

The Institute for the Learning Sciences

Northwestern University

**THE ROAD TRIP PROJECT:
LEARNING GEOGRAPHY
THROUGH SIMULATED TRAVEL**

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Introduction

Traveling makes geography come alive, but it is difficult to create the same level of excitement about geography in the classroom without special technology. The objective of the Road Trip project is to build a multimedia computer system that makes geography relevant by replicating aspects of real-world travel in the classroom. Specifically, Road Trip attempts to teach rudimentary U.S. geography to grade school students by allowing them to take simulated car trips around the country.

In this paper we argue for the importance of situating learning within realistic task environments, and we argue that computer programs can help achieve this objective. We will describe the main features of the Road Trip program as they exist now, and as we envision them taking shape in the future. We will also discuss our experience with elementary school students using the program, and will outline the results of some of our preliminary studies. These studies were designed to investigate students' attitudes towards the program, to demonstrate the program's effectiveness, and to determine which aspects of the program contribute most to its success. The results of our preliminary studies suggest that Road Trip teaches geography in an effective and engaging way.

The Importance of Providing Realistic Contexts for Learning

A hard problem that must be solved

Some subjects that are interesting, even exciting, when encountered in real life contexts, can become dull when encountered in a traditional classroom setting. Why is it difficult to create an interesting learning environment in the classroom? It may sometimes seem as if the failure to make a topic interesting is the result of a simple lack of imagination on the part of a teacher, but we believe that more often, students become unmotivated because external constraints on the traditional classroom setting make it difficult to create the kinds of realistic task environments necessary to motivate and situate learning. The physical constraints of the classroom

sometimes get in the way, as do organizational and managerial constraints imposed by a 30:1 student-teacher ratio.

As a result of this problem, school can become a place where students are asked to learn irrelevant facts and skills, rather than a place where they can learn to do interesting things. As anyone who has ever spent a class period gazing out the window rather than listening to a lecture knows, this cynicism toward school can have devastating consequences for students' attitudes toward schooling.

One approach to this problem is to try to replace the motivation that a realistic task environment provides with some type of artificial motivation, such as contrived games designed to make students want to memorize the target material. One might call this the "Jeopardy" approach to motivation (after the popular TV quiz show). The Jeopardy approach is well-suited to computers, and has been implemented numerous times in commercial educational software. Such strategies can increase motivation, at least temporarily, for at least some students. However, the message such strategies send can have negative long-term effects since students often become more focused on the extrinsic rewards than in the subject matter they are supposed to be learning (Lepper, 1988). Furthermore, motivation is only part of the problem with teaching out of context. Another part of the problem is that when learning takes place in the absence of an appropriate situating context, the knowledge "learned" may remain "inert," or difficult to put to use, and may be quickly forgotten (Brown, Collins, & Duguid, 1989). Students who memorize a set of facts or rules may be able to recite them on a test, but when the test is over they may be unable to apply them. Divorcing the acquisition of knowledge from the contexts in which such knowledge can be put to use is problematic even if the students are motivated (Resnick & Resnick, 1991).

How computers can help solve this problem

Computers with inappropriate software can be just as disconnected from realistic task environments as any other classroom experience. However, we believe that computers, equipped with appropriate software, can help the educational process enormously by recreating the realistic task environments that are otherwise quite difficult to create in the classroom.

Computers can provide simulations of task environments that would otherwise be too expensive, inconvenient, or even dangerous to make available to a student. For instance, while many students might find designing and flying an airplane to be fun and interesting, and might be anxious to learn the physics necessary to design and operate such a machine, it is impractical to let students do this. However, computer-based simulations can bring good approximations of the real task into the classroom in a way that is safe, and relatively inexpensive. When such simulations are structured appropriately, focusing on the knowledge needed to successfully perform the task, they can not only contribute to the integration of learning with doing, but can help to motivate learning, and situate the knowledge learned.

The example of geography

Geography is a good example of a subject that is often very dull when encountered in school. It is often taught in isolation, abstracted away from “authentic contexts” (Brown et al., 1989), since it is difficult to bring tasks that use geographic knowledge into the classroom. This may be why the state of geographic understanding, particularly among American schoolchildren is so abysmal. In the words of the Association of American Geographers (AAG), “[i]n the United States, most educational programs today have failed utterly to provide a structured knowledge of the world.” (Association of American Geographers, 1965, p. 1) This statement was made nearly 30 years ago, but as a later AAG report (Natoli et al., 1984) points out, the statement still prevails. In a 1983 study by the Dallas Times Herald fewer than 20% of the students surveyed could locate the U.S. on a world map, and more than 20% incorrectly identified Brazil as the United States. In the pretest portion of the study reported here we also found grim results regarding student’s understanding of U.S. geography; for instance, only about 25% of Chicago-area fourth-graders tested were able to place New York City in the proper location on a U.S. map. See McGee & Beckwith (1993) for more detail.

Many levels of geographic sophistication are possible, ranging up to a complex understanding of the effect of geography on economics, politics, and the environment, but none of these levels of understanding can develop

unless students have a basic understanding of relative and absolute locations (Natoli et al., 1984). This need is not currently being met in schools.

And yet, while Americans often lack rudimentary geographic knowledge, our informal observations suggest to us that students who travel a great deal do acquire this knowledge. That makes sense, since the process of deciding where to go, planning a route there, and then actually traveling to a destination and experiencing the distant location directly, brings geography alive. This suggests that if practical constraints were not a consideration, the ideal way to teach geography would be to send students on a series of trips around the U.S. and around the world. Since that approach is too expensive to achieve on a mass scale, the Road Trip program does the next best thing. It teaches U.S. geography to grade-school students by allowing them to take simulated car trips around the United States. Since the main reward for taking a real trip is the opportunity to visit the destinations one arrives at, we have built an approximation of this reward into Road Trip. The program contains video clips set in each of its destinations, which the student can view upon arrival at the appropriate place. The program also attempts to convey a feel for the experience of traveling between destinations by providing a driver's view video, which the student sees while "driving" from place to place.

The Design of the Road Trip Program

General principles that guided our design

Road Trip is one of several learning-by-doing programs under construction at The Institute for the Learning Sciences¹. Our experience developing computer-based learning environments has led us to adopt a number of design principles which guide our work on all such projects, including Road Trip. Two of these principles were particularly relevant to our design of Road Trip. Defining them explicitly may serve as a useful introduction to the design of the program:

¹Others include a program that teaches high school students about social studies by letting them put together their own TV news show (Kass & Guralnick, 1991), and a program that teaches grade school students about biology by having them design their own animal (Edelson, 1993).

- **The program should explicitly emphasize the activities it offers, not the knowledge that can be studied.** If the students are excited by the activities they will quickly discover what knowledge is needed to succeed at the activities, and will seek out that knowledge. The program must make the necessary knowledge available, but shouldn't ever push it on the student.

Within Road Trip this principle led us to stress the simulated travel, rather than stressing a set of locations to be mastered, or any other explicit knowledge-acquisition goal.

- **The program should allow individual students to use it in a way that reflects their individual interests.** Since students differ from one another, attempts to force them all to learn the same things at the same time are often self-defeating. Furthermore, when there are different ways to go about an activity, students should be allowed to go about it the way that appeals to them, rather than be forced to do things a standard, "right" way.

This principle influenced the design of Road Trip in several ways. First, the need to account for individual interests motivated us to include several different categories of videos in the program. Also, different students have different traveling styles. Some like to plan an entire trip in advance, while others like to wander, to see what they can find. Because of this principle we designed the program to accommodate either style, rather than coercing the student to, for example, plan the entire trip out in advance of doing any traveling.

We are attempting to study the effect of different traveling styles on learning, by requiring some students to plan first, and prohibiting others from planning first. This study is discussed in detail in McGee & Beckwith (1993).

How Road Trip presents itself to the student

Although Road Trip has turned out to have strong appeal to a surprisingly broad range of students, our original intention was to target the least motivated students. Road Trip is designed to reach the student who would rather not be in school at all – the student who would rather be home

watching TV. Because it aims to reach the student who begins with little or no interest in studying geography, Road Trip does not present itself to the student as being a geography lesson at all. Instead the program presents itself as a vehicle for watching TV clips. In the introductory screen, the program tells the student the following:

Road Trip contains many different kinds of videos. You can watch whichever ones you choose. All you have to do to watch a clip is to get to the location where the clip is set.

After an initial introduction, the program presents the main Road Trip screen (see Figure 1). This screen has three principle components: the main map, the big-picture map, and the video catalog.

The student using Road Trip engages in four main kinds of activities:

1. browsing the maps to plan a trip;
2. browsing the video catalog to find interesting destinations;
3. using the maps to engage in simulated travel; and
4. watching videos at a destination.

In the rest of this section we describe how each of these activities works, and how certain elements of the design contribute to the educational experience.

Browsing maps to plan the trip

The main map area takes up a significant portion of the screen. Initially, the main map area contains a map of the United States, with the state boundaries drawn in. The student can “zoom in” on a particular state by clicking on that state. The state maps look like a simplified road atlas; the cities and the major roads are visible. In the newest version of Road Trip, a student viewing a state map can zoom in yet another level by clicking on a city. The student can zoom back out at any time by clicking on the big-picture map area, which always displays a map that is one level broader than the one in the main map area. For example, when the main map area shows a city map, the big picture is a state map. When the main map shows a state, the big picture is the U.S. map. The student’s current location is always marked with a red triangle on both the main map and the big picture map. The maps also contain a searchable index so that a student who wants to go to a particular city, but doesn’t know where that city is, can look the city up in an alphabetical list and have the system highlight it on the map.

Browsing the video catalog to find interesting destinations

The program's video collection is divided into several categories. Different students prefer different kinds of videos. The current version of Road Trip contains the following categories:

- Sports highlights
- Movie clips
- Amusement parks
- Historical footage

In the future we hope to add more categories, such as music videos, and to make it possible for a teacher to add additional categories that suit a particular set of students.

The student often begins browsing the video catalog by selecting one of the categories from a menu. When a category is selected, all destinations having a video of that type are highlighted on the map, and a menu of video-clip titles is presented. For instance, the menu of movie clips in Pennsylvania currently includes selections from the movies *Witness* and *Rocky*. The program's sports titles include "Mets defeat Red Sox," and "Pete Rose sets record."² If the main map area is currently showing the U.S. map when the student browses the video catalog, then all the programs videos in the chosen category will be listed. If the student is currently zoomed in on a particular state or local map, then only the videos within that locale will be listed.

The student can see a synopsis of a particular clip by either selecting it from the list or by clicking on its location on the map. When a clip is selected, its location flashes on the map and the student is shown a brief paragraph which advertises the clip as enticingly as possible. In the future, students who do not read well will be able to hit a button to have the blurb read aloud by the computer.

The blurb always explicitly mentions the location of the clip, thus initiating an association in the student's mind between the place name and the

² See Appendix A for a complete list of the videos available in the prototype version which was used in the studies described below.

location. For example, if the student chooses "Pete Rose sets Record," then Cincinnati will flash on the map, and the student will see a blurb that reads:

See Pete Rose thrill the crowd in Cincinnati, Ohio by surpassing Ty Cobb as baseball's all-time base hit leader with hit number 4012.

The Witness blurb reads:

In a scene from the movie, *Witness*, the residents of an Amish community near Harrisburg, Pennsylvania build an entire barn without any modern equipment.

When a student finds a blurb that sounds appealing he or she can keep track of it by hitting a "mark as destination" button. The program will make a special mark on the maps to identify each destination the student has so marked.

The student can browse the catalog as much or as little as desired. Some students like to browse extensively, marking many potential destinations before doing any traveling. Others like to browse until they find one appealing video, travel there, and then browse again. Still others never browse, preferring to just set out traveling and stumble across interesting destinations as they go. The program does not attempt to enforce any style over any others. It simply tries, through various advertising techniques, to get the student excited about as many different destinations as possible. Our premise is that the more locations students visit, the more geography they will learn.

Using the maps to travel

Students can travel from city to city along the interstate system by zooming into the state where they are currently located, and then clicking on a road that is accessible from their current location. When a student travels along a road, the map animates to depict the student's motion, in much the same way that old movies, such as the opening sequence in *Casablanca*, depict travel routes through animated maps. In addition, the student sees a

driver's-view video of a car traveling along a road, through terrain that is indicative of the student's current location.

Road Trip does not force a student to stick to his or her original travel plans, or to visit any particular set of destinations. In fact, it does quite the opposite. Because the student has presumably already learned about the location of a city if he has chosen it as a destination, the system leans not toward encouraging him to actually get to the intended destination, but instead toward distracting the student with other possible destinations that he may not even know exist.

Road Trip uses every possible opportunity to advertise new destinations. For example, whenever the student crosses an interstate, a road sign appears announcing the junction. When the road sign appears, the program offers the student an opportunity to find out what destinations the road being crossed leads to. This might entice the student to make an unplanned side-trip to a newly-discovered destination. Later, the student may or may not return to his original travel plans.

Similarly, when a student enters a new state, a road sign welcomes him or her to that state. By clicking on that road sign, the student can find out what things are available to see in that state. In this way, students often are enticed to spend time exploring a state that they originally just planned to travel through. Students often find that traveling – which they may originally have viewed as a mildly-unpleasant chore to go through in order to get to a chosen video – can quickly become a fun opportunity for exploration. Traveling in Road Trip is depicted in Figure 2.

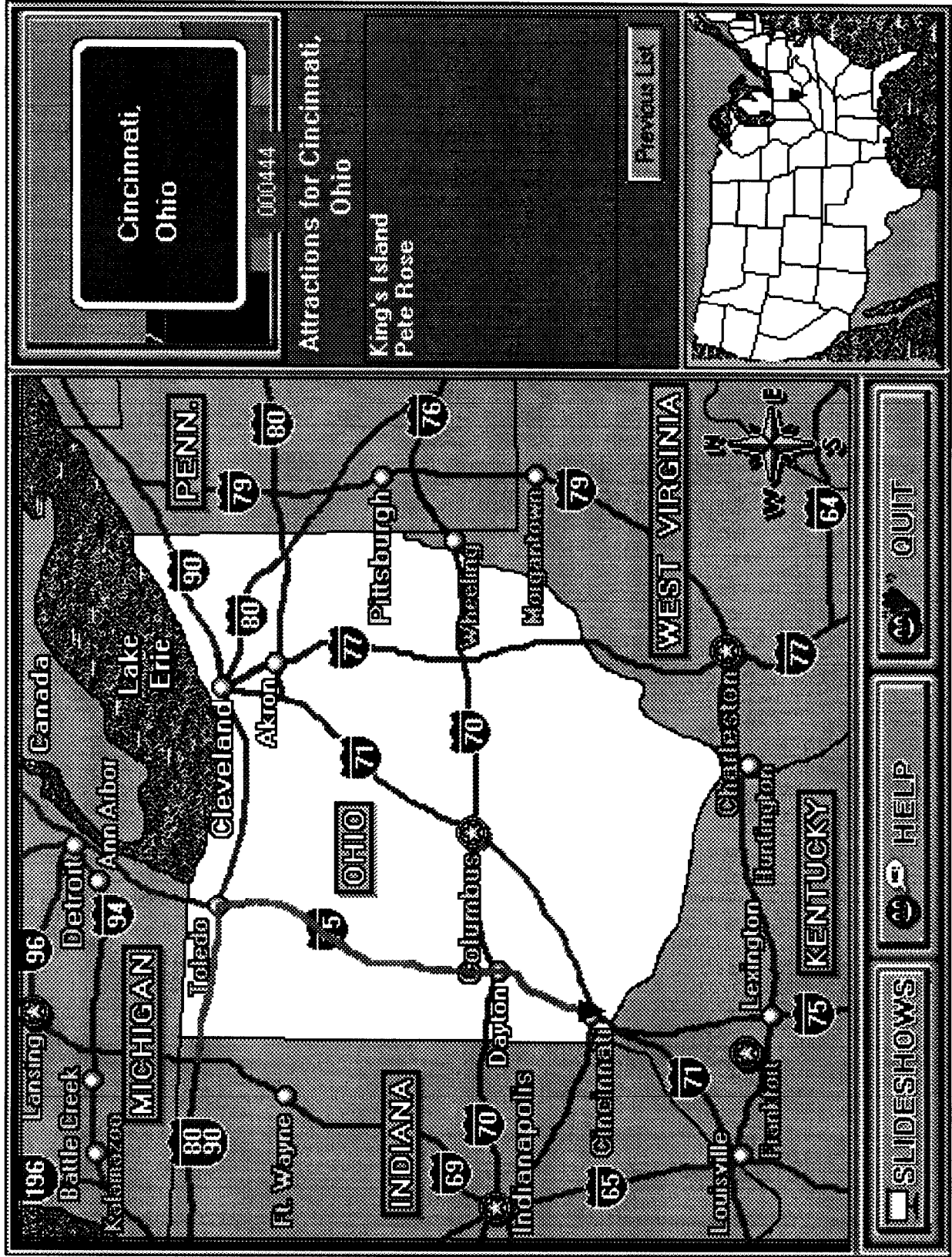


Figure 2: Simulated Travel in Road Trip

Watching videos at a destination

Figure 3 shows what the screen looks like when the student watches a video at a destination. Road Trip videos are designed to entertain, advertise, and educate. The main purpose of the Road Trip videos is motivation. In the real world people often travel in order to sightsee; travelers in Road Trip travel in order to see videos. Therefore, much of the success of the program depends on how rewarding the videos are. For this reason we spend a lot of time acquiring and producing video; experimenting with different content and different production styles; and getting feedback from students. Some of the videos in the current, experimental version of Road Trip, are MTV style – that is, fast-paced, with short cuts and rock music. Other videos are more narrative. Different students have different tastes.

In addition to entertainment, Road Trip videos can serve to advertise similar videos which are available at other destinations. For instance, at the end of the video about the Indy 500, the announcer exclaims, "...and if you don't want the racing action to stop head southeast to Daytona Beach, Florida, to see the Daytona 500!" Students who watch Pete Rose break the major league hit record in Cincinnati are told that they could also go to Atlanta to see Hank Aaron break the home run record.

Of course, it is also possible to include educational video in Road Trip. Even clips from feature films can be educational as well as informative. For example, students who watch the Amish in Witness or the Civil War scenes in Glory may learn about people and events with which they were not previously familiar. In future versions of Road Trip, we plan to support this

Students can stop the videos they watch at any point, and, as mentioned above, can choose to include the current freeze frame in a "slide show" that will document their trip. At the end the session, the student can save the slide show, and add it to the list of slide shows available for other students to watch. (Note: This feature was not included in the version of the program that was evaluated in the studies described later.)

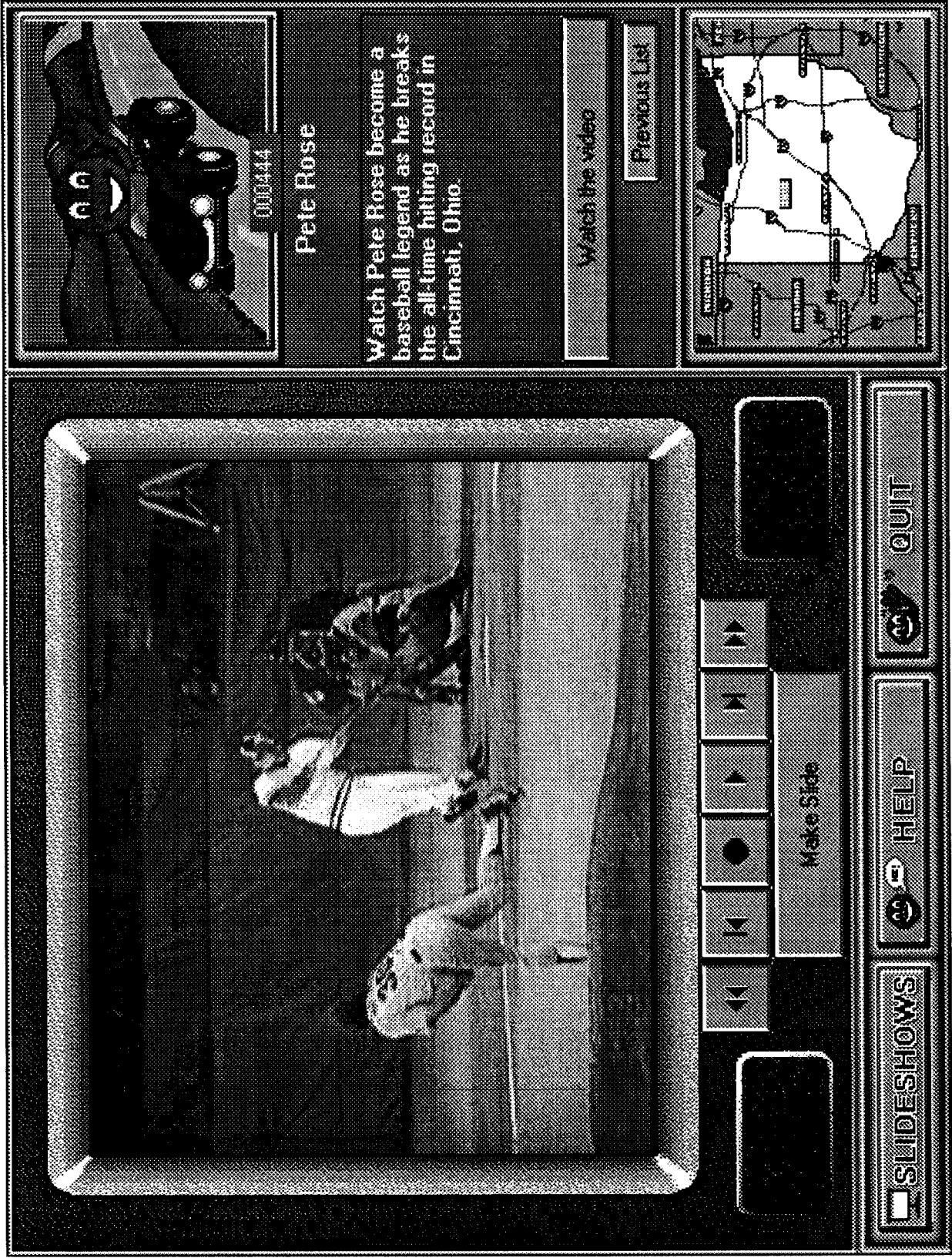


Figure 3: Watching Videos in Road Trip

Making a slide show of one's trip

The newest version of Road Trip incorporates an additional feature into the travel sequence. When the student leaves a state in which he has stopped and watched videos, he is asked to identify which places he's been to, and which videos he saw and which videos he liked best. This information, in conjunction with still images students can pick from videos they watch, is used to construct a slide show documenting the student's trip which he or she can show to friends when the trip is over. The point of this feature is twofold. First, it serves as yet another way to advertise destinations to students – the students advertise to each other. Second, by causing the student to think back on where he or she has been, the program helps the student remember where places are.

Asking questions about the videos

We are currently building a hypermedia system into Road Trip to help students learn from the videos. It is intended to allow students to ask questions about the videos they watch. For instance, we were surprised to find how popular the clip from Witness, which depicts a group of Amish building a barn, proved to be among our test population of fourth-grade students. However, many of those students had never heard of Amish before, and wanted to ask who they were, why they dress differently, and so forth. The system we are building into Road Trip will allow students to ask such questions, and to view encyclopedia articles, news stories, and documentary film-clips which answer those questions.

Empirical Study of the Road Trip Program

Overview

A prototype of Road Trip was subjected to a set of preliminary studies to help guide our development efforts. We are interested in exploring a number of issues, most importantly, discovering whether students enjoy using Road Trip, and whether they learn about geography by using it. Our preliminary results on both of these questions are very encouraging.

In addition to these basic questions, we are interested in some finer-grained questions: One is whether students actively engaged in “driving” with Road Trip learned differently from students who were passive observers. Another issue of interest is whether the style of traveling that a student prefers (well-planned trips versus unplanned exploration) effects what is learned.

The version that was ready at the time of testing lacked some of the features discussed above. Most notably, there was no capability to build slide shows. In addition, the evaluation version was restricted to a single video-disk, containing 26 videos, which were restricted to the Northeast quadrant of the United States. Even with this rather limited version of the program we received encouraging results. As we shall describe, subjects using the program seem to exhibit improved knowledge of geography, and seem better able to put that knowledge to use. One particularly clear finding is that the program is very popular with students. In fact, students who used the program in the study often returned during free periods, asking if they could use it again.

We performed two separate studies in the spring and summer of 1992. The first investigated active vs. passive use of Road Trip. In the second study we looked at planned or goal-directed travel vs. unplanned or non-goal directed exploration.

Settings

The first study took place at an elementary school in a suburb of Chicago with a population of students from mixed socio-economic backgrounds. It was conducted during a four week period in May of 1992. Three other studies from the Institute for the Learning Sciences (ILS) took place in the school at the same time. The school decided that the groups for each study would be based on the 4th grade reading classes. Each reading teacher decided which study they wanted their class to participate in. The teacher for the high-level reading class (n=26) decided to have her students participate in the Road Trip study. One of the lower level reading classes (n=18) became a no treatment group. Specific demographic information on the students was not available to us; however, the students were mostly lower middle class with working class backgrounds.

The second study took place at a middle-class elementary school in another suburb of Chicago. It was conducted during the school's summer session in June and July of 1992. Two other studies from ILS took place at the same time in this school. Students from two separate sessions of the summer school class on computers were selected; students from each session were divided among the three studies being conducted. Students from the first session (n=9) were assigned to the non-goal condition and students from the second session (n=10) were assigned to the goal condition.

For each study, four IBM PS/2 computers were set up side-by-side in a spare room next to the students' classrooms. Each computer had a color monitor, keyboard, mouse, and attached videodisk player. Students watched the video clips on the color monitor, and listened to the sound on head phones. There were varying levels of prior experience using computers, but everyone quickly adapted to using the mouse to travel and select videos. For the first study, an additional 25 inch external monitor was connected to one of the computers.

Assessment materials

In both studies, students were administered a matched pre-test and post-test to determine the effect of using the program. All of the students in both studies were administered the pre-test as a class. Those students who used the Road Trip program were given the post-test immediately following their last session with Road Trip. The tests contained four components.

The first section of the test was an interest survey. It asked students to rate how much they enjoy geography and how much they enjoy specific activities that are related to videos in Road Trip. The interest survey was primarily used in the first study to pair the drivers and passengers.

We refer to the second section of the test as the "map test". The students were tested on their ability to place 20 cities on a map of the United States. The map contained outlines for each of the 48 contiguous states. None of the states were labeled. Ten of the cities were randomly selected from the 16 possible cities that have videos in Road Trip. The other 10 cities were randomly selected from other parts of the country, not represented in Road Trip. The 20 cities were presented in random order on the test. Each city was

labeled with a unique letter. The student was instructed to place the letter associated with a city within the state boundaries of the state that it belonged to.

We refer to the third section of the test as the “state name test”. The student was presented with a different list of 20 cities. Once again, 10 were selected from Road Trip cities and 10 were selected from non-Road Trip cities. They were presented in random order. The student was instructed to write the name of the state to which the city belonged. The student was judged to have answered a question correctly if the answer was in any way recognizable as the correct state. For example, abbreviations and close spellings were judged as correct answers.

The fourth section of the test we refer to as the “directions test”. The student was presented with 20 pairs of cities and was asked to write down which direction to travel to get from the first city to the next city. To construct the test items, 20 cities were randomly selected as before. For each city, a paired item from the same list would be chosen that resided on an approximate north, south, east, or west line from the initial city. That way students would not be penalized if they were not aware of the more refined direction statement (e.g., northeast, southeast). They were given credit, however, if they did give the refined direction correctly.

Methods

In order to ensure that all of the students understood what a map was, we asked them to identify geographic features of the program before their first session with Road Trip. While the student was seated in front of the computer, a researcher first pointed to a map of the United States on the screen and asked, “Can you tell me what this is?” All of the students were able to identify it as a map of the United States. Next, the researcher pointed to the roads on one of the state maps and asked, “Can you tell me what these green lines represent?” All students were able to identify them as roads. Finally, the researcher asked, “Which direction would you need to travel to get from Chicago to Cincinnati?” Most students were able to respond with east or southeast. If the student did not know where Cincinnati was located, the researcher would tell the student the correct answer.

At that point, the students were trained to use the program. Students were led through the process of selecting a movie and noticing the mark on the map that resulted from that selection. Once a movie was selected, the student was instructed to select the desired road to get to the city where the movie takes place. During the training, and while answering any questions during the session, the researcher refrained from using city names or directions. The researcher referred to cities as “that yellow circle” and referred to roads as “that green line.”

In the first study, there were three conditions: drivers, passengers and no treatment. The drivers used Road Trip during two, 45-minute sessions. Each driver was paired with a passenger who, based on the results of the interest survey, had similar interests. The passenger sat on the opposite side of the room in front of the 25-inch external monitor. The external monitor displayed the same output that the driver's monitor displayed. In other words, the drivers interacted with the program and the passengers watched where the drivers traveled. The no treatment condition did not interact with Road Trip.

In the second study, two separate versions of Road Trip were created. One version was intended to encourage a goal directed style of traveling. A major change was made to the standard version of Road Trip. Students were required to select a destination before they could travel anywhere, and they could not watch another video until they had arrived at the destination they had marked. This was the version used by the goal condition. The other version of the program had two major changes to the standard version. It was not possible to mark a destination to travel to nor was it possible to see what videos were available outside of the state the student was currently traveling within. This version was used by the non-goal condition.

Results

Surprisingly, in the first study there were no significant differences between the performance of the drivers and the performance of the passengers. Therefore, their scores were combined into a treatment condition and compared with the control group performance. Figure 4 indicates the mean improvement from pre-test to post-test for the treatment and the control group on all three sections of the test. Students in the treatment condition

improved significantly on all three sections of the test, while the control group only improved significantly on the state name test. The treatment group's improvement was significantly greater than the control group on the map test and the state name test.

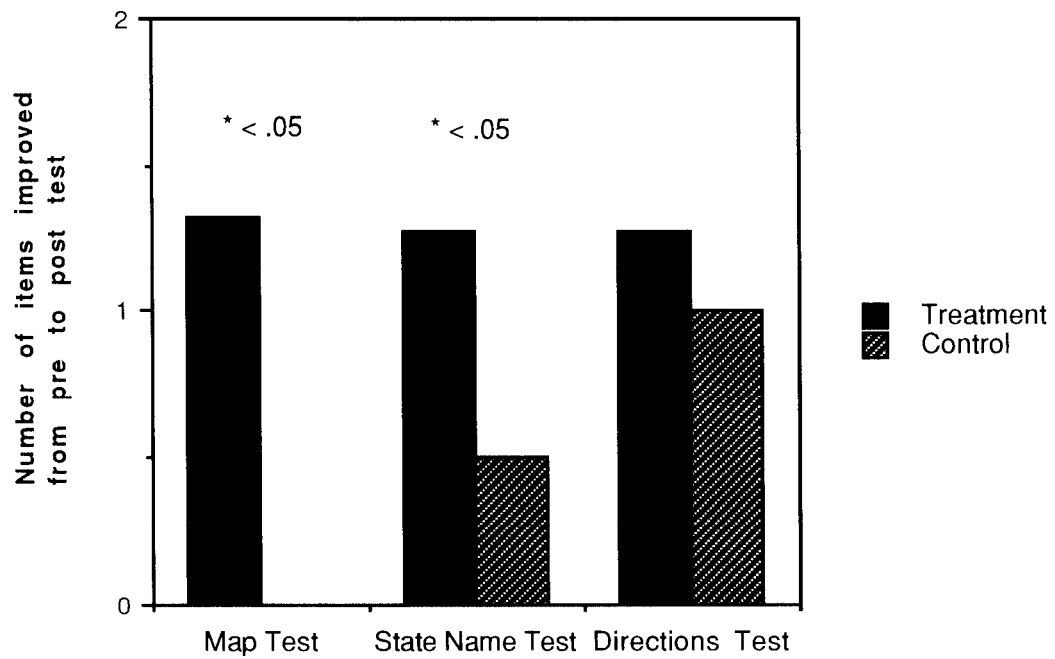


FIGURE 4
Mean improvement scores (Study I)
Combined Treatment vs Control

Figure 5 indicates the mean improvement in the second study from pre-test to post-test for the goal and non-goal condition on each section of the test. The goal condition improved significantly on the city test, while the non-goal condition improved significantly on both the map test and the city test. There were no significant differences between the groups.

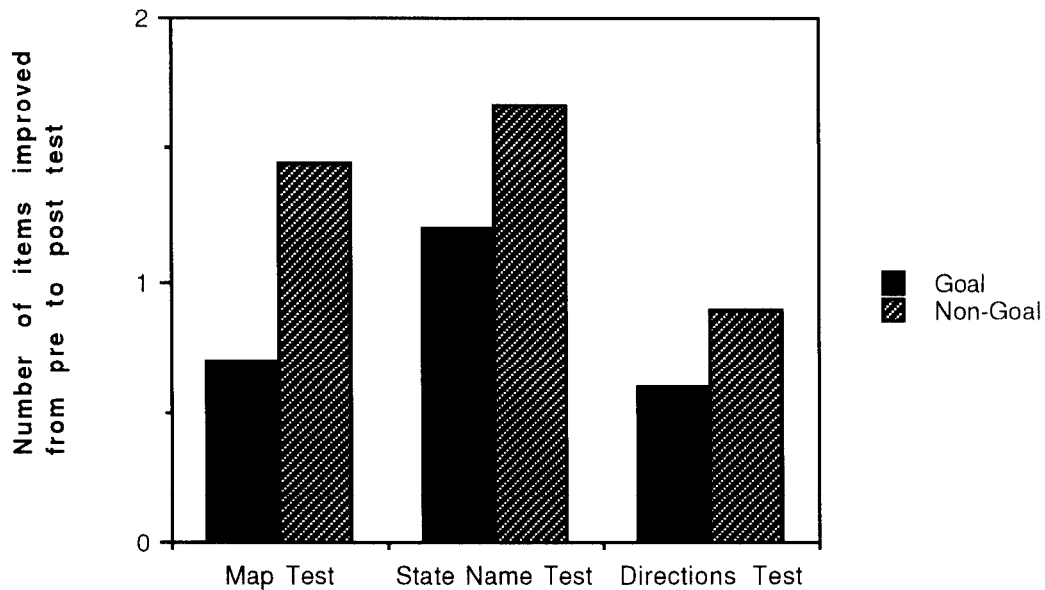


FIGURE 5
Mean improvement scores (Study II)
Goal vs Non-Goal

Discussion

As we indicated above, our principle goals in evaluating Road Trip were to determine whether students enjoyed using it, and to determine whether they learned from it. On the first issue we have very strong anecdotal evidence. On the second we have some statistically significant results.

Beyond the two main questions, we were also interested in looking at issues related to *how* students learn from the program and which features contribute most to learning. See McGee & Beckwith (1993) for a discussion of these issues.

Road Trip is fun to use: Our evaluation studies have shown Road Trip to be enjoyable to use. Students' attitudes toward the program are extremely encouraging to us. In post-interviews, the students demonstrated unanimous agreement that they enjoyed using Road Trip. They wanted to see more videos and a wider variety of videos. They enjoyed the way the program simulated travel through the moving cursor and the driver's-view video. As noted earlier, students who used the program under formal

sessions often returned during their free time, such as lunch or recess, asking if they could “play” with the program some more. Since the primary hurdle in educating our target population is to transform school into an exciting and fun place, we consider these positive attitudes extremely important.

Road Trip teaches about geography: Our formal studies of Road Trip’s effectiveness at teaching geography are still in their early stages, but encouraging results were achieved, even with a limited prototype and with a small population. The students tested did in fact know more about absolute and relative locations as a result of using Road Trip.

While the improvement between pre- and post-tests was statistically significant, we believe that with minor enhancements to the program we will be able to achieve larger results. In the first study, for every four cities that a student travelled, he only improved on one of those on the post-test (McGee & Beckwith, 1993). Therefore, after this initial testing, we made some minor improvements to the program. In order to boost students’ performance on cities traveled to, we have added the feature, described above, in which the students review which cities they traveled to before leaving the state. The trick was to design this task in such a way that it remained authentic and situated in the task of traveling. This was accomplished by embedding the review task within the task of creating a slide show of the student's trip.

Other Issues: Our results on some of the secondary issues that might help us design future versions of Road Trip are much less conclusive. In both studies, the populations may have been too small and the exposure too limited to achieve significant results on issues such as the effect of active versus passive travel, and of planned versus unplanned travel. The results indicate that there is an initial cognitive load associated with learning how to navigate maps (McGee & Beckwith, 1993). This initial cognitive load may, for instance, be masking the benefits of active decision making versus passive observations. Future studies of Road Trip will attempt to tease out the effect of this cognitive load by allowing students longer exposure to the program.

Where We Go From Here

Road Trip is a working prototype, which has been used by students in both informal settings and under formal observation. We consider Road Trip to be a big success as a proof of concept, but it is, in our eyes, far from complete. There are numerous features on our wish list, and almost certainly many more will occur to us as we observe the program in more extensive use. The current version, at the time of this writing, has only limited local travel. It has video for only the Northeast quadrant of the country, and does not yet contain the hypermedia system component described in a previous section, but does incorporate all the other features we have described.

Our plans to extend the program reach in several directions. First among these is simply making the system's video database more extensive. The primary obstacles are the time and money needed to collect and produce the video. A secondary issue is video technology. Ideally, the system would have a very large amount of video. Therefore, while the current version of Road Trip uses analog video technology, the next generation will use digital; we will probably move eventually to a system in which many Road Trip stations are served by a single, very large, video server, via a high-speed network.

Some of the other extensions we are planning include increasing the emphasis on local travel; providing a tourist office, where students can ask questions about places they are visiting; and providing more complex levels of the program to challenge the experienced Road Trip user. Local travel is important because many of the implications of geographic location are more apparent at a fine-grained level. For instance, the fact that steel mills need to be by bodies of water is something the student isn't exposed to by looking at a national or state map, but this is something you realize when you travel the streets of a steel town.

The current version of Road Trip was designed to make travel as easy as possible, so that the most unmotivated student would not be deterred by the work needed to get from one city to another. But after students use the program for a while they become very proficient travelers, and are ready for more complex challenges, which could be used to keep them interested, and

to further drive home geographic points. Thus, we have extensions on the drawing board, such as a version of the program in which the student has only a limited amount of gas, and thus must find efficient routes with a finite amount of money. We are also planning to incorporate into the program an ability to monitor where the student has gone in past sessions, and encourage the student to go places not yet visited. When the student chooses a destination in a future version of the Road Trip, the program might say, "You've gone to New York to see the Mets beat the Red Sox seven times already! Do you know that there's an even more exciting World Series comeback in Los Angeles? Why don't you go see Kirk Gibson hit his ninth-inning homer?"

We believe that Road Trip exemplifies an important contribution that computers and multimedia can make to education. By providing simulations of real-world environments that would otherwise be difficult to recreate in the classroom, the program makes it possible to situate learning in an authentic task. This makes learning fun without resorting to artificial motivation, such as competitive games. Based on the feedback we received from the students who used Road Trip, we believe the enhancements we have planned will strengthen Road Trip's potential as an interesting and effective learning environment.

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