2006-144: STUDENT GENERATED REAL-TIME NOTE DEVELOPMENT AND WEB PAGE ARCHIVAL

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and
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Abstract

An experimental, delayed-time, student-generated course note and on-line archival system was initiated in a Junior-level Environmental Science course, which is required for all Civil Engineering majors, during 2004 to test the validity of generating a system of archived consistent course notes for all students. The system involved a designated student each day throughout the course being responsible for the class notes that were generated in the lecture or the laboratory sessions. The student preparing the notes was required to submit the notes by email to the instructor or to upload them directly to the course website for review and approval. The instructor reviewed the notes each day to edit them, and the notes were accessed on-line at the start of the next meeting with the students. Needed corrections and theoretical misunderstandings were in this way identified, and resolved very quickly for the students. This methodology was proposed to accomplish several objectives: to get the students more involved in the development of the course material (increasing their active participation and learning); to allow the instructor almost immediately to recognize and resolve misunderstandings in the material; and to allow the students to develop confidence in the accuracy of their own notes. Narrative and quantitative student assessments were supportive of the note generation and on-line archival process. However, assessments indicated the need for an improved archival system. Additionally, the process was limited by the inability of the students to generate most of the laboratory diagrams and notes in anything but a "word processing" representation. This paper will provide details of the first year program and assessment along with the successes and frustrations encountered in the second year of implementation using a course web management system and a "smart board" for real time note recording.

Introduction

Cognitive learning theory teaches us that students come to the university with a diversity of learning styles. Kolb[1] developed a learning style inventory to help students and teachers evaluate the learner's predominant learning style. Cheek described that part of the constructivist model is based on knowledge being not passively received, but actively built up by the cognizing subject [2]. Different methods of assessment are commonly used to evaluate student learning in a single course, such as the following: homework, quizzes, tests, group or team projects, individual research papers, and quantitative and qualitative formative and/or summative assessments. Nair, et al. [3], stated that "the availability of software systems and electronic bulletin boards augment teaching by supporting student teamwork and facilitating communication and the management of projects." Poole, et al. [4], suggested the use of embedded assessments as tools for teachers to use in their classrooms as an integrated part of their lessons. Kirkpatrick [5] proposed a three-step model for teachers to use to make presentations more meaningful: (a) present the material, (b) personalize the material, and (c) allow students to interact with the material. Waller [6] suggested

developing procedures to elicit immediate feedback from students on lecture clarity. She indicated that there appears to be value added to the learning process by briefly reviewing points and assessing current understanding. Additionally, student input can provide guidance for initial information to be explored in the next lecture. Turns, et al.[7], detailed the need for instructors to be able to generate robust, valid and informative descriptions of what students know.

This research hypothesized that an entire class of students would benefit from increased interaction with the lecture and laboratory material in a Junior level environmental science course if one student in the course had the individual daily responsibility of posting notes to an on-line archival system for each lecture or laboratory period. Additionally, it was hypothesized that if the information were posted in a timely manner before the next class period, the instructor would get feedback from the one student that would give an indication of misconceptions held by many of the students. Further, the display of the notes in class on a projection screen from the on-line system would initiate each subsequent lecture or laboratory period establishing continuity with previous lecture or laboratory sessions as well as correcting any identified misconceptions. Finally, all of these factors should lead to higher levels of positive assessment by the students and the instructor that course objectives had been successfully met. The product of this type of applied educational research is information that educators could use for designing and choosing among possible instructional strategies and forms of assessment.

Background

An experimental, delayed-time, student-generated course note and on-line archival system were initiated in CE 321 during Fall Quarter 2004 to test the validity of this proposal. The system involved a designated student each day throughout the course being responsible for the class notes that were generated in the lecture or the laboratory sessions. All students had the responsibility to take notes for the class on a rotating mandatory assignment basis. The student preparing the notes was required to submit the notes by email to the instructor or to upload them directly to the course website, which had been established on LUMINIS (an on line university administration and management system with rudimentary course management aspects), for the instructor's review and approval. The course instructor reviewed the notes each day to edit them, and the notes were accessed on-line at the start of the next meeting with the students. Needed corrections and theoretical misunderstandings were in this way identified, and resolved very quickly for the students. This methodology was proposed to accomplish several objectives: to get the students more involved in the development of the course material (increasing their active participation and learning); to allow the instructor almost immediately to recognize and resolve misunderstandings in the material; and to allow the students to develop confidence in the accuracy of their own notes.

Results

A narrative assessment was conducted at the end of the quarter for 31 students involved in the delayed time note archival experiment. The summary results of this outcome assessment indicated that 80% of the students felt the procedure was valuable and should be continued. The remaining 20% of the students were not negative about the process but were neutral about the value. There was no negative input about continuing the process. Students consistently

indicated the value to them in seeing and having access to the understanding of the other students in the course through the on-line system.   Further, quantitatively, the on-line course management software indicated that 22/31 students were accessing the course notes regularly through the end of the quarter.

A seven question summative quantitative assessment has been completed by the students taking the environmental science course each of the past four years. The purpose of the assessment is to develop a quantitative score for the students' evaluation of how well they believe the expected course outcome was accomplished. The students score each expected course outcome with a 1 (strongly disagree) to 5 (strongly agree) value. The expected course outcomes listed by main topic and their mean score for the past four years are shown in Table 1.   The P value in the last column is a quantitative estimate of the strength of your ability to reject the null hypothesis that the mean value for each year is the same. The analysis was completed using an Analysis of Variation (ANOVA) software tool in the data analysis in EXCEL. The null hypothesis states that all of the means are the same even though there was different treatment of the means. The P value would have to be less than 0.05 to reject the null hypothesis with 95% confidence.

Expected Course Outcome	2001	2002	2003	2004	P
1	4.48	4.58	4.52	4.39	0.709
2	4.26	4.61	4.61	4.35	0.088
3	3.39	4.38	4.35	4.19	0.0009
4	4.30	3.96	4.39	4.25	0.178
5	4.04	3.58	4.35	4.00	0.017
6	4.83	4.31	4.57	4.58	0.057
7	4.70	4.35	4.44	4.52	0.208

Table 1. Expected Course Outcome Mean Value Summary.

Additionally, an analysis of the students' total course average score performance for the four years was performed with the results shown in Table 2 for each year along with the variance of the course quantitative scores and the P value.

Year	Avg Score	Variance	P
2001	76.7	305.2	0.005
2002	84.2	54.5	
2003	86.2	61.4	
2004	85.5	34.2	

Table 2. Average Course Scores and Variance.

Discussion

The students' narrative assessment indicated that 80% of the students thought that the note archival system was valuable. Additionally, approximately 70% of the students continued to use

the system regularly throughout the quarter. Students sensed and expressed that there was a value to them in having access to the other students' understanding of the course material. The P value of 0.005 for the analysis of the treatment of the mean course scores for the four years would seem to indicate that there is a difference in the mean scores of the students and perhaps the null hypothesis that the average course score is the same should be rejected in the four year analysis. However, it is certainly not clear that the students' quantitative performance improved in the fourth year due to the addition of the note archival system. Actually, the average student score in the fourth year was slightly higher than the second year and slightly lower than the third year. If the students overall course scores for 2001 were not included in the analysis, the resultant P value is 0.584 which would not allow rejecting the null hypothesis that the mean values of all of the years' quantitative scores are the same. This would lend strength to the conclusion that the different treatment of the course by using the delayed on-line note archival system in the fourth year did not improve the students' quantitative performance in the course.

ANOVA analysis of expected course outcome 3 would result in a P value of 0.585 if the first year was not included in the analysis. This lends strength to the conclusion that the addition of the course note archival system in the fourth year did not improve this outcome as the data does not allow us to reject the null hypothesis that the average score given the outcome by the students in the last three years was the same. Also, ANOVA analysis of expected course outcome 5 would result in a P value of 0.218 if the second year was not included in the analysis. This lends strength to the conclusion that the addition of the note archival system in the fourth year is not the treatment that caused there to be a difference in the means of the student evaluations.

One interesting observation in the four years of data is in regards to the variance of the students' course quantitative scores shown in Table 2. Although the data indicates that the average of the students' course score was not changed by the online course archival system, the variance of the students' scores in the fourth year was almost ½ of what it was in years two and three. Apparently, the on-line archival system doesn't improve the overall class average, but does appear to make the students more similar by moving more of the students closer to the average by the sharing of the "same" knowledge.

Input from students for improving the note generation and on-line archival system indicated the need for an improved archival system, i.e. LUMINIS is a less than user friendly format to systematically archive information for efficient retrieval. Additionally, the process was limited by the inability of the students to generate most of the laboratory diagrams and notes in anything but a "word processing" representation. Further, the system was severely limited by the size of the file that could be uploaded by the instructor or students to the website. It was nearly impossible to upload a scanned file to the course management system.

The instructor also struggled with the need to improve the transfer of the information in the laboratory to address the students' learning styles and to integrate them into the formal inquiry process. The students are reluctant and/or inexperienced in the process of researching, organizing, and prioritizing background information to develop the context for conducting the laboratory investigations. Additionally, delays in the students' uploading the material need to be addressed as delays were frustrating to the students as they studied, and caused the system to

breakdown as the professor could not address conceptual problems as they occurred in the development of the students' understanding. A follow up research project was suggested by the instructor to evaluate the use of a "smart board" system for archiving laboratory notes in "real time" as a solution to both of these issues.

Follow Up, "Smart Board" Phase

Based on the results of the initial delayed-time note archival system, the project received follow-up funding through Ohio Northern University in a 2004 – 2005 Teaching with Technology Grants initiative. Funds were requested for the purchase of a 72" diagonal Smart Board, Tablet PC Computer, and Wireless Computer Projector for implementation of the proposed pedagogical project. The second phase of the project was implemented in CE 321 Environmental Science in the Fall Quarter of 2005. During the course, the students were investigating the acid – base relationships that interact in our environment and are modified by the carbonate alkalinity system. The understanding of these equilibrium relationships provides a powerful foundation for the students' progression into applied design for the water environment (streams, rivers, lakes, groundwater and atmosphere).

The project focused on the real time development of laboratory notes by the students and the professor along with the concurrent archival of these notes to the course web page using WebCT course management software for the course students to utilize during the quarter. The intent of this process was to address student learning styles in the development of the laboratory experimental concept. It was hypothesized that the real – time development of the laboratory background material would have a direct impact on the students' understanding of the underlying fundamental theories which the laboratory experience seeks to reinforce. The archival of the notes on the course web page was intended to provide the students with a distributed, consistent, permanent reference source to use throughout the quarter.

Observations

The smart board was initially installed in the environmental laboratory on a portable frame designed and supplied by the manufacturer. A synchronized projector and "air projector" system was used to communicate with a notebook computer. The air projector was intended to free the instructor for walking around the studio laboratory and interacting with the students while writing on the notebook screen which would be displayed on the smart board through wireless communication. The intent was that the integrated product of the instructor's pre-laboratory notes, the class discussion during the studio laboratory, sketches, etc. would all be archived on the course web-site and be available to the students for reference and studying throughout the quarter.

The physical experience with the notebook computer and the air projector were less than acceptable. The air projector consistently conflicted with the building's wireless network with the result being that it was basically unusable during the laboratory sessions. The notebook computer did work consistently with the smart board interface if it was hard-wired to the smart board and the projector. This allowed the instructor to interface with his pre-written notes and to

annotate them during the pre laboratory discussion session, but "land-locked" him to a fixed podium status as he was before the use of the smart board.

Once the decision had been made to proceed with the fixed, hard-wired computer system, the instructor tried to interact with the portable smart board by writing with one of his fingers or one of the electronic styluses provided by the manufacturer. These systems all work well for highlighting information in pre-loaded notes, and for rough graphical representations of qualitative concepts. However, the notebook computer software is not sophisticated enough to recognize the instructor's hand printing to use this methodology in archiving class-generated notes. This was concluded by the instructor and the students to be a total failure. The notes had to be generated through a word-processing software or they were deemed worthless. (It should be noted that the instructor was "draftsman" in a "younger former" life, and that no amount of painful slow fine printing could be consistently interpreted by the computer software.) Undoubtedly, this recognition software will improve, but it is not ready for this type of utilization at this point in time. Additionally, the portable smart board stand is not sufficient robust to withstand even soft touching for a laboratory or lecture period on a smooth floor. The locking leg system is not sufficiently designed to hold its position. Anecdotally, other instructors have told me that they have been successful in holding the board's position using tape on the floor. Also, it may be possible that the portable board would hold position better on a carpeted surface. However, the board had to be synchronized at least twice during each presentation on a smooth laboratory floor surface. Finally, the notebook computer used a software package called "one note" to interact with the smart board for taking notes. This word processing type note taking software works well with the smart board but is not readily available to the student population. The instructor must either make sure to convert the notes developed to a common word processing or PDF format before loading to the course web site or must make sure that all students are given access to the proprietary software being used with the smart board interface. The "one note" software also appears to conflict with other software packages when they are running such as Adobe Reader.

Future Work

I plan to implement an improved delayed time note archival system in the next course delivery using WebCT software. Additional, data will be evaluated to determine in the results are consistent with 2004 results of maintaining the same overall course grade average while moving more of the students closer to the mean score. I anticipate that the WebCT software will perform much more seamlessly for the students and will relieve much of the frustration with the previous use of the LUMINIS system. I do not plan to re-evaluate the use of the real-time Smart Board archival system at this time until I find better software packages to interpret hand writing and graphical representation that will work more seamlessly with WebCT and typical available word processing software available to the general student population.

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