

Abstract	2
TimeWeb.....	3
Evaluation Statement.....	4
Fall 1999	4
The Students.....	4
The Instructor.....	5
Implementation	6
Findings.....	8
The Task.....	8
Lost Windows	9
Basic Functionality.....	9
Potential	9
Spring 2000.....	10
The Students.....	10
The Instructor.....	12
Other Participants	12
Implementation	14
Day One—March 23, 2000.....	15
Day Two—March 24, 2000	15
Day Three—March 30, 2000	16
Day Four—March 31, 2000.....	16
Sources of Data.....	17
Pre-Course Student Profile.....	17
Close-ended Questionnaires.....	17
Observations	18
Interviews.....	19
Findings.....	19
General Results.....	19
Positive Aspects of TimeWeb	22
TimeWeb makes vast amounts of data accessible.....	22
TimeWeb offers different presentation of material	22
TimeWeb is new and interesting.....	22
TimeWeb helps visualization	23
Limitations of TimeWeb	24
Windows.....	24
Search History.....	24
Run/load speed	24
Non-finding.....	25
Recommendations for Tool Improvement.....	25
Recommendations for Implementation Improvement.....	26
Recommendations for Study Improvement	27

ABSTRACT

This study examined the use of a web-based tool in two undergraduate Archaeology courses taught in consecutive semesters at Indiana University. In the Fall 1999 term, students enrolled in P380 (Prehistoric Diet) used TimeWeb, a data search and visualization tool, during one 75-minute class. In the Spring 2000 term, certain students in P200 (Introduction to Prehistoric Archaeology) opted to use TimeWeb as a research tool for one of their assignments. TimeWeb underwent a series of revisions and debugging procedures during and between the classes. ROCKMAN *ET AL*, an independent research and consulting firm, conducted independent evaluations of the implementation of TimeWeb, including classroom and computer lab observations, pre-course surveys and attitude questionnaires, and individual interviews with students. Although the complete integration of TimeWeb into a course is still clearly in the developmental stage, it appears to have interesting implications for affecting the way students work and think about archaeology.

TIMEWEB

TimeWeb is a web-based tool designed to provide users with time and location data on archaeology. Users are able to explore data in the context of both time and space; they also have the opportunity to explore additional information with links outside the program. While applicable in a variety of research and instructional settings, this tool was adapted for use in undergraduate archaeology courses (P200: Introduction to Prehistoric Archaeology and P380: Prehistoric Diet). TimeWeb is designed so that users can run specific queries on archeological sites based on location, relevant artifacts and other remains, the time periods associated with the artifacts at the site, and other relevant archaeological data. Once the query has been run, users are able to look at the data sites in a number of ways. The **map view** provides a map of Africa with a single dot representing each site and its location. **Forest, tree, and leaf views** show site timelines at three different levels of detail. The forest view shows all sites related to a chosen variable on one screen while the tree and leaf views provide progressively more restricted time ranges. Users can move a scroll bar along each of these time lines to access specific time periods. The **list/table view** shows students a list of the sites with certain characteristics, sortable by name, date range, etc (add info. or delete). Finally, a **histogram** view allows users to look at site frequencies based on time ranges. An additional feature generates individual web pages for sites, which contains photos and other images, more information about artifacts and evidence, and expanded information about location, climate, and other site details. At this time, however, complete information is not available for all sites .

EVALUATION STATEMENT

This is the second consecutive year that ROCKMAN *ET AL* has studied the use of TimeWeb in undergraduate archaeology classes. This report is a summary of data and observations collected in both the Fall 1999 and Spring 2000 semesters. The purpose of this evaluation is to determine the strengths and limitations of the preparation and implementation of TimeWeb, to explore the outcomes of the classroom use of the tool. This report includes a discussion of TimeWeb's strengths and limitations, as well as recommendations for improving the tool and its implementation improvement; the report also includes suggestions for enhancing the study of TimeWeb. A more detailed report expanding on above topics was submitted to various stakeholders.

FALL 1999

The Students

We developed several surveys to create a profile of the students enrolled in the two courses. Twenty-six of the students enrolled in the Fall semester of P380: Prehistoric Diet, completed the demographics survey; twenty-two filled out both the computer-use/problem-solving survey and the group work/general course attitude survey. Almost all the students participated in the TimeWeb demonstration, conducted on November 16, 1999, and most of them used it for at least part of one class session.

Over two-thirds of the students were female, and 58 % were archaeology majors. There was one freshman, three sophomores, twelve juniors, and eight seniors (see Table 1).

Students reported being relatively comfortable using technology to access class materials—on a scale of one to five the average was 1.4 (1= very comfortable, 5= not at

all comfortable). The students reported being somewhat less comfortable using technology to present class materials the average score among these students on this item was 2.5.

Variable	P 380 students N=26	
	Number	Percentage
Female	18	69%
Freshman	1	4%
Sophomore	3	12%
Junior	12	46%
Senior	8	31%
5 th year	1	4%
Graduate student	1	4%
Anthropology/Archaeology major	15	58%
One or both parents attended college	18	69%
One or both parents received graduate degrees	13	50%
Average comfort using technology to access materials (1-5)	1.4	
Average comfort using technology to present materials (1-5)	2.5	

Table 1: Characteristics of P380 Students.

The Instructor

The instructor for this course was Dr. Jeanne Sept, professor of Archaeology at Indiana University. She is a co-developer of TimeWeb and has experience both with teaching the courses in which the tool was implemented and with providing opportunities for students to use computers in a variety of ways in her classes. She has developed an instructional CD-ROM that her students use as a resource, posts the course syllabus and extensive resources online, and requires students to take weekly online quizzes about the course readings.

Dr. Sept's instructional philosophy focuses on getting her students (both undergraduate and graduate) to learn how to think. She wants to encourage them to create questions, think through answers, build strong arguments, and critique the arguments of others.

Dr. Sept presented her objectives and expectations for this course as follows:

This class will introduce you to what we know about prehistoric cultures and ancient civilizations. It will also involve you in the types of questions archeologists ask about the human past, and the scientific methods we use to search for answers. We will develop your understanding of the major changes in human culture by examining a series of archeological case studies—sites from different times and places around the world (taken from course syllabus).

In this class, Dr. Sept used a variety of instructional approaches, including lectures, discussions, videos, slides, hands-on activities, and group projects. For those students who decided to try it, TimeWeb provided an additional resource for accessing information and challenging their thinking about archeological research questions.

Implementation

Dr. Sept had reserved a computer lab for six consecutive classes, and planned to use it for at least five sessions. On the first day, approximately twelve weeks into the semester, she did a demonstration of TimeWeb, and the students defined themselves either as plant specialists or animal specialists. Students then formed the three or four-person groups in which they would do their TimeWeb projects the next class. Three students were interviewed after this brief introduction to TimeWeb, to get their first impressions of the tool.

Three people underwent training prior to the observation session where they were asked to record the students' comments and ways of working. They observed the TimeWeb

demonstration session, then were assigned to specific groups for the remaining work sessions. A few students were interviewed immediately after the initial demonstration, to get their first general impressions of TimeWeb as a tool.

On the second day, the students had a few brief preliminary questions to answer before they could begin using TimeWeb. The various groups worked in very different ways: some split into pairs and barely communicated, others clustered around one or two computers, and others split into pairs but had considerable interaction and involvement. The levels of experience and accuracy varied as well: some students were confident and comfortable using the web-based resources; others preferred to print out maps and sheets and not use the computers at all.

There were six groups in all, and the three observers were each assigned to observe one particular group. The three observed groups were very different in their demographic make-up, experience levels, and ways of working. The observers took extremely detailed notes about the paths the students took, their interactions with the machines and with each other, and the content they covered.

Dr. Sept spent this second lab session moving from group to group, answering questions. At the end of the class, once she had determined that the tool was reporting consistently incorrect results to all groups, she announced that TimeWeb was not working properly and that the class would not use it again. No interviews were performed after this session.

A few weeks later, Dr. Sept devised a paper-based activity that replicated parts of what TimeWeb does. The observers again took notes on their groups as they performed the

paper-based activity. They also interviewed a number of students after the paper-based activity, asking students to compare this activity to TimeWeb and about their general perceptions of TimeWeb. Since no post-intervention questionnaires were administered to the larger group, all findings are based on these interviews and the observation notes from both sessions.

FINDINGS

The Task

In both observations and in interviews, students expressed that they didn't understand the task they were given. (Add here or above, in implementation section, a brief discussion of the task.) Their uncertainty included the smaller first part where students were supposed to find evidence on the Prehistoric Puzzle site (i.e., no TimeWeb use whatsoever) and e-mail it to the professor, and the second part where they were to work together using TimeWeb to find evidence of food production in Africa. Many students commented to each other that they were lost, didn't understand what they were supposed to be doing, etc. Often, one question answered by Dr. Sept would clear up the problem, but students often waited 20 minutes, clicking back and forth, before asking the questions. Note that this happened as much in the pre-TimeWeb use of the on-line resources as it did when students were actually using TimeWeb. One group remarked: "How are we supposed to do the research when we don't know what we're researching?" "Can't we just write an essay or something?"

Lost Windows

One group started a new version of TimeWeb every time a student accidentally clicked elsewhere on the screen and the TimeWeb windows “disappeared.” This group ended up with four versions running before someone pointed out the twelve TimeWeb buttons at the bottom of the screen. This meant that the group was running queries with one version, but looking at the result of another version, which obviously didn’t match.

Basic Functionality

The students had been told that the tool’s functionality was shaky, and that if they encountered trouble, they should quit and re-start TimeWeb. One group ended up restarting TimeWeb a dozen times; every time they lost a window or closed the wrong window or wanted to run a new query, they quit TimeWeb and restarted it. Usually, they talked amongst themselves about trying to ask questions about the assignment in the interim, but never made any move to get the instructor’s attention. They seemed to not understand either what they should be doing, or how TimeWeb worked. This group expressed a lot of frustration.

Another student had fond memories of using TimeWeb the year before, when it was more functional, though she couldn’t remember exactly what she had used it to research. This familiarity with the tool made her even more frustrated because she knew it worked and thought it would be a good match for this project.

Potential

Because the students had been told that the tool wasn’t working, the interviews conducted after this session (a few weeks later, in conjunction with the paper-based activity) framed

all questions in the conditional, prefixing each with “what if?” Students were asked how they could envision using the tool, whether they thought they would use it once it worked, etc. Another student who had used TimeWeb the previous year, when it was more functional, and said he had quite enjoyed it then, but was very frustrated by its present state. Based on his previous experience with it, he would use it again. In the lab session, one student who had just expressed extreme frustration about the tool said to her teammates, “It would be awesome if it worked.” The general consensus among students was that TimeWeb was very powerful, that contained ample information, and they would use it if it were functional.

SPRING 2000

The Students

Of the students enrolled in the spring semester of P200: Introduction to Prehistoric Archaeology, sixty-six filled out the demographics survey, and forty-four filled out the computer-use/problem-solving survey. Approximately ten students used TimeWeb during the course. (Note: not all the students were observed using TimeWeb. Some were given private demonstrations and explored it on their own time.) Four students used TimeWeb for their final projects; the other students tried TimeWeb, but did not use it officially for any class projects.

Just over half the students in P200 were female, and 41% were archaeology majors. The class was split into approximately one-third freshman, one-third sophomores and one-third upper classmen. In reporting their comfort using technology to access class materials, students averaged 1.3 (1= very comfortable, 5= not at all comfortable); the

average score among these students for level of comfort with using technology to present class materials was 2.5 (see Table 2).

Variable	P 200 students N=66	
	Number	Percentage
Female	36	55%
Freshman	24	36%
Sophomore	24	36%
Junior	12	18%
Senior	6	9%
Anthropology/Archaeology major	27	41%
One or both parents attended college	52	79%
One or both parents received graduate degrees	35	53%
Average comfort using technology to access materials (1-5)	1.3	
Average comfort using technology to present materials (1-5)	2.5	

Table 2: Characteristics of P200 Students

The Instructor

The instructor for this course was Dr. Jeanne Sept, professor of Archaeology at Indiana University.

Other Participants

For this term, we ran additional testing sessions to see how other groups of students would use TimeWeb. We had two “control” groups, neither of which had experience with either TimeWeb or the P200 coursework: seven graduate students in archaeology/anthropology and twenty-three students enrolled in a human-computer interaction course. (See Table 3 for additional demographic information on the control groups.) The rationale for using these particular participants was that the archaeology/ anthropology graduate students would be familiar with the archaeology material and with the critical thinking skills necessary to complete the assignment, and the HCI students would be

sophisticated computer users and very aware of interface issues, while not knowing any of the content.

Variable	Archaeology/ Anthropology graduate students, N=7		Human-computer interaction students, N=23	
	Number	Percentage	Number	Percentage
Female	4	57%	15	65%
Graduate students	7	100%	20	87%
One or both parents attended college	7	100%	18	78%
One or both parents received graduate degrees	5	71%	6	26%
Average comfort using technology to access materials (1-5)	1.2		1.0	
Average comfort using technology to present materials (1-5)	2.0		1.2	

Table 3: Characteristics of Control Group Subjects.

Implementation

Because TimeWeb was not ready for implementation in the P200 class earlier in the semester, it was given as an optional resource for students to use while writing one of their assignments. Four 1.5-hour out-of-class sessions were set up (at the same time as class is normally held, but on different days) during which P200 students could go to the lab, participate in a demonstration and explanation of TimeWeb, and work in pairs on their assignment, with the instructor present to answer questions either about TimeWeb or about the assignment. These sessions, on March 23, 24, 30 and 31, 2000, were also attended by archaeology/anthropology graduate students, and by HCI students, i.e., the “control” participants.

A computer lab was booked for these times, available only to students participating in the TimeWeb session. The computers were set up in four rows, with a projection screen at the front of the room. Students needed to turn 90 degrees from their computer screens to

see the TimeWeb demonstration on the large screen. Although they would work in pairs on the assignment, all students went through the demonstration on their own computers, exploring or following as they wished. The participants received no instruction or information about TimeWeb prior to the demonstration session.

Day One—March 23, 2000

There were no P200 students at the first session; those who had signed up did not come. The participants were all graduate students in anthropology and archaeology. They were given a four-page “jump start” handout for TimeWeb, which they consulted rarely. They watched Dr. Sept demonstrate TimeWeb, following along and exploring on their own computers. In general, they followed directions during the structured part of the demonstration, but were encouraged to run different queries and to investigate different views. There were few technical problems during the demonstration. Following the demonstration, students worked in pairs to complete an assignment that Dr. Sept had designed especially for the control group participants, one which would simulate the type of activity that the P200 students were doing. The activity was designed to be completed in one to two hours, and most of the graduate students completed a good part of the activity by the end of the session.

Day Two—March 24, 2000

There were two P200 students at the second session. One arrived late, and the other had to leave early, so the first person missed the demonstration and was more or less lost until Dr. Sept did a private demonstration, and the second had little time to work on the project. The other participants included six HCI students. The demonstration proceeded

in the same manner as the first session. The participants received the handout for TimeWeb and watched Dr. Sept demonstrate TimeWeb, following along and exploring on their own computers. A larger group meant a few more technical problems, having to do mainly with loading and query speed. Students worked in pairs to complete the same assignment that the archaeology graduate students had worked on the day before. None of the HCI students completed the activity in the first session; they took their assignments home to finish them.

Day Three—March 30, 2000

There were two P200 students at the third session. The other participants included nine new HCI students. The demonstration proceeded in the same manner as the other sessions. Once again, the larger group meant more technical problems, again involving loading and query speed. Students worked in pairs to complete the assignment. None of the HCI students completed the activity in the first session, and they, too, took their assignments home to finish them. The P200 students were working on their own class assignments, and most of them seemed not to get beyond a very basic set of queries.

Day Four—March 31, 2000

One P200 student attended this session; because he had already seen the demonstration, he worked alone at the back. The other participants included nine new HCI students. The demonstration proceeded in the same manner as the other sessions. Again, the larger group encountered a few more technical problems related to loading and query speed. Like those in the previous sessions, students worked in pairs to complete the assignment,

and, again, none of the HCI students completed the activity in the first session but rather completed their assignments home to finish.

In all sessions, Dr. Sept was kept very busy running from group to group to answer content or tool-related questions. Her graduate assistant, Tadewos Assebework, also helped students with both types of questions.

Sources of Data

To effectively evaluate the implementation of TimeWeb, we employed a number of data sources in our study.

Pre-Course Student Profile

At the very beginning of the semester, all students enrolled in P200 filled out a pre-course student profile. This survey collected information such as age, sex, major, computer experience, as well general information about why students enrolled in the course, and how they saw the professor's and the students' roles. The archaeology/ anthropology graduate students and the HCI students also filled out these surveys, right before they did the TimeWeb demonstration.

Close-ended Questionnaires

The P200 students were administered two close-ended questionnaires in the first few weeks of the semester, many weeks prior to using TimeWeb. One questionnaire dealt with students' attitudes toward computer use and problem-solving, and the other had questions concerning group work and general questions about the course. The control group participants filled out a modified version of the questionnaire that had pertinent

questions about computer use, group work, and problem-solving skills. These same questionnaires were administered to all participants after the TimeWeb session.

Observations

Throughout the semester, an evaluator sat in on the archaeology course. This opportunity provided the evaluator with a greater understanding of the course content, a chance to see how the professor interacted with her students, and a context in which to consider the results of TimeWeb's implementation.

Prior to the first TimeWeb session, a number of observers were trained and given suggestions about what to look for with their participants, and took notes on students' work patterns, steps, reactions, and results. During the TimeWeb work sessions, all participants were observed using TimeWeb. Participants worked in pairs for three reasons:

- the instructor and developers felt that better learning takes place when students work with another person,
- working with a complicated tool such as TimeWeb is more engaging and less frustrating when the student doesn't feel alone, and,
- when working in pairs, students have to vocalize their ideas, experiences and emotions to their partners, so observers can more easily measure their work patterns, questions, and attitudes.

Interviews

Trained interviewers conducted short, one-on-one interviews with participants immediately after their TimeWeb experience. The interviewers asked eight general questions (each with a number of sub-questions), designed to examine students' experiences using TimeWeb; interviewers were instructed to probe certain answers further if they seemed fruitful. The participants were asked about the task they were given, the benefits and limitations of using TimeWeb, how they thought TimeWeb was useful, and whether they'd use it again; interviewers also gave students the opportunity to express any specific feelings about the task or the tool. Results from the interviews are explained in the **Findings** section.

Interviews with the control group subjects were carried out immediately after their first (1-hr) exposure to TimeWeb. Interviews with six P200 students were performed right after their first exposure to TimeWeb, with follow-up interviews and questionnaire administration set for the end of the semester, once they had handed in their assignments. At the end of the semester, only one of the six students who had volunteered to participate in an interview about their experiences with TimeWeb replied to a message about setting up an interview time.

FINDINGS

General Results

In general, the P200 students said they

- understood the assignment
- didn't complete it to their satisfaction
- found it useful to work in pairs

- used two computers
- divided up tasks by each doing the same thing on different machines

Students most often used the leaf and map views; they also found the view “easy to interpret.” A few students mentioned using the sliding bars. They found the tool most useful for accessing large amounts of data; a few students noted its utility for visualization and for conceptualizing the big picture.

All the P200 students interviewed appreciated the vast quantity of information they were able to access using TimeWeb, noting that “it is faster than using the library.” Most considered the tool as a search engine.

P200 students found the tool “interesting” and a “break from reading.” They generally found the software easy to navigate, although one student noted it would be easier to use if she had more training. Students found the visual interface easy to use, although one student thought it should be more visually “exciting.”

In general the HCI students said they

- did not understand the assignment
- did not complete it to their satisfaction
- found it useful to work in pairs

Half of the students worked in pairs and divided up tasks, with each partner working on a different computer; the other half worked together on one machine, doing the same question. Some participants were confused by the forest, tree and leaf views: “I understood the difference between forest, tree, and leaf but I didn’t understand how they could be used;” “The forest, tree, and leaf views are vague labels. I couldn’t really expect what would be shown for each.” The view most often mentioned as useful was the map

view. Students reported finding TimeWeb most useful for visualization and fact-finding. They echoed the P200 students' comments about the huge amounts of information available to them. One of the HCI participants found the graphics "good and imaginative." A few participants found the interface "very confusing. I didn't find it intuitive at all." Another said that "the mouse overs need work—need some descriptions of what the buttons do. Like the forest, tree, and leaf icons."

In general the graduate students said they

- understood the assignment
- didn't complete it to their satisfaction
- found it useful to work in pairs
- used two computers
- divided up tasks by each doing the same thing on different machines

The graduate students were the most "successful" users of TimeWeb, both in their attitudes toward it and their ability to perform tasks. They came closest to finishing the assignment, used the widest variety of views, and were most confident in their queries. One student would have liked to be able to query by "keyword," i.e., an alternative word used in archaeology circles that is not necessarily the one used in TimeWeb. A few noted the incompleteness of the database, but were generally impressed with the organization of the material. One student said that she liked TimeWeb because it might make archaeology "more accessible" to more people. Some of them felt the interface was confusing; others felt it was extremely workable.

Positive Aspects of TimeWeb**TimeWeb makes vast amounts of data accessible**

All participants recognized the enormous amount of data that are available and searchable. Two P200 students noted that it is better and faster than using the library: “It has a lot of varied information centrally located.” All of the P200 students remarked on the quantity of data; the HCI and archaeology graduate students were less focussed on the database side and more interested in the presentation aspect.

TimeWeb offers different presentation of material

Participants liked the variety of views available and used them for different purposes. Some students always used only the map and list, whereas others routinely used all views at different times. They mentioned finding the rich information available in the web pages very useful, especially the photographs. One participant said the web pages added context to the site and “made it come alive. You could see the actual dig.” Participants liked the rapidity with which they could change views.

TimeWeb is new and interesting

Students found that the program offered them new and different ways of searching for and obtaining information. The novelty of TimeWeb may wear off, but compared to reading articles, the searching and presentation capacities of TimeWeb are commendable. Some participants found the interface easy and engaging, and reported few problems with navigation. Trained to look at interfaces with a critical eye, the HCI students reported the most dissatisfaction with the interface.

TimeWeb helps visualization

Students appreciated the visualization capabilities of the tool, and especially liked the ability to have sites plotted in the map view. They also liked using the slider bars to move around on the map and within time in the timeline views. The most popular timeline view was leaf. According to one student, “It was helpful to look at the ‘leaf’ display to see the earliest of different regions.” Another participant appreciated “Seeing regions at one time and breaking down to smaller areas and going into depth.”

Limitations of TimeWeb

Windows

A number of participants noted that there were too many windows operating at once and they often closed the wrong ones, losing their query results. One student felt that he was “flipping through too many pages.” The idea of getting lost in the windows was echoed by a number of the HCI participants. One HCI student remarked: “When you get results, you lose the query window and forget what question the results answer. When you close the results window the query is also gone, so you have to go back to new query.” Another said “Too many windows are open in one screen, so it looks confusing.”

Search History

The lack of a back button or search history means that participants can easily lose their search results and must re-create the search to continue their work. This is less of a problem if students write down their search terms and strategies each time, but if their searches are at all spontaneous, they have no hope of recreating them. One HCI participant said: “The user might want to save the query. If TimeWeb has search history, it will be very useful for the user. Currently, the user has to run the query every time even for the same query.”

Run/load speed

Some participants found TimeWeb to be too slow. This was an inconvenience most often not because of the time it took, but because students did not know if the machine was indeed searching or if it had stopped working. Then, once students learned to wait 3-4

minutes for a query result, they became confused if the queries took less time, thinking that they had entered the wrong information or somehow had done the wrong thing.

Non-finding

One expected result that was **not** found in this study was a general anti-computer attitude. Based on previous studies and questionnaire results, the evaluator expected more comments such as “I don’t like computers,” “I’d rather listen to a lecture,” or “I don’t think computers have a positive role in education.” It should be noted that because the P200 students volunteered to use TimeWeb for this assignment, they were already predisposed to be open to using computers. However, perhaps because the student self-selected to participate, the expectation of a generally negative attitude was not supported.

Recommendations for Tool Improvement

- It is unclear what can be done about the number of windows and their tendency to “hide.” One solution would be better labeling of windows, or more thought to program or user ability to better control screen real estate. A number of participants mentioned this as a shortcoming.
- A general consensus is that TimeWeb needs some sort of search history, or at the very least, a back button, so students can compare and revisit queries.
- One student suggested a “print function that could grab a paper copy of information.”
- Many participants commented on the wealth of data available in TimeWeb. The ability to capture data from TimeWeb for use at another time or for another reason could increase its value to users.

- Because stability has always been a concern, tests should be run to see exactly how many simultaneous users TimeWeb can support. This will give the instructor more confidence in pushing the students to use the tool in upcoming semester.

Recommendations for Implementation Improvement

- Depending on the stability of TimeWeb, it should be integrated into the course as much as possible as a “normal” or indispensable resource. To this end, TimeWeb should be introduced to the students early in the course. They should become familiar with it in the first few weeks of the semester so that they have the opportunity to use it throughout the semester.
- All students should be required to use TimeWeb in an assignment.
- Students need more hands-on time with TimeWeb, but also need to be encouraged to explore the tool out of class.
- Students should get to learn to use TimeWeb on small assignments in pairs before doing their large assignments. They can iron out any inaccuracies in their understanding or in their searching strategies before starting a large project.
- Students need the tasks to be more clearly articulated. Although the ideal is to present the learner with an open-ended problem they define for themselves, or an otherwise “fuzzy problem” for them to work through, TimeWeb as a tool is extremely unclear, non-intuitive, and amorphous for them. They become frustrated solving a question they don’t understand using a tool they can’t operate.

- Students need more direct instruction about TimeWeb. Although most of them say they “get it” at the end of the demonstration, observing them using the tool shows that very few of them have even a rudimentary understanding of what they’re supposed to be doing, let alone how to do it using TimeWeb. In all the sessions, Dr. Sept was continually running from group to group to answer questions. Many groups were incapable of continuing until they had a question answered, and would wait 10 or 15 minutes for help. In addition to Dr. Sept, we recommend having other facilitators in the lab. These mentors can be graduate students who have worked a bit with TimeWeb, or former students who are interested in helping. Often, the questions that stymie the groups are of a very basic nature. An ideal ratio would be one instructor/facilitator to three groups.

Recommendations for Study Improvement

The two major problems with this study can be controlled with different tool implementation.

1. There were very few subjects. Because of instability issues, TimeWeb was not used by all students, but by a handful who volunteered. Of that handful, only 4 actually ended up using it enough to complete an assignment. Of those who tried TimeWeb, the evaluator was only able to talk to one student, because others either did not want to participate or left town right after term ended. Having all students use the tool would increase the participant pool.
2. Even if the participant pool were larger, there must be enough time between completion of the TimeWeb activity and the end of term in order to collect data from

students. In this case, the necessary timing of the assignment meant that data collection was severely hampered. TimeWeb should be employed earlier in the term, both for pedagogical and evaluative purposes.