The Tell-Tale Data: Virtual Whispering and Final Student Grades

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Abstract

Online classroom management issues pose new problems for the online instructor and pose seductive communicative options for students. This exploratory group of studies examined Blackboard/WEBCT™ data as collected for the course designer of an online course as possible indicators of "whispering" or backchanneling between students with potential impacts on course outcomes (grades). Three studies examined possible significant relationships between WEBCT data (HITS, READ, POSTED, and MAIL) with student final grades. Studies varied the independent variables of course content, instructor, length of course, and enrollments. Enrollments in studied courses ranged from nine students to 17. Correlational matrices and cluster analyses were performed using SPSS ver. 13. Findings included a strong significant relationship between HITS and student final grades across all studies, while MAIL (student-student interactions) failed to correlate significantly with final grades except in one lower-level course. Cluster analyses identified from two to three clustered groups within each study. Clusters were determined by hierarchically organizing WEBCT™ data as follows: HITS, READ, POSTED, MAIL, and GRADE (ltr). Analyses of clusters supported the relationships noted between HITS and student final grades, but varied on the value of MAIL data relationships.

The Tell-Tale Data: Virtual Whispering in Online Courses

Introduction

A recent review of Web-based protocols for students studying in an online environment revealed the following instruction:

> Side Conversations in class – Also, like a traditional classroom, there can be no whispering in the back of the room. You may only raise your hand or post a question.
>
> (http://www.infosec.jmu.edu/courses/CommonWebPages/ChatProtocol.html, p. 3)

This instruction is a stretch of the imagination for anyone who has taught in both the traditional and online format. How can a student raise a hand? How can an instructor tell if anyone is whispering in the back of the room? And, even more importantly, what difference does the potential whispering in the back of the room make for the student, the student's grade, or for the instructor? This study examines the value of WEBCT data from online courses as an indicator of the impact of virtual whispering on learning outcomes. First, terms are defined reflecting the use of communication terms in the virtual WEBCT domain. Second, extant research is reviewed to see what, if anything, has contributed to an understanding of this phenomenon -- whispering in the back of the virtual classroom. Finally, the analysis of data in three studies collected from online classes taught in WEBCT is offered, followed by a discussion of the possible interpretations of these data for the online instructor.

Terms Defined

Computer-mediated communication frames the interactions with the virtually-taught course. Two categories of interaction generally comprise web-based learning – synchronous (real-time interactions) and asynchronous (time and place independent) communication. Often synchronous communication is difficult to impossible if students and professor are geographically diverse. Thus, this study focuses on the value and contribution of asynchronous communication between participants in virtual learning. Three forms of interaction are likely in this category of communication – 1) communication through course web pages (the least interactive approach), 2) postings to a discussion forum, and 3) e-mail messages through the course shell (Lavooy and Newlin, 2003).

Blackboard/ WEBCT™ is a commercial product for online course delivery, usually employed by colleges and universities. The course environment in Blackboard / WEBCT™ is designed by the instructor to include any of the following options: syllabus information equivalent to a hard copy syllabus, course content materials, discussion folders, assignment instructions with submission links, group projects, and e-mail within the course shell. Tracking data are collected through WEBCT™ so that access to specific course sections and materials are logged for each individual student. A history of the data is available to the instructor throughout the semester as well as at the conclusion of the course.

The following data are collected per individual student (Blackboard / WEBCT™ Glossary, http://socrates.berkeley.edu/~fmb/articles/webct-glossary.html):

Homepage visits	Organizer page visits
Content Page visits	Assignment visits
Quiz visits (if used)	Calendar visits
Mail events	My Grades visits

Articles read	Original Posts
Follow-up Posts	Last login
Last page visited	Total number of accesses

Most of the collected data provides an interesting picture of overall student interactions, but few studies have examined the relationships between the data and student outcomes. Blackboard / WEBCT™ is usually regarded as a "teaching tool"(Brown Daily Herald, March10, 2005), while the tracking facilities are often ignored or employed only to check on students whose participation has been questioned.

E-mail within a web-based course takes on two roles. First, students can e-mail an instructor within the course, and the instructor is alerted to the email by a letter icon or an asterisk by MAIL in the Course Tools each time the instructor logs in. These e-mails appear only in the course shell and are generally regarded as course-specific interaction. Second, students can e-mail each other within the course. These e-mails may occur within a discussion forum in the course (student-to-student or student-to-instructor) or privately between students without the instructor's knowledge of content. Of particular interest to this study is the latter, the private student-to-student e-mails with unknown and unmonitored content.

Backchanneling or "whispering in the digital classroom" (Cogdill, Fanderclai, Kilborn & Williams 2001) is defined as private communication visible only to the sender and receiver, in this case two students, creating the "whispering" property. *The Web Dictionary of Cybernetics and Systems* (2000) further defines this phenomenon as "communication which travels through informal rather than formal channels." Of particular interest for this study and its focus are the factors relating to private nonvisible content and the informal channel. Backchanneling could feasibly be course-related, participation-enabling, tangential, or process-related interaction between students in an effort to assist each other in successful completion of the course assignments. However, the possibility of personal interaction that is off-topic or destructive to the learning environment or instructor exists as well. If we reflect on our understanding of "whispering" in a traditional classroom, this possibility is logical. Yet, studying the backchannel for this category of interaction is difficult, considering the likelihood that announcing a study of backchannel interactions will change the tenor and content of the exchanged e-mails. And yet, the question remains – what impact does this personal backchannel have on the course and the student's outcome? Is this form of communication contributing to student outcomes, and is the contribution significant statistically?

Most of the literature to date has provided little in response to this question. As mentioned already, Cogdill et al (2001) provided a definitional and ethical discussion of backchanneling and its presence in the online classroom. The value of the backchannel and its categories is clearly helpful for online instructors, but the mystery of the content and the persistence of backchannel communication raise the specter of concerns without obvious technological or instructor-initiated solutions (Cogdill et al, 2001).

Lavooy and Newlin (2003) suggested in their study that computer-mediated communication and web instruction fostered increased student-student communication as well as the essential instructor-student interaction. Logically, interactivity in an online course is critical to instantiating the course environment. Additionally, students who engage and interact often reduce the isolative feelings that may be dreaded by students in

online courses (Lavooy and Newlin, 2003, p. 3). These student-to-student interactions may indeed take the form of forum postings though, removing the concerns inherent in personal, off-topic backchanneling (Wang and Newlin, 2000).

Wang and Newlin (2000) also provided substantive input on student characteristics and student success in online courses. Given the measures of online course activity already mentioned, the Wang-Newlin study found that successful online students (as measured by final grades) exhibited a greater internal locus of control, higher need for cognition, and interacted more through forum postings and readings than their less successful counterparts. Reynolds, Cox, Rice and Uddin (2001) extended the value of Blackboard / WEBCT™ data by collecting site and page hits for online therapeutic-course participants for a year, though their efforts only sought to describe students' usage over time without examining relationships between usage and final outcomes. As well, the component for private backchanneling is ignored in this study.

Merceron and Yacef (2004) examined student data captured from a web-based tutoring tool with a goal of improving teaching while better understanding student usage of the tool. Marra (2006) most recently examined research methods that would help instructors understand and analyze student participation and content in online discussion forums. Different coding schema as well as numerical counts for postings and readings offered insights into these student interactions, but once again content is visible and the communication is deemed public, not private.

The current study examines the meaning of the Blackboard / WEBCT™ data for online classes taught in the Department of Technical Communication and Media Production at an urban college in a large city in the Rocky Mountain region. The questions driving this study are as follows:

- What significant relationships exist among the Blackboard / WEBCT™ data for an online course that reflect student outcomes as defined by final grade?
- Without viewing or analyzing content of backchannel interactions between students, is productive (course-or content-related) or off-topic (personal or negative) engagement capable of being logically inferred from the online course data?
- Which Blackboard / WEBCT™ data contribute the strongest significant relationships with student outcomes as measured by final grade?
- Finally, are relational hypotheses possible regarding student outcomes based upon multiple-course data as gathered through Blackboard / WEBCT™ software?

METHODS

Three studies were conducted to examine these research questions when considering frequently-varied course components such as length of the course, different instructors, and same instructor/different courses for any impact on data relationships in Blackboard / WEBCT™. Two comparative studies were conducted using one instructor teaching two simultaneously offered courses, different content. One study reflects the shorter course term (eight weeks) with the same instructor offering different course content. And finally, the last study examined one instructor in two sections of one course online to see what relationships emerged reflecting student outcomes.

The instructors were all faculty within the Department of Technical Communication and Media Production at a large urban college in the Colorado. All instructors had taught online courses for three to five years as well as having taught the same course material in courses on campus. Enrollments in the courses ranged from nine students to 18 students (the usual cap for online courses at this college). Only students who completed the courses and received a grade were included in the statistical analyses. Demographics for the students were not collected as this exploratory group of studies focused primarily on the Blackboard / WEBCT™ data and any possible relationships to student outcomes (grades).

At the conclusion of the semester or the course (for eight week courses), each instructor for the individual courses collected data from the Blackboard / WEBCT™ course shell. Table 1 below shows the data that were collected from the MANAGE COURSE link available in Blackboard / WEBCT™ for course designers (aka instructors).

Table 1. Blackboard / WEBCT™ Data collected for each online course in each of three exploratory comparisons

	Definition of this variable	*Comments*
Student course # - #	Course #s include four numerals and each student was assigned a number in sequence	No identifying information about the student was included in the analysis
HITS	Number of pages visited within the course, i.e., Homepage, organizer, assignments, etc.	A total number of HITS for the semester was recorded for the analysis.
READ	Number of articles read within the course	
POSTED	Number of postings to discussion forums	
FOLLUP	Number of follow-up postings to discussion comments in forums	
MAIL	Number of emails sent within the course	This number includes student-to-student emails AND student-to-teacher emails.
GRADE	Letter grade recorded by the instructor for the student's semester work	The standard unit value for letter grades (A = 4, B = 3) were used in the analyses.
GRADEPC	The % grade for the student's	

work in the course

Once data were collected for each study, descriptive analyses were performed using SPSS (Statistical Package for the Social Sciences, ver. 13) and then correlation matrices were examined for each course within each study. Finally, cluster analyses were performed using SPSS to "data-mine" for specific related groups of individuals within courses using the Blackboard / WEBCT™ data for HITS, READ, POSTED, GRDPRCT, and MAIL. Hierarchical cluster analyses were performed first to examine the average linkages between groups using the visual dendogram. Following this analysis, quick clusters were then examined for cluster membership and distances between clusters.

RESULTS

Study 1 – Comparing Two Courses (different content) taught by a single instructor, 16 weeks long

For this study, two sets of two courses taught by single instructors were compared. Blackboard / WEBCT™ data for each course were gathered. Professors Alpha and Beta taught both a sophomore level course (COM 2610) and an upper division course (COM3670) taken by juniors and seniors. Courses taught by Professor Alpha were required courses for majors in the department, though the lower level course is considered a "service course" for other technical majors in other disciplines. Courses taught by Professor Beta were also one lower division course (COM 2460) though the subject matter related to Media Graphics and Presentations, while the second course was an upper division course (COM 3470). Descriptive data for the two-course comparisons are provided in Tables 2 and 3 below. Calculated statistics are rounded up to two places beyond the decimal point.

Table 2. Descriptive Statistics of Blackboard / WEBCT™ variables for Professor Alpha Courses COM 2610 (n = 14) and COM 3670 (n = 16).

	Minimum		*Maximum*		*Mean*		*SD*	
	2610	*3670*	*2610*	*3670*	*2610*	*3670*	*2610*	*3670*
HITS	120	185	1329	866	547.71	498.81	336.46	225.14
READ	2	0	467	182	137.79	109.63	152.30	74.55
POSTED	0	0	53	34	18.29	6.63	19.25	9.04
MAIL	6	13	88	122	46.36	58	27.48	31.04
FOLLUP	0	0	53	34	18.36	6.44	4.67	2.50
GRADE	0	0	4	4	2.93	2.56	1.21	1.41

Table 3. Descriptive Statistics of Blackboard / WEBCT™ variables for Professor Beta Courses COM 2460 (n = 16) and COM 3470(n = 17).

	Minimum		*Maximum*		*Mean*		*SD*	
	2460	*3470*	*2460*	*3470*	*2460*	*3470*	*2460*	*3470*
HITS	18	173	917	1779	316.56	815.35	232.31	413.24
READ	0	39	181	511	84.88	266.76	63.18	174.94
POSTED	0	5	34	70	8.81	25.59	9.26	19.82
MAIL	0	16	120	185	31.19	62.88	27.73	42.07
FOLLUP	0	1	33	60	7.63	17.65	8.57	18.57
GRADE	0	0	4	4	2.75	2.94	1.91	1.48

Apparent from these tables, Professor Alpha's students in 2610 engaged in the course more frequently to read course materials, post to the discussion forums, and respond to comments in the discussions. Professor Alpha's students in 3670 engaged in the course less frequently when compared to the 2610 students, but mailed more personal communications as noted by the maximum number of mails and the mean value across all students. Professor Beta's students in 2460 and 3470 reversed this trend. Students in 3470 engaged frequently in the course by reading more course materials, posted more to the discussion forums, and responded more to comments in the forums than the students in 2460. Aggregate grades for all students in both course comparisons vary little on the range and the measures of central tendency.

The second phase of statistical analysis involved examining the correlation matrices for both compared courses. The question driving this analysis sought to uncover significant relationships between any Blackboard / WEBCT™ data and student outcomes. Tables 4 and 5 below list the correlation matrices for Professor Alpha and Professor Beta courses.

Table 4. Correlation Matrix of WEBCT™ variables for Professor Alpha Courses COM 2610 (n =14) and COM 3670 (n = 16).

	HITS		READ		POSTED		MAIL		GRADE (letter)	
	2610	3670	2610	3670	2610	3670	2610	3670	2610	3670
HITS										
READ	.934**	.797**								
POSTED	.816**	.626**	.837**	.514*						
MAIL	.829**	.788**	.657*	.394	.605*	.394				
GRADE (letter)	.548*	.675**	.753**	.501	.501	.472	.776**	.281		

** Correlation is significant at the 0.01 level (two-tailed).
* Correlation is significant at the 0.05 level (two-tailed).

Table 5. Correlation Matrix of WEBCT™ variables for Professor Beta Courses COM 2460 (n = 16) and COM 3470 (n = 17).

	HITS		READ		POSTED		MAIL		GRADE (letter)	
	2460	3470	2460	3470	2460	3470	2460	3470	2460	3470
HITS										
READ	.857**	.741**								
POSTED	.924**	.768**	.762**	.450						
MAIL	.916**	.756**	.641**	.270	.922**	.771**				
GRADE (letter)	.732**	.255	.750**	-.072	.602*	.439	.597*	.407		

** Correlation is significant at the 0.01 level (two-tailed).
* Correlation is significant at the 0.05 level (two-tailed).

Apparent from these matrices, a majority of the data are significantly and strongly correlated. Specifically for Professor Alpha's classes, HITS are strongly and significantly correlated with READ, POSTED, MAIL, and GRADES across both classes. Additionally, READ data correlate strongly and significantly for the lower level course with POSTED, MAIL, and GRADES. However, the data that lack significant or strong correlations pose the most interesting information. For the upper division class that Professor Alpha taught, no significant correlations exist between READ, MAIL, GRADES, and POSTED data. The correlation matrix for Professor Beta's classes offer

similar strong and significant correlation as noted for Professor Alpha, while the upper level course relationships fail when comparing similar pieces of data. Specifically, for Professor Beta's upper level course POSTED, MAIL, and GRADES fail to correlate significantly.

Examining these matrices for the strongest and most significant relationships between student outcomes (grades) and other data, we find that for Professor Alpha's classes, number of hits across both courses correlates most strongly with grades. For the lower level course, the number of articles read and the number of postings to the discussion forums correlate strongly and significantly with grades. However, for the upper level course, a marked lack of significant correlations exists between these data and grades. For Professor Beta's courses, the strongest and most significant correlations exist between HITS, READ, POSTED, and MAIL. However, a consistent correlation between grades and other data is lacking when considering both courses. The lower-level course data for HITS, READ, POSTED, and MAIL correlate strongly and significantly with grades, while the data for the upper-level course clearly do not suggest this relationship. The discussion suggests how these relationships might be interpreted and how instructors might use this information.

Study 2. Shorter course terms (eight weeks), different course content, same instructor

Professor Pi taught two eight-week courses that covered media material for sophomore and junior students. Course enrollments for both courses totaled 15 students. Blackboard / WEBCT™ data (as noted for the previous study) were gathered for both shortened courses when the courses concluded. Descriptive data for the two-course comparisons are provided in Table 6 below.

Table 6. Descriptive Statistics of Blackboard / WEBCT™ variables for Professor Pi eight-week Courses CRS 1 and 2 (n = 15 for each course).

	Minimum		*Maximum*		*Mean*		*SD*	
	CRS 1	*CRS 2*	*CRS 1*	*CRS 2*	*CRS 1*	*CRS 2*	*CRS 1*	*CRS 2*
HITS	42	0	404	528	234.87	252.93	135.75	154.87
READ	0	0	92	72	49.73	41.60	39.02	23.47
POSTED	1	0	17	11	5.67	4.73	5.56	3.77
MAIL	0	0	33	44	10.20	20.20	9.63	15.58
FOLLUP	0	0	13	5	3.20	2.13	4.36	1.60
GRADE	0	0	4	4	2.47	2.86	1.64	1.66

Apparent from these data, students in CRS 1 engaged in the course more frequently to read material, though students in CRS 2 appeared to engage more in the course overall by logging in more frequently and sending more personal email. Student outcomes (grades) were quite similar for both courses as noted by the means and standard deviations. Thus, the measures of central tendency appear to tell little about the engagement levels and any relationship to student outcomes.

The second phase of statistical analysis involved examining the correlation matrix for both courses. The question driving this study sought to uncover significant relationships (if any) between any WEBCT™ data and student outcomes. Tables 7 and 8 below list the correlations plus significance levels for CRS 1 and CRS 2 for Professor Pi.

Table 7. Correlation Matrix of Blackboard / WEBCT™ variables for Professor Pi eight-week CRS 1and CRS 2 (n = 15 for each course).

	HITS		READ		POSTED		MAIL		GRADE (ltr)	
	CRS 1	CRS 2	CRS 1	CRS 2	CRS 1	CRS 2	CRS 1	CRS 2	CRS 1	CRS 2

HITS									
READ	.894**	.822**							
POSTED	.719**	.789**	.788**	.788**					
MAIL	.737**	.754**	.512	.568*	.369	.695**			
GRADE	.788**	.700**	.858**	.592*	.722**	.571*	.491	.409	
(letter)									

** Correlation is significant at the 0.01 level (two-tailed).
* Correlation is significant at the 0.05 level (two-tailed).

Examining these data shows a majority of strong correlations with significance levels. However, the data that lack significant or strong correlations pose once again the most interesting information. MAIL demonstrates neither a strong correlation nor significance compared to student outcomes (GRADE). As well, since CRS 1 shared fewer personal email interactions, MAIL does not correlate significantly with READ, though CRS 2 does demonstrate both the relationship between these two variables as well as significance.

Study 3. Same Course Content , Same Instructor and Same Semester

For this study, two sections of the same course were examined when taught by the same instructor during the same semester lasting a full 16 weeks. Blackboard /WEBCT™ data were gathered for both courses at the conclusion of the semester. The course content provides both an entry-level course for majors in this field as well as serving multiple technical disciplines with the college as a required course for their majors. Professor Theta had nine (9) students enrolled in one section and 16 students enrolled in the other section. Descriptive data for both courses are offered in Table 9 below.

Table 9. Descriptive Statistics of Blackboard / WEBCT™ variables for Professor Theta's courses (Course A (n = 9) and B(n = 16)).

	Minimum		*Maximum*		*Mean*		*SD*	
	CRS A	*CRS B*	*CRS A*	*CRS B*	*CRS A*	*CRS B*	*CRS A*	*CRS B*
HITS	45	114	773	506	322.06	282.33	220.57	106.02
READ	0	3	133	123	51.63	62.56	44.57	42.09
POSTED	0	1	20	16	7.06	6.78	6.60	4.12
MAIL	0	9	106	24	29.81	17.11	28.53	5.13
FOLLUP	0	0	20	5	3.19	2.56	5.06	1.94
GRADE	0	0	4	4	2.63	2.11	1.50	1.69

These data present a different "picture" compared to the previous two studies. The constants in these two courses are the professor and the course material. Both courses also are full-semester courses so length of engagement was identical and simultaneous for these offerings. However, the student enrollment differed both in numbers and individuals, creating different data. The lower enrolled section (CRS A) appears more engaged from the start (HITS range) and more consistently engaged (HITS SD) when compared to the higher enrolled section (CRS B). Grades spread across the same range for each section, but the mean was higher with less deviation in the more-populated section. The second phase of analysis mirrors these differences as well.

The second phase of statistical analysis involved examining the correlation matrices for both courses. The question again remains – are Blackboard / WEBCT™ data significantly and strongly related to student outcomes (grades)? Table 10 lists the correlations for the examined variables for each course.

Table 10. Correlation Matrix of Blackboard / WEBCT™ variables for Professor Theta's courses

CRS A (n = 9) and CRS B (n =16).

	HITS		READ		POSTED		MAIL		GRADE (ltr)	
	CRS A	CRS B	CRS A	CRS B	CRS A	CRS B	CRS A	CRS B	CRS A	CRS B
HITS										
READ	.961**	.747*								
POSTED	.724**	.267	.769**	-.116						
MAIL	.942**	.120	.879**	-.013	.633**	.374				
GRADE (letter)	.021	.325	.052	.220	.016	.094	-.030	-.505		

** Correlation is significant at the 0.01 level (two-tailed).

* Correlation is significant at the 0.05 level (two-tailed).

Strong and significant relationships exist for students in CRS A with the following Blackboard / WEBCT™ data: HITS, POSTED, MAIL, and READ. However, no significant or strong relationships exist between these variables and student outcomes (grades). Examining the strength of the relationships between HITS, POSTED, MAIL, and READ suggest that students were engaged in this course interpersonally via email more so than in course content and course discussions. CRS B students appear to be reading the material as evidenced by the HITS significant relationship with READ, but grades are not significantly related to any of the Blackboard / WEBCT™ data collected for the course. This last study exploring the meaning of Blackboard / WEBCT™ data and student outcomes prompts more questions than answers.

Cluster Analyses Results for All Studies

Cluster analyses examine the possibility of groups within these courses that share structures in the Blackboard / WEBCT™ data without explaining why these structures exist. The goal in looking at possible clusters within each course is to determine similarities and dissimilarities in the Blackboard / WEBCT™ data. This procedure augments the correlational analyses by separating individual cases into groups and then examining all Blackboard / WEBCT™ data for each case. When exploring course data in this manner, the homogeneity or heterogeneity of the course members affects the results. See Table 11 below for cluster data.

For Study 1, hierarchical cluster analyses for Professor Alpha and Beta courses produced different results. For Professor Alpha's courses (2610 and 3670), three distinct clusters emerged in the dendograms in the first analysis step. The linkages between individuals within the three clusters were similar, and the membership in each cluster was somewhat evenly distributed. For the introductory course (2610) though, the membership in the "top cluster" (best students) was smaller than membership in this cluster for the advanced level course (3670).

For Professor Beta courses, the dendograms again appeared to create three clusters, but in each compared course this time, one individual made up the "top cluster" with outlying values on all Blackboard / WEBCT™ data – HITS, READ, POSTED, MAIL, and GRDPRCT. The lack of cluster membership and the decreased distances between clusters prompted a suggested solution of two clusters for the quick cluster analysis.

Table 11. Quick Cluster Data for All Three Studies Showing Membership and Euclidean Distances between Cluster Centers

Study/Course	**# of Clusters with membership (X)**	**Distance between cluster centers**

Study 1		
COM2610 (n=14)	1 (2); 2(6); 3(6)	301.842
		723.105
		1013.909
COM3670 (n=16)	1 (4); 2(7); 3(5)	
		253.498
		327.479
		578.153
COM 2460 (n=16)	1(9); 2(1); 3(6)	310.793
		531.553
		837.663
COM3460 (n=17)	1(8); 2(1); 3(8)	
		607.284
		766.182
		1339.396
Study 2		
CRS 1	1(6); 2(3); 3(5)	180.431
		209.769
		390.012
CRS 2	1(4); 2(4); 3(7)	133.357
		184.454
		317.669
Study 3		
CRS A	1(5); 2(3); 3(8)	208.785
		411.714
		620.244
CRS B	1(7); 2(2)	177.255

For both professors' course comparisons using quick cluster analysis, individual cluster membership focused on the best group of students compared to less competent students in the remaining clusters. Professor Alpha had good students, adequate students, and less adequate students in the three clusters for each course. Professor Beta had good students and average students in the two clusters that emerged in quick cluster analysis. In all courses, the cluster membership was distinct and separated by adequate Euclidean distances between cluster centers. The cluster centers were determined in a hierarchical analysis using the Blackboard / WEBCT™ data in this order: HITS, READ, POSTED, MAIL, and finally GRDPRCT.

For Professor Pi's shorter term eight-week courses, hierarchical cluster analyses produced three clusters in the dendograms with distinct distances ranging from a low of 133.357 to a high of 390.012 between all three clusters generated for both courses, though cluster membership was highest (seven students out of 15) for the "top cluster" (best students) in one course.

For Professor Theta's sections of the same course (introductory level material), hierarchical cluster analyses produced three clusters (n = 16) and two clusters (n = 9). For the larger enrolled class, the Euclidean distances between cluster centers were distinct (620.244, 411.714, and 208.785) suggesting that the groups were structured differently according to the Blackboard / WEBCT™ data. However, the grades for the "top group" and "better group" were less disparate (3.33 compared to 3.25) than all other Blackboard

/ WEBCT™ data. The smaller enrolled class demonstrated much lower Euclidean distances between final cluster centers (177.255) suggesting that the structures in the clusters were less distinct, though certainly distinct in grades as the final outcome (1.71 compared to 3.50 on a 4.00 scale).

DISCUSSION

These studies began with four questions. The first question focused on possible significant relationships between Blackboard / WEBCT™ data and student grades. The obvious answer would assume that the more HITS a student has, the more impact on the final grade. However, several exceptions to this hypothesis exist. First, in Study 1, HITS did significantly and strongly correlate for both courses. However, articles read in the course, number of postings to discussions, and MAIL did NOT correlate significantly with the final grades for one course in particular – the upper level course for advanced majors. A logical inference here would be that backchanneling or "whispering in the back of the classroom" is occurring, detracting from the course content though interaction is clearly occurring.

Second, in this same study, HITS again appeared to relate significantly to final grades, but NOT for the upper division course for advanced majors again. Final grades were not related to any of the collected Blackboard / WEBCT™ data for the advanced course. Once again, a logical inference would suggest that "whispering" among classmates contributes to the HITS count, but content likely consists of off-topic material or personal communication which does not contribute to a student's grade.

In Study 2 with the shorter term courses taught by the same instructor with identical enrollments, final grades related significantly and strongly with every variable except MAIL, suggesting that interpersonal "whispering" focused on content <u>not</u> related to the course. And in the final study, Study 3, no Blackboard / WEBCT™ data related significantly to final grades for either course taught by Professor Theta, giving rise to the question – what actually determined the students' final grades in this course?

Interviews with both instructors in Study 1 elicited qualitative data that deepened the view for these courses' final grades. In both upper-level courses, a mutiny of sorts occurred that prompted a dramatic rise in MAIL and backchannel engagement – "whispering in the back of the room". As the MAIL events rose, communication about course content may not have risen. Thus, final grades were not related to number of HITS as MAIL is included in the number of HITS recorded by Blackboard / WEBCT™. The backchanneling is surmised by the instructor to have begun in midcourse when one student posted the following message to the public forum:

> I cannot get any help from our instructor. She feels that it's rude of me To bother her on a Saturday night when she has company although she also feels it is acceptable to ignore an email I sent on Friday . . . with a question on the assignment. Then she blames me for waiting to ask my question til Friday. So, I am asking all of you for help. What the hell are we supposed to be basing the coal article report on? Is it the newspaper article? Is it the government reports? Do we analyze all of them? What???????

Failing to get a response from the group beyond one public response, students appeared to backchannel and email each other with further comments that may or may not have

dealt with course material, as detected by rising MAIL counts immediately following this posting. The second instructor teaching both a lower and upper level course had similar experiences with bold, critical and public postings eliciting little response while promptly thereafter MAIL counts rose dramatically. Thus, without reviewing the content of MAIL exchanges for the upper-level courses, one could surmised that these interpersonal exchanges focused on other than course content and may have detracted from a focus on course material so strongly that as MAIL counts rose for some students in this backchanneling, final grades may have suffered.

For Study 2 with the shorter term courses and similar enrollment figures, final grades are strongly and significantly related to all Blackboard / WEBCT™ data except MAIL. This suggests again that MAIL exchanges are more likely to be interpersonal and not course-related. Study 3 poses the most difficulty in hypothesizing the value of MAIL and its influence on final grades since for this study, no data were correlated to final grades. Additionally enrollments varied in both of Professor Theta's classes making even the cluster analyses sketchy at best.

The second question driving these studies focused on productive or destructive engagement as a possible tentative inference. Given the qualitative data for the first study's upper level courses, a logical hypothesis would be that MAIL counts are off-topic (or non-course related in content) if these data do not significantly relate to final grades. Though this relationship can only be tested (or assessed) upon course completion, this hypothesis bears further examination across more courses and different disciplines.

The third question seeks a relationship between Blackboard / WEBCT™ data and final grades in online courses. Without Study 3, we might suggest that HITS and READ form the strongest relationships with final grades. Again, this hypothesis bears further testing.

Finally, are relational hypotheses possible based upon these studies? Given the data from Study 3, the answer to this question would have to be NO -- not without further examination of other variables. In each study and each online course, a number of human-related variables are not considered here – professor's communication style teaching online, professor's experience and enjoyment in teaching online, number of students in a course, previous relationships between professors and students, students' experience in online learning environments, students' levels of digital literacy overall, course material (technical, abstract, or concrete), students' preparation and motivation regarding course material, and type of assignments contributing to the final grade (subjective versus objective or a combination). Additionally, students in an online course may have different course designs waiting for them when they log into a course. Some online courses direct students to reading material and research outside the course software, while other online courses engage students in substantive material presented through the course software or discussion forums. In the former case, HITS and READ data may not directly relate to learning the course material, while in the latter these data may indeed reflect course content and engagement.

CONCLUSIONS

Overall, the data gathered by Blackboard / WEBCT™ courseware in an online course offered virtual snapshots of student activities and engagement. The cluster analyses for all studies suggest that individual student performance in a course creates group clusters based upon the Blackboard / WEBCT™ data as collected. Thus, all the

Blackboard / WEBCT™ data taken as a whole and hierarchically -- with HITS having the strongest impact upon cluster formations – form groups of students that are characterized by their course engagement which influences the course grade. When reflecting back upon the questions guiding these studies, the answers are mixed at best.

What significant relationships exist among the Blackboard/Web CT data for an online course that reflect student outcomes as defined by final grade? Clearly the data in these studies suggest that HITS and READ data plus POSTED data more often have significant relationships with final grades. However, one course's data fail to demonstrate any significant correlations with final grades. The question here becomes what, if anything online or offline, impacts student final grades? Further studies in this area including qualitative methods are required.

The second question guiding these studies focuses on the possibility of logically inferring general communication content in backchanneled (or whispered) interactions without viewing the message content. The data support logical inferences regarding general message content by examining significant correlations between HITS/MAIL and final grades. In courses where the MAIL counts rose but the significant correlations to final grades failed to exist, one may infer that message content is either personal or off-topic. The qualitative data from interviews with instructors who taught upper level advanced majors courses suggested this inference once the lack of significant correlation was examined.

The third question seeks insights into what, if any, collected data in an online course shell contribute to student final grades. In all courses where significant correlations were found, HITS and READ contributed the strongest significant relationships with student final grades. This information suggests that student engagement with the course (HITS) and student processing of course materials (READ) impact positively a student's final grade.

Coupled with content and instructor awareness of interactions, it may be possible to suggest tentatively that specific interpersonal communications ala the "tell tale data" (student-student MAIL) are off-topic or neutral contributors to the student's final grade in some cases. However, doing something about this type of interaction remains the key to keeping an online course on track for substantive engagement and successful student outcomes. Only after gathering qualitative data through interviews with instructors is a deeper understanding of the course data possible. Clearly further studies with more qualitative data may broaden the picture in lieu of relying on snapshots in numerical time.

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