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ABSTRACT

A science classroom was used to study the effects of a shared intranet environment on students' problem-solving ability and metacognitive reflection skills through shared contextualization. Subjects were first-time 9th- and 10th-grade biology students from three public high schools. An evaluative analysis of the CourseInfo software (Blackboard, Inc., 1998) was undertaken, and the tracking capabilities of the CourseInfo software were evaluated through measurement of: number of log-ons to the threaded discussion; number of threaded statements; number of threaded dialogue statements of response to other student statements; and number of threaded dialogue statements of response to teacher statements. Analysis of tracked user movement within the shared Web-based environment was investigated as one possible model of evaluating learner academic behaviors within, and as a result of, Web-based environments. Results of the study support tracking user movement as an avenue of quantifying the effectiveness of Web-based learning initiatives. (AEF)

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Research Paper: Connecting Technology to Teaching and Learning

Web-Based Extended Learning through Discussion Forums

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Introduction and Rationale

As the intranet/Internet is introduced in to the learning environment of the classroom today, the effects of this technological environment must begin to be studied. Technology offers an opportunity to affect and monitor academic behaviors such as problem-solving ability and metacognitive reflection. However, what evidence can be found that speaks to the effectiveness of the use of such learning places? Can a model for visualizing any level of effectiveness be generated for such environments?

As technology creates a virtual classroom environment as it moves to a Web-based space, questions arise regarding the effectiveness of such geographically unrestricted, collaborative problem-solving places (Jacobsen & Levin, 1993). Collaborative designs such as these become possible when the learning environment is placed within a Web of computers, thereby facilitating and encouraging access by many to a shared intranet/Internet Web-place.

As students use the collaborative capabilities of a networked intranet learning environment, thinking about their own thinking evolves, thereby increasing the opportunity to clarify misconceptions of knowledge, procedural or declarative. The science classroom presents one opportunity to study the effects of a shared intranet environment on student problem-solving ability and metacognitive reflection skills through shared contextualization. Field study data collection, posting, and discussion create a context, or anchor (Brown et al., 1989), for this virtual learning environment based on real, concrete information.

Questions Researched

As part of a secondary research question, an evaluative analysis of the CourseInfo software (Blackboard, Inc., 1998) was undertaken. The tracking capabilities of the CourseInfo software were evaluated through measurement of (1) the number of log-ons to the threaded discussion Web page, (2) the number of threaded statements, (3) the number of threaded dialogue statements of response to other student statements, and (4) the number of threaded dialogue statements of response to teacher statements.

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Analysis of tracked user movement within the shared Web-based environment was investigated as one possible model of evaluating learner academic behaviors within, and as a result of, Web-based environments. While further analysis is needed, results of this study support tracking user movement as an avenue of quantifying the effectiveness of Web-based learning initiatives.

Study Background

Subjects

Subjects for this study were first-time 9th- and 10th-grade biology students from three public education high schools in the Conroe ISD within Conroe, Texas. The sample (n) contained 78 students of the 1,400 students enrolled in Biology I courses. Two classes from each school were selected and randomly assigned to a control class and a treatment class. Selected campuses operated on an A-B, 90-minute class alternating block schedule.

Technology

Participants assigned to treatment groups received access to technology. This technology included Macintosh® platform computers. Scanners, digital cameras, Internet connections, and laser printers rounded out the technology utilized by the treatment groups. Software access included Apple® QuickTake® PhotoNow software, HP® scanning software, Microsoft® Office, Netscape Navigator® Gold 3.0, and Inspiration® 4.0.

Ecology Curriculum

Teachers at selected campuses received an Adopt-a-Ditch ecology curriculum (Stone & Myers, 1994). This modified curriculum provided the context for the Web-based learning environment. Training for all curriculum lessons, the LaMotte Freshwater Testing Kits, and the Web-based database was provided. Spontaneously generated forum topics were noted as the researcher analyzed collected data within the Web-based learning environment.

Teacher Training

Technology training consisted of instruction and practice in using the CourseInfo intranet simulation software (Blackboard, Inc., 1998), uploading and downloading Inspiration files through the Internet, using a digital camera and downloading images, working with Excel spreadsheets and graphics, and using the discussion forum environment.

Software Background

A secondary intent of this study was to provide evaluative discussion of the software product used to create the shared learning environment. As this newly developed distance education software product was in the process of being piloted by a variety of institutions and research programs, permission for its use as part of this study was obtained (from Blackboard, Inc.). Agreements between the author and software developers included evaluative information resulting from use of the product, taking into consideration the constraints of its application within the nature of the study. Results addressing the secondary research question focused

on an examination of tracked user movement findings, discussion forum findings, and difficulties experienced during use of the software product.

One caveat exists as a part of answering this secondary research question. It is imperative to remember that this section's evaluative basis remains the by-product of this particular study. As many other piloted uses of this product have occurred, or are presently ongoing, this author suggests that additional review of other evaluative efforts be examined should any future use of the product be initiated.

Further, it must be noted that use of the product within this study represents a model whereby security access was granted to all subjects within the study. This type of widespread access is not the usual mode of access suggested by the developers. However, this approach was utilized to create a more constructivist (Jonassen, 1996), shared environment given the nature of the software product. Therefore, review of the secondary research question findings should occur with forethought of these caveats. Future users of this software product should consider the type of learning environment they envision, as well as the learning philosophy underpinning that environment, as this study's findings of the software are taken into account.

Software Capabilities within the Model of Study

Tracked User Movement

CourseInfo software provides a database of user movement patterns once entry in to the Web site occurs (see Figure 1). Analysis of recorded user movement can be obtained for a variety of statistical views of user movement.

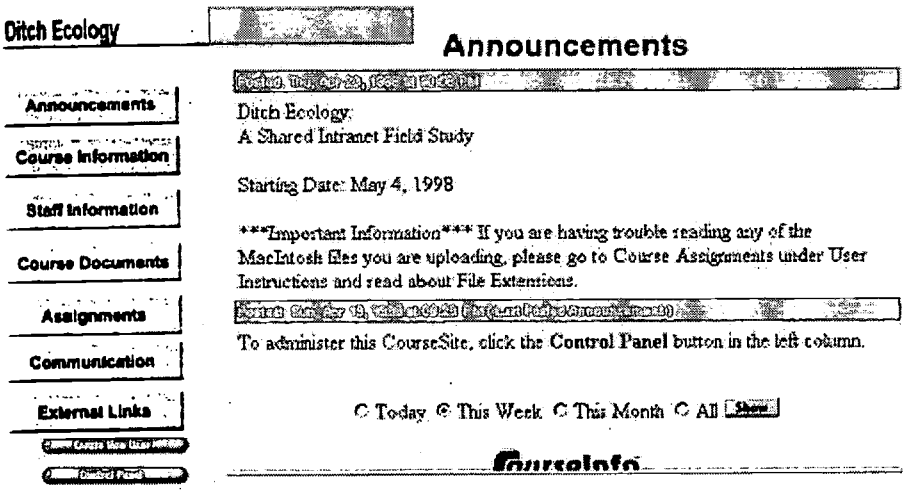

Figure 1. Announcement page for Web-based learning environment.

These statistical views were made available through the CourseSite Stats option accessible with a security password through the control panel. Views (analyses) available include: (1) traffic hits for the entire course

time and by links (see Figure 3); (5) traffic hits by countries, visitors, and browsers; and (6) filtering the preceding information by server domain.

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View Selected Statistics

Hits	%	Web Page URL Analysis	Filter Go
176	34.7%	Main_Page	
68	13.4%	Course_Documents	
52	10.2%	Assignments	
49	9.66%	Student_Tools	
46	9.07%	Communication	
33	6.50%	Course_Information	
31	6.11%	External_Links	
28	5.52%	Staff_Information	
12	2.36%	Student_Homepages	
10	1.97%	Virtual_Chat_Room	
2	0.39%	Index_Noframes	

Figure 2. Movement analysis by Web-site page.

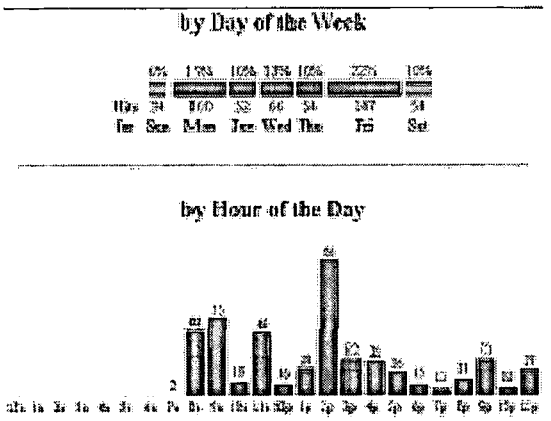

Figure 3. Analysis by Web-site day and time.

As a part of the study, tracked user movement generated information related to several aspects of user movement. Repeated visits (interpreted as level of traffic) can be connected to user preferences related to Web-page function, design, or information. The total number of hits can indicate to some degree user time within the shared learning environment in general. Evaluating which pages were accessed during the study could indicate depth and type of use of the shared environment. Use of help pages within the shared environment could imply use in a self-sufficient way. Finally, tracked use of the discussion board provided information as to the development of the entire study group, the collaborative extent of the group, and student-initiated discussion. Tracked user movement, identified movement by page title, and number of traffic hits, as well as percentages, were summarized (see Figure 4).

Analysis of user movement by page indicated entrance in to the shared environment through the main page. The Course Documents page was used with the most frequency (13.3%) after entering the shared environment. This page provided the storage location for uploaded files (graphs, images, and documents) for all participants. All files accessed through this page by any participant were viewed or downloaded. Use of the

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Assignments page incurred 9.8% of the hits. This page held sample files and user instructions for the various activity demands of the ecology

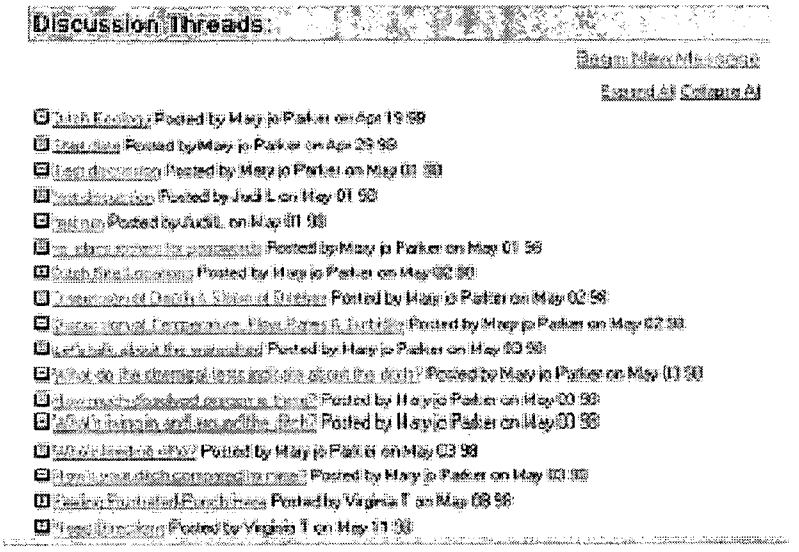

Figure 4. Sample discussion threads used in tracking learner movements.

curriculum. The limited use of this page simulated the nature of FAQs pages in other Web sites, that is, it remained relatively unused. The third most frequented page within the Web site was the student Tools page, at 11.9%, indicating that help pages entitled Tools seem to be more frequently accessed by novice users than pages titled in other ways.

An analysis of user movement by date was undertaken as an indicator of the overall use of the shared environment. Table 1 contains a use-by-date display of user movement within the Web site. Examination of use-by-date hits, filtered through server domain, provides evidence of the site's extension of interactivity between time and the users. At first glance an appearance of minimal use might be seen in the small number of hits and the low percentages. However, closer examination indicates that in an A-B block schedule hits were recorded for each day of the school week. This looms important as it suggests that in some way students gained access to the shared Web-based environment during days when no science class was scheduled.

Discussion Forum Findings

Analysis of the use of the shared environment's discussion board revealed much about the amount of time spent using a shared discussion place as well as about other previous discussion forum experiences within the classroom. Extrapolation of the number of hits associated with accessing the discussion board provided evidence of minimal use of this type of environment and technology, suggested a lack of previous exposure to the electronic sharing of ideas and information, and detected technical issues as the most pressing and reported discussion topics. The following sections address these extrapolations.

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Table 1. Analysis of User Movement by Date of Use for the Duration of Study

Date of Use	Day of the Month	Scheduled Study Dates	Hits	Percentage of Hits (%)
5-4-98	Monday	+	4	1.4
5-5-98	Tuesday		7	2.5
5-6-98	Wednesday	+	7	2.5
5-7-98	Thursday		8	2.8
5-8-98	Friday	+	103	39.2
5-11-98	Monday		70	24.7
5-12-98	Tuesday	+	16	5.7
5-13-98	Wednesday		27	9.5
5-14-98	Thursday	+	25	8.8
5-15-98	Friday		16	5.7
Total			283*	100.0

Note: The * denotes the number of hits remaining after discounting the number of hits recorded by the dissertation's author while monitoring the site.

Use of the shared discussion board

Originally, a total count of discussion threads posted by the author of the study was determined. Sixteen threads were initially established as "starters" for each of the activities in the ecology curriculum guide. The use of starter threads potentially enabled moderation and enumeration of topics by the author or by each campus teacher. A count of the number of discussion responses indicated very little activity within the shared discussion board. Minimal new discussion threads were originated through the duration of the study. The lack of discussion threads or responses seemed surprisingly low considering that each curriculum activity included responses to the discussion board topics as indicated in each activity directions. Analysis of discussion threads and responses suggested little time of use within the forum opportunity of the site. Only five new discussion threads were recorded over the duration of the study. Of the new threads recorded only one came from a student. Efforts to understand this lack of activity brought focus to the nature of the discussion threads or response messages actually recorded within the discussion forum.

Nature of the discussion forum threads and responses

A review of the content of the discussion threads created by teachers and students indicated their experiences with technical difficulties associated with some aspect of the various technologies involved in the study. Primarily, use of the uploading and downloading capabilities presented time-consuming difficulties as apparent in the number of discussion threads and responses made by teachers and the one student discussion response dealing with this aspect of the study. Additionally, qualitative analysis of the dissertation author's discussion responses suggests frustrations and needed help on the part of the writers of the responses. In some instances the discussion thread titles indicated the degree of technical problems being experienced: "Feeling Frustrated-Punch Here," "Need Directions," or "Need Directions too."

An analysis of the dates of the forum threads and responses provides additional evidence of the minimal use of the discussion forum as well as potential reasons for this lack of use. The dates of teacher and student discussion threads and responses seemed to indicate initial use occurred late in the study and did not follow the curriculum guide of activities. Table 2 summarizes discussion threads and responses by date.

Table 2 seems to suggest that the teachers, at least, were beginning to try to use the forum as a place to share difficulties as well as a place for seeking help. When dissertation author discussion threads and responses were analyzed, all appeared to address technical issues inherent in the software or in the computer platform providing technology capabilities.

Table 2. Summary of Discussion Threads and Responses by Date

Discussion Thread Titles	Date	Respondent
Test Discussion	May 1	Teacher
Test Run	May 1	Teacher
Feeling Frustrated-Punch Here	May 8	Teacher
Need Directions	May 11	Student
Need Directions too	May 11	Teacher
Discussion Response Titles		
Re: Ditch Site Locations	May 5	Teacher

Difficulties Experienced Using CourseInfo Software

Examination of uploaded files and discussion forum transcripts provided evidence of a variety of difficulties experienced with the piloted software. These difficulties seemed to cluster around novice user levels of the participants, computer platform inconsistencies, and software security issues.

When an initial survey of all uploads in to the CourseInfo ditch ecology site was performed, upload attempts provided evidence that use of the site by students was high. However, this same information suggested that the on-site help pages and on-hand training documents had not been accessed during initial uploads, as many attempts to upload were to incorrect locations.

Once user uploads were found, attempts to open and view each was made. This was initially undertaken by the dissertation author to ensure the viewability of the data. Computer platform issues came into evidence during this phase for all campus users. All campus users operated Macintosh platforms that automatically upload files with no preassigned file extension added to the file name. PC platforms and software automatically preassign the file type extension to a file name, thereby enabling identification of the file type. This became critical within the CourseInfo environment as each uploaded file, when opened, launched a copy of the application needed for readability. The lack of automatic assignment of file type extensions as a result of Macintosh platform use caused initial uploads by each campus to be unreadable. This issue created multiple upload attempts of the same data and high frustration levels among the users uploading.

Summary

The secondary research question attempts to identify academic behaviors that can be tracked within a shared Web-based learning environment such as that offered by the piloted CourseInfo software. Identifying user movement patterns in Web-based environments and discussion forum patterns as well as attempting to ascribe meaning to these movement patterns by connecting these movements to academic problem-solving and metacognitive reflection offers much potential for understanding these new learning environments. Connecting meaning to these movement trends within the context of the shared Web-based environment may be the most interesting, potentially meaningful aspect of this study.

As shared Web-based learning environments within secondary classrooms experience rising use, models focused on understanding the critical elements of effectiveness of these environments seem necessary, rather than novel. Tracking user movement and discussion forum patterns offers a potential way of documenting and quantifying learner critical thinking and metacognitive reflection within a Web-based learning environment. Tracking movements and discussion forum patterns provides one method of assessment within the Web-based environment that can be maintained behind the scenes without interference to the learner and without overt, game-like feedback. This type of assessment informs instruction, the instructor, and the learning environment. The potential exists for measuring the effect of the environment through the learner's movement patterns, thereby offering the possibility of creating an optimum learning environment for each and every type of learner.

The richness of shared data, data examination, and learner insights follows naturally from analyzing user movement patterns. Moving learner metacognitive reflection capabilities to a Web-based learning environment presents the academic accountability often missing from current models of Web-based learning. Not only depth of knowledge, but also critical-thinking levels, can begin to be warehoused for constructive use by each learner/user.

Contextualizing Web-based learning environments with real-time scientific data collection and evaluative activities appears to favorably support the improvement of academic behaviors. Given the strong emergence of distance education initiatives, evaluating and assessing these behaviors within the Web-based learning environment becomes ever more important. Add to this the constructivist nature associated with this study's model, and the power and empowerment of this type of Web-based learning place becomes awesome, and needed.

Future Implications

The results of this study present one practical model for infusing technology in to the classroom setting; for improving problem-solving ability and metacognitive reflection over a short duration; for creating a collaborative, cooperative learning space; and for maintaining a science space for learning where no gender differences arise.

The power an intranet offers within the constraints of a school district, or geographic locale, has not yet been tapped. This study proposes one mechanism for doing just that given the infrastructure present or absent through the use of a Web-based intranet. This model offers a "get your feet wet" method of networked connectivity for classrooms and teachers who have not yet jumped in to the World Wide Web.

This research provides a study in contextualizing connectivity with end goals of improved problem-solving and metacognitive reflection. Both of these elements are often lost when initial attempts to jump in to networked learning occur or are contemplated. Further, this study provides an avenue of documenting the nature of learning during the use of Web browsing or other networked connections. Tracking learner movements within a browsed Web site has metacognitive as well as problem-solving implications for each and every learner.

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