they show that multimedia-based inquiry projects may influence students' understanding of history as a discipline.

This project used learning activities with a complex set of features: extensive initial instruction in the content area, working in groups, the assignment of specific inquiry tasks, access to original source information, interaction with knowledgeable mentors to guide the multimedia inquiry, and the presentation of the results of the inquiry projects to the class. All of the features of the environment may have had an influence on how the students learned to talk about historical evidence. It has been noted that one of the primary differences between the expert and students in Wineburg's (1991) seminal study was their sense of audience in their presentation of arguments as evidence (see also Greene, 1994; Seixas, 1994a). Professional historians' writings were presented as if intended for a large audience engaged in an ongoing discourse on a controversy, while students discussed their writing as if it was intended for a single authority who would judge the "correctness" of their argument. The students in the TCP program may have achieved a more ex-

pert sense of audience through both their interactions with their expert mentors, as well as through having to present their findings to their peers. More study is needed to ferret out which set of this program's activities is responsible for improvements in students' historical thinking, but it is especially interesting to determine if providing students with expert and peer audiences for their thinking helps them to understand the nature of history better.

The preceding studies have all highlighted how multimedia environments can be used for inquiry tasks, in which the student emulates the authentic process of historical inquiry. A second main class of use of multimedia in the history classroom is the use of graphics, videos, or other artifacts to make the context of the time under question more engaging, vivid, or personally relevant for the learner.

In terms of generating interest, video-based media seems among the most compelling. Films have a huge impact on our sense of history. Starting as young children we glean our first images of heroes and historical events from films. Among fourth and fifth graders, Barton (1995) found that the most commonly reported sources of historical knowledge were from relatives and then from popular media, especially television and movies. But films, as informal sources of historical knowledge, perhaps remain the largest source of historical information for many. Both Wineburg and Seixas have noted the influence of films on people's understanding of history. Wineburg (2000) noted that both students and their parents make references to movies such as *Forrest Gump* and *Schindler's List* to support claims in their arguments about historical events. Seixas (1994b) found students were unable to appreciate that the film *Dances with Wolves* did not accurately depict that time.

In terms of use of film media in formal (classroom) instruction, some positive learning effects have been documented. For example, Swan (1994, 1996-1997) has investigated the use of a commercial hypermedia application called *Set on Freedom* to teach students about the civil rights movement.

Several studies have found advantages when students learned from chapters with video than from chapters without. Further, Swan has found that including videos as part of a hypermedia environment helps students to see relationships between historical events and people, places and ideas.

Another interesting use of graphics in interactive multimedia has been to teach young children a sense of historical time (Masterman & Rogers, 2002). Elementary school children often have great difficulty thinking about the past as continuous and connected to the present. Instead children's sense of the past has been described as an undifferentiated time when their parents or other people were young, and there were wars, dinosaurs, kings, and sometimes Jesus (Barton & Levstik, 1996; Lynn, 1993). Young children develop a number of heuristics for reasoning about historical time, such as the past being "colorless" (Masterman & Rogers, 2002) explaining why black and white photographs are of older times than those in color. The past happens before the child's life, and young children's only sense of chronology is through what they have experienced. Thus, their understanding of past time is often disconnected from the present and lumped together as one time before they were born. However, an understanding of chronology across both present and past is essential for historical understanding, and is a critical precursor to the skill of contextualization where the reader needs to place new information on events in their historical time and context. The understanding of historical time and chronology is often still incomplete even by the time students enter secondary school (Masterman & Rogers, 2002).

Using the metaphor of time travel, Masterman and Rogers (2002) developed a multimedia system that provided a road map timeline along which students found photographs, video, text, and audio clips about personalities and events in British history. In addition to mapping out a timeline, the program integrated some learning activities that involved sequencing tasks such as unscrambling diary pages and spotting anachronisms. Students navigated the road map with tasks

such as figuring out what happened during the Fire of London and finding out how the days of the week got their names. Students reported their findings in a logbook. Five pairs of British school children aged six and seven all showed some ability to reason about time using this system. All pairs were able to put the events of the Fire of London in sequence. Most pairs showed lively debate when asked to spot anachronisms. These observations suggest that sequencing activities such as these may facilitate the development of an understanding of historical time, but further evaluation needs to be done.

Several other researchers have used activities with photographs and graphics to help students develop a sense of historical time. In a series of studies, Barton and Levstik have also examined young children's abilities to sequence historical photos, and other ways of incorporating photographs into the history classroom (Barton & Levstik, 1996; Levstik & Barton, 1996). Based on his research, Barton (2001) has suggested that using historical pictures in the classroom is one way to engage students in historical inquiry activities. Barton proposes that instead of using pictures as mere visual aids or examples, historical pictures can be the content of the lesson, with students being explicitly taught how to analyze the photographs. In one activity, Barton suggests teachers could present students with historic pictures from different times at a single location, and ask probing questions to help the students think about what the differences are between sets of historical images, or differences between the historical images and what they see today. Smith and Blankinship (1999) created a multimedia activity very close to this suggestion in which students used digital cameras to take pictures of buildings and locations around their communities. Back at school, the students download the picture and location information into an interactive computer interface. Using Global Positioning System information, this system then searches a database for any pictures of that building or location from a large online database of historic photographs. This interface also gives students tools to use

to identify objects in the historic photos and make notes on differences and similarities between different eras. Both activities are intended to improve historical reasoning and analysis skills through the compelling and personally involving medium of photographs. However, because there has been no research done on these activities measuring learning outcomes, the effectiveness of using historic photographs in these ways in the classroom is still unknown.

Finally, one of the most powerful sources of information for historians are data archives, such as census data. In keeping with the trend toward authentic or discipline-based instruction, attempts have been made to use these tools in the classroom as well (Radinsky, 2004). For example, Radinsky and colleagues have developed a unit that uses census data as well as texts and maps, to teach students about the Great Migration of African Americans to the urban north of the United States in the early 20th century. This instructional unit was developed and tested on college students preparing to be history teachers. By design, the unit had four phases: (1) students read and discuss a secondary text and primary sources, and develop research questions, (2) students gather data from online documents, (3) students develop a historical argument and prepare a presentation, and (4) students present the results of their inquiry to the class.

The Great Migration unit has embedded in it several supports that seem important for effective learning. Embedded in the first phase was explicit instruction in the conventions of working from primary sources: making explicit observations from artifacts and discriminating observation from interpretation or inference. Students are also supported in this phase by the development of a concept map on the blackboard. All proposed inquiry questions are also recorded. For the second phase, students are given a preselected page of Web resources that can be used as starting points for their online inquiry. They are also scaffolded in their investigation through the use of a worksheet that prompts them to consider the nature of the source, and the claims and evidence it

offers (and conveniently, the program links the information entered on the worksheet to the original source). Students can also generate and add original text. Finally, students are prompted to give a theme label to each note they create. This helps them to reflect on which inquiry questions might be most answerable given the information they found, and theme labels often shift as inquiry progresses. Students are supported in creating an argument through a template Web page (basically a five-paragraph essay). Arguments consist of a main page with an introduction, outline of points, and conclusion, and are linked to three-point pages in which students must provide specific claims and evidence. Again the links to the original data sources are included.

The intended outcome, in addition to developing Web searching and authoring skills, is that students will gain a better understanding of what it is to “do history,” that is improvement in the skills of developing arguments from evidence and developing relevant and answerable research questions. Although no evaluation yet is available on this project, it incorporates several design principles that have been successful in supporting argument–evidence coordination in other subject matter areas (Loh et al., 2001) and several elements of this instructional unit are similar to those that have been used successfully in history instruction in the past (Britt & Aglinskas, 2002; Spoehr & Spoehr, 1994; Wiley & Voss, 1999). The use of census data and population maps is an interesting addition to the multimedia and primary sources that have been previously included in instruction and it will be interesting to see whether it can be leveraged into better student learning.

### Limitations of Research on Multimedia Learning of History

At the beginning of this chapter, we proposed that the process of authentic historical inquiry is by definition a multimedia experience. A growing number of researchers are

examining how instruction in the knowledge and skills of history as a discipline can be accomplished through specific-inquiry learning tasks and multimedia environments. A few studies have shown, on the basis of controlled experiments, that such multimedia learning can be effective (Britt & Aglinskas, 2002; Spoehr & Spoehr, 1994; Wiley & Voss, 1999). In addition to these important pieces of evidence about when multimedia learning in history can be effective, there have been many more investigations that have looked at other new and innovative ways to incorporate multimedia and technology into the classroom. One limitation of the remainder of this research is that the investigations tend to consist of "design studies" instead of controlled experiments. The data reported for many of these studies are observations about the pragmatic constraints of the technology and reports of the students' acceptance of or abilities to use the educational tools. While the systems or tools developed in this type of research are often strikingly creative, research that focuses on the usability of the technology should be viewed as research on multimedia design or use, and not as research on multimedia learning of history. The main difference is while the former avenue of research attempts to engineer multimedia technologies and courses for the classroom, the later attempts to uncover how multimedia learning environments affect the quality and type of domain knowledge students acquire.

There may be several reasons behind the lack of well-designed studies that systematically investigate the effects of the content and design of multimedia environments on history learning. First, because of the nature of history as a discipline, the need for and advantages of multimedia learning may often be taken for granted. A second reason may be that while rote memorization learning lends itself to easy assessment of learning outcomes, assessing improvement in historical disciplinary knowledge is less intuitive and straightforward.

Some studies on multimedia instruction in history do report pre-post gains in learning

and this is a good start. However, pre-post designs cannot address whether the multimedia environment is better than learning from a textbook or lectures. This is a critical question because the costs of multimedia instruction are typically higher than those that involve textbooks. The limitation of the literature on multimedia instruction in history is that only a small portion of studies have seen their way through to controlled experiments that can help us to understand which alternatives produce the best learning outcomes.

### Implications of Research on Multimedia Learning in History

Multimedia learning environments seem to be well suited for history instruction, especially when the goal of the instruction is to promote disciplinary knowledge in students. Historical thinking and reasoning skills can be acquired through inquiry-based learning tasks that require students to assess historical evidence and materials from across a number of sources. Students need to learn to compare and contrast differing accounts of historical events based on evidence from primary sources and historical artifacts. In multimedia inquiry tasks, students construct their knowledge of a historical topic, as opposed to being presented with information in one "true" narrative format. Because of the constructivist nature of these tasks, they are also consistent with cognitive theories of learning that predict that active inquiry tasks should be the most effective methods of promoting content knowledge. This prediction has been supported by some of the studies reviewed in this chapter (Britt and Aglinskas, 2002; Wiley & Voss, 1996, 1999). Therefore, the use of inquiry tasks in multimedia learning environments seems to be an effective way for learners to acquire both disciplinary knowledge and topic content knowledge.

However, as Wineburg (1991) showed in his expert/novice study of historical reasoning, these disciplinary skills of historical

inquiry do not come naturally to students. Therefore, simply giving students access to multiple sources or multimedia learning environments will not guarantee any meaningful learning. This type of knowledge needs to be acquired through participation in highly structured, guided activities with a clear problem-solving or inquiry goal. All the research studies in which significant learning gains were obtained in multimedia environments put students in these types of guided learning contexts. Furthermore, the research suggests that there are benefits to active instruction or guidance in the skills of historical inquiry (O'Neill & Sohbat, 2004) and that this type of instruction is appropriate in the earliest stages of education (Barton, 2002). Hence, at every level of history education students may benefit from direct instruction in the way historians use, judge, and interpret historical sources and evidence. This interaction between the educational task and the nature or structure of the multimedia environment is of primary importance in planning curriculum, designing multimedia technology, and researching the effectiveness of multimedia instruction.

### Future Directions for Research on Multimedia Learning in History

Although there are many possible future directions for this research, we will focus on three that seem most striking: (1) the need to develop new ways of assessing historical understanding, (2) the need for investigations of individual differences and how they may affect learning from multimedia, and (3) the need for controlled studies investigating the effects of multimedia instruction on student learning and understanding.

In terms of the first future direction, to the extent that instruction continues using the disciplinary approach to teach historical thinking skills, then it is an important question as to how historical reasoning skill may be best assessed. Wineburg (2000), among others, has noted the difficulty of

attempting to measure historical understanding using traditional methods such as multiple-choice tests. Simple fact-based tests will likely not be good measures of improvements in historical thinking skills or understanding (Alonso-Tapia & Villa, 1999). It is clear that authentic training approaches warrant authentic, discipline-based assessments, or at least assessments that focus on the acquisition of conceptual understanding, the development of a model of events that is able to explain cause-effect relations (Downey & Levstik, 1991; Leinhardt, Stainton, & Virji, 1994), or the development of a causal mental model (Wiley & Voss, 1999).

Several alternative measures have been used in recent studies as indicators of historical understanding. These include the use of concept maps (Spoehr, 1992), analyses of student's written reports, multimedia projects, arguments (Britt & Aglinskis, 2002; Spoehr, 1992, Spoehr & Spoehr, 1994; Wiley & Voss, 1999), post-tests based on whether or not students can correctly identify inferences that follow from presented information (Wiley & Voss, 1999), and reasoning about analogical or hypothetical events (Alonso-Tapia & Villa, 1999; Wiley & Voss, 1999).

A second important area that needs more attention in the future is the investigation of individual differences in prior content knowledge and cognitive ability, and whether learners of different ages or abilities can gain the same benefits from the disciplinary approach to instruction and inquiry-based multimedia learning activities. Individual differences in prior content knowledge could be a factor in the benefit a student gains from interaction with multimedia environments or activities. For the most part, the multimedia sources used in these studies have been preselected for students or students are provided with support through direct mentoring or introductory lectures on the inquiry topics. These aspects of the successful instructional approaches discussed in this chapter may be critical for novices (i.e., students with low

prior knowledge) to approach expertlike reasoning as they engage in multimedia inquiry tasks. It would make sense that some prior knowledge of either the topic or the task, or both, needs to be put in place in order for students to benefit from inquiry learning. But, whether this is the case, and how the background instruction and inquiry activities should be integrated into classroom instruction are important open questions that need to be directly researched.

Individual differences in students' cognitive abilities could also mediate the effectiveness of multimedia learning environments. Several studies by Ferretti, MacArthur, and Okolo have investigated multimedia-based learning activities with learning-disabled students and have generally found that these students benefit from multimedia inquiry tasks. In one study (Ferretti, MacArthur, & Okolo, 2001) students participated in an eight-week project-based, technology-supported investigation about westward expansion in the United States. Both learning disabled and non-learning disabled groups of students showed pre-post gains knowledge and understanding of historical content, as well as increases in their self-efficacy as learners and their understanding of historical inquiry. Other projects have investigated learning through the design of multimedia presentations about controversial topics such as immigration policy (Okolo & Ferretti, 1998) and through debates about these topics (MacArthur, Ferretti, & Okolo, 2002) where students work collaboratively to represent and defend one side of a controversy. Although none of their studies has involved comparison groups, pre-post measures generally indicate that these activities led to learning gains as well as increases in engagement by learning disabled students, suggesting multimedia learning activities such as these may be effective for lower-ability students as well as more able students.

Finally, in terms of age appropriateness of multimedia learning in history, Booth (1994) has suggested that historical reasoning skills are more a function of instruction than they seem to be of developmental stages. Several

studies (Ashby & Lee, 1987; Booth, 1980, 1983; Dickinson & Lee, 1984) have shown that students of a wide range of ages and abilities can engage in realistic historical analysis and reasoning from sources.

As mentioned in the limitations section, there is a clear need for controlled experimental designs that measure the effects of multimedia instruction on learning outcomes. This is a third important direction for future research. More studies need to systematically investigate the effects of the content and design of multimedia environments on history learning. Design studies and studies with pre-post learning measures are initial steps in a larger research agenda that seeks to understand how and why multimedia instruction in history can lead to better understanding of both subject matter and the discipline. At present, many multimedia instructional activities have not been assessed in terms of their effectiveness in comparison to normal classroom instruction. Nor is there much research on which aspects of multimedia inquiry tasks are responsible for better learning outcomes. These are critical questions that need to be addressed in order for us to engage in a cost/benefits analysis when we consider whether multimedia is "worth it." Finally, it is only through studies that manipulate multimedia presentation and measure learning that we can come to understand what elements of learning environments affect the quality and type of domain knowledge students acquire. Findings such as these will then be central toward advancing theories of cognition as well as instruction.

## Glossary

*Concept-mapping tasks:* Tasks that are designed to evaluate students understanding of the relationships between concepts in a subject domain, usually in node and link format. For example, Spoehr (1992) asked students to list all of the aspects (people, events,

locations) of a topic and their causal relations to each other. This type of measure taps not only students' memories for the important facts in a topic, but also their deeper understanding of the underlying relationships among these facts.

*Constructivism:* A philosophy or theory of learning that proposes that individuals actively construct their understanding of the world. Based on prior experience, individuals generate mental representations of situations, which they use to make sense of their environment. Therefore, learning is the process of adapting one's mental representations to accommodate new information and experiences.

*Contextualization heuristic:* Term used by Wineburg (1991) to describe a strategy used by expert historians to draw conclusions based on historical documents. When trying to construct accounts of historical events from sources, expert historians often explicitly consider *when* and *where* this event took place. This allows them to incorporate previously known information or look for new information about the social, political, chronological, and geographic aspects of the event to aid in their description and explanation.

*Controlled experiments:* In educational research, these are studies that are designed to systematically manipulate an educational treatment in order to investigate its effect on learning outcomes. Most importantly, in controlled experiments only single aspects of a learning environment are manipulated between treatment groups, thereby allowing any change in a learning outcome to be attributed to that aspect of the learning environment.

*Corpus:* A large collection of writings of a specific kind or on a specific subject.

*Corroboration heuristic:* Term used by Wineburg (1991) to describe a strategy used by expert historians to draw

conclusions based on historical documents. When considering new information presented in a document, experts often seek out independent sources on the same topic to see if they support or confirm this information.

*Design studies:* In educational research, these types of studies investigate the feasibility, cost, and practical constraints of introducing new curricula or educational technology into the classroom. Although these studies sometimes include learning outcomes, they often do not examine alternative instructional conditions.

*Heuristics:* An informal and usually simple "rule-of-thumb" procedure or strategy used in problem-solving situations to help save time and effort.

*Hypermedia:* A computer-based information retrieval system that enables a user to gain or provide access to texts, audio and video recordings, photographs, and computer graphics related to a particular subject.

*Hypertext:* A computer-based system that enables a user to access to related Web pages or other electronic documents by clicking on highlighted or underlined words in the text of a document.

*Inquiry learning:* The acquisition of information or knowledge through actively seeking to answer a question or solve a proposed problem. Often contrasted with rote or memorization learning where individuals acquire information through simple repeated exposure to information or concepts.

*Learning outcomes:* Measures of knowledge acquisition or change as a result of some environmental event or educational experience. The key aspect of learning outcome measures is that an individual's knowledge is measured on multiple occasions (e.g., before completing an educational activity, then again after). Only measures of changes in knowledge are considered learning outcome measures.

Simply testing knowledge after an activity is a memory outcome, because it does not distinguish between prior and newly obtained knowledge.

*Mental model:* The internal representation of a system, situation, event, story, and so forth, that an individual constructs in the process of understanding incoming information. These models are thought to be formed based on prior experience or memory schemas and are important in the comprehension of new concepts and in problem solving.

*Multiple-channel learning:* Knowledge or concept acquisition that requires a learner to integrate across information presented using different sensory modalities (e.g., visual and auditory), types of media, and/or sources.

*Primary sources:* Original documents used in historical research such as diaries, government documents, logs, photographs, and physical artifacts. Can be contrasted with secondary sources such as newspaper reports, magazine articles, and biographies that are based on other authors' evidence and interpretations.

*Scaffolding:* Designing educational curricula or materials to provide a meaningful structure that aids in the students' development of an appropriate mental model or representation of the concept or topic.

*Sequencing tasks:* Educational tasks that ask students to place information, people, and events into chronological order, or spot information that is inconsistent with the chronological order of historical events. These tasks can be used as either inquiry learning activities, or as learning outcome measures.

*Sourcing heuristic:* Term used by Wineburg (1991) to describe a strategy used by expert historians to draw conclusions based on historical documents. When experts read a document, they often seek out information about the author (e.g., name, credentials, affiliations, relationship to information they

are writing about) and the document (e.g., where it was published, document type) in order to draw conclusions about the credibility of the information.

*Vertical links:* Navigational links in a hypermedia environment that direct the student to information within the same content domain. For example, in a unit on the Civil War, accessing a vertical Gettysburg link could direct the student from an overview of the war to information on the Gettysburg battlefield. In contrast, a *horizontal link* for Gettysburg could lead to more information in another content domain, such as "tourist attractions in Pennsylvania."

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## References

- Alonso-Tapia, J., & Villa, J. L. (1999). How can historical understanding best be assessed? Use of prediction tasks to assess how students understand the role of causal factors that produce historical events. *European Journal of the Psychology of Education*, 14(3), 339-358.
- Ashby, R., & Lee, P. (1987). Discussing the evidence. *Teaching History*, 48, 13-17.
- Barton, K. C. (1995). "My mom taught me": The situated nature of historical understanding. Paper presented at the annual meeting of the American Educational Research Association, San Francisco, CA.

- Barton, K. C. (2001). A picture's worth: Analyzing historical photographs in the elementary grades. *Social Education*, 65(5), 278-283.
- Barton, K. C. (2002). "Oh, that's a tricky piece!": Children, mediated action, and the tools of historical time. *The Elementary School Journal*, 103(2), 161-185.
- Barton, K. C., & Levstik, L. S. (1996). "Back when God was around and everything": The development of children's understanding of historical time. *American Educational Research Journal*, 33, 419-454.
- Booth, M. B. (1980). A modern world history course and the thinking of adolescent pupil. *Educational Review*, 32, 245-257.
- Booth, M. B. (1983). Students' historical thinking and the History National Curriculum in England. *Theory and Research in Social Education*, 21, 105-127.
- Booth, M. (1994). Cognition in history: A British perspective. *Educational Psychologist*, 29(2), 61-69.
- Britt, M. A., & Aglinskas, C. (2002). Improving students' ability to identify and use source information. *Cognition and Instruction*, 20(4), 485-522.
- Britt, M. A., & Gabrys, G. (2002). Implications of document-level literacy skills for Web site design. *Behavior Research Methods, Instruments, and Computers*, 34(2), 170-176.
- Britt, M. A., Perfetti, C. A., Van Dyke, J., & Gabrys, G. (2000). The Sourcer's Apprentice: A Tool for Document-Supported History Instruction. In P. Stearns, P. Seixas, & S. Wineburg (Eds.), *Knowing, teaching and learning history: National and international perspectives*. New York: NYU Press.
- Brush, T., & Saye, J. (2000). Implementation and evaluation of a student-centered learning unit: A case study. *Educational Research and Development*, 48(3), 79-100.
- Dickinson, A. K., & Lee, P. J. (1984). Making sense of history. In A. K. Dickinson & P. J. Lee (Eds.), *Learning history*. London: Heinemann Educational.
- Downey, M. T., & Levstik, L. S. (1991). Teaching and learning history. In J. P. Shaver (Ed.), *Handbook of research on social studies teaching and learning*. New York: Macmillan.
- Ferretti, R. P., MacArthur, C. D., & Okolo, C. M. (2001). Teaching for historical understanding in inclusive classrooms. *Learning Disabilities Quarterly* 24(1), 59-71.
- Greene, S. (1994). The problems of learning to think like a historian: Writing history in the culture of the classroom. *Educational Psychologist*, 29(2), 89-96.
- Holt, T. (1990). Thinking historically: Narrative, imagination, and understanding. *The Thinking Series*. New York: College Board.
- Leinhardt, G., Stainton, C., & Virji, S. M. (1994). A sense of history. *Educational Psychologist*, 29(2), 79-88.
- Leinhardt, G., & Young, K. M. (1996). Two texts, three readers: Issues of distance and expertise. *Cognition and Instruction*, 14(4), 441-486.
- Levstik, L. S., & Barton, K. C. (1996). "They still use some of their past": Historical saliences in children's chronological thinking. *Journal of Curriculum Studies*, 28, 531-576.
- Loh, B., Reiser, B. J., Radinsky, J., Edelson, D. C., Gomez, L. M., & Marshall, S. (2001). Developing reflective inquiry practices: A case study of software, the teacher, and students. In K. Crowley, C. Schunn, & T. Okada (Eds.), *Designing for science: Implications from everyday, classroom, and professional settings*. Mahwah, NJ: Erlbaum.
- Lynn, S. (1993). Children reading pictures: History visuals at key states 1 and 2. *Education* 3-13, 21(3), 23-30.
- MacArthur, C. A., Ferretti, R. P., & Okolo, C. M. (2002). On defending controversial viewpoints: Debates of sixth graders about the desirability of early 20th-century American immigration. *Learning Disabilities: Research and Practice* 17(3), 160-172.
- Masterman, E., & Rogers, Y. (2002). A framework for designing interactive multimedia to scaffold young children's understanding of historical chronology. *Instructional Science*, 30, 221-241.
- National Assessment of Educational Progress. (1996). *NAEP 1994 U.S. history report card: Findings from the National Assessment of Educational Progress*. Princeton, NJ: Educational Testing Service.
- National Center for History in the Schools. (1996). *National standards for United States history: Exploring the American experience*. Los Angeles: University of California.
- Okolo, C. M., & Ferretti, R. P. (1998). Multimedia design projects in an inclusive social studies classroom: "Sometimes people argue with words instead of fists." *TEACHING Exceptional Children*, 31(2), 50-57.

- O'Neill, D. K., & Sohbat, E. (2004). *How high schoolers account for different accounts: Developing a practical classroom measure of thinking about historical evidence and methodology*. Paper presented at the annual meeting of the American Educational Research Association, San Diego, CA.
- O'Neill, D. K., Sohbat, E., Martin, A., Asgari, M., Lort, M., & Sha., L. (2003). *Sharing accountability through sharing our accounts: Piloting an on-line community for high school history learning*. Paper presented at the annual meeting of the American Educational Research Association, Chicago, IL.
- Perfetti, C. A., Britt, M. A., & Georgi, M. C. (1995). *Text-based learning and reasoning: Studies in history*. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Perfetti, C. A., Britt, M. A., Rouet, J.-F., Georgi, M. C., & Mason, R. A. (1994). How students use texts to learn and reason about historical uncertainty. In M. Carretero & J. F. Voss (Eds.), *Cognitive and instructional processes in history and the social sciences* (pp. 257-283). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Quinlan, K. M. (1999). Commonalities and controversy in context: A study of academic historians' educational beliefs. *Teaching and Teacher Education*, 15, 447-463.
- Radinsky, J. (2004). *Teaching the teaching of history with digital resources: Possibilities and limitations of an on-line inquiry project in a methods course*. Paper presented at the International Conference of the Learning Sciences, Santa Monica, CA.
- Rouet, J.-F., Britt, M. A., Mason, R. A., & Perfetti, C. A. (1996). Using multiple sources of evidence to reason about history. *Journal of Educational Psychology*, 88, 478-493.
- Saye, J. W., & Brush, T. (2002). Scaffolding critical reasoning about history and social issues in multimedia-supported learning environments. *Educational Technology Research and Development*, 50(3), 77-96.
- Scardamalia, M., & Bereiter, C. (1994). Computer support for knowledge-building communities. *Journal of the Learning Sciences*, 3(3), 265-283.
- Seixas, P. (1994a). When psychologists discuss historical thinking: A historian's Perspective. *Educational Psychologist*, 29(3), 107-109.
- Seixas, P. (1994b). Confronting the moral frames of popular film: Young people respond to historical revisionism. *American Journal of Education*, 102, 261-285.
- Seixas, P. (2000). Schweigen! die Kinder! Or, does postmodern history have a place in the schools? In P. N. Sterns, P. Seixas, & S. Wineburg (Eds.), *Knowing, teaching, and learning history: National and international perspectives*. New York: New York University Press.
- Shemilt, D. (1987). Adolescent ideas about evidence and methodology in history. In C. Portal (Ed.), *The history curriculum for teachers*. London, England: The Falmer Press.
- Smith, B. K., & Blankinship, E. (1999). *Imagery as data: Structures for visual model building*. In Proceedings of the Computer Support for Collaborative Learning, Palo Alto, California.
- Spoehr, K. T. (1992). *Using hypermedia to clarify conceptual structures: Illustrations from history and literature*. Paper presented at the meeting of the American Educational Research Association, San Francisco, CA.
- Spoehr, K. T., & Spoehr, L. W. (1994). Learning to think historically. *Educational Psychologist*, 29(2), 71-77.
- Stahl, S. A., Hynd, C. R., Britton, B. K., McNish, M. M., & Bosquet, D. (1996). What happens when students read multiple source documents in history? *Reading Research Quarterly*, 31(4), 430-456.
- Swan, K. (1994). History, hypermedia, and crisscrossed conceptual landscapes. *Journal of Educational Multimedia and Hypermedia*, 3(2), 120-139.
- Swan, K. (1996-97). Exploring the Role of Video in Enhancing Learning from Hypermedia. *Journal of Educational Technology Systems*, 25(2), 179-188.
- Voss, J. F., & Wiley, J. (1997). Developing understanding while writing essays in history. *International Journal of Educational Research*, 27, 255-265.
- Voss, J. F., & Wiley, J. (2000). A case study of developing historical understanding via instruction: The importance of integrating text components and constructing arguments. In P. Stearns, S. Wineburg, & P. Seixas (Eds.), *Knowing, teaching, and learning in history* (pp. 375-389). New York: New York University Press.
- Wiley, J. (2001). Supporting understanding through task and browser design. *Proceedings*

- of the 23rd Annual Conference of the Cognitive Science Society. Hillsdale, NJ: Erlbaum.
- Wiley, J., & Voss, J. F. (1996). The effects of "playing historian" on learning in history. *Applied Cognitive Psychology*, 10, 63-72.
- Wiley, J., & Voss, J. F. (1999). Constructing arguments from multiple sources: Tasks that promote understanding and not just memory for text. *Journal of Educational Psychology*, 91 (2), 301-311.
- Wineburg, S. S. (1991). Historical problem solving: A study of the cognitive processes used in the evaluation of documentary and pictorial evidence. *Journal of Educational Psychology*, 83(1), 73-87.
- Wineburg, S. (2000). Making historical sense. In P. N. Sterns, P. Seixas, & S. Wineburg (Eds.), *Knowing, teaching, and learning history: National and international perspectives*. New York: New York University Press.