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A Discourse Analysis of Online Classroom Chats:

Predictors of Cyber-Student Performance

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Abstract

We applied a discourse analysis (DA) to the electronic chatroom discussions of a 16-week, Internet-based section of Statistical Methods in Psychology. This analysis revealed that across the semester, several DA categories (e.g., total number of student comments) were correlated with final grade in the class. An additional analysis involving only the chatroom discussion of Week 3 revealed that two DA categories (i.e., student response to a problem/example given in lecture and total number of student comments) correlated with final grade in the class. We discuss the pedagogical implication of these results with regard to an instructor's ability to identify early-warning predictors of student performance in the virtual classroom.

A Discourse Analysis of Online Classroom Chats:

Predictors of Student Performance

This study explored the possibility that a discourse analysis of the "real-time" (i.e., synchronous) communication that occurs in electronic chatrooms would reveal predictors of students' performance in the virtual classroom. Because Internet technology and courseware are new, there are only a few studies on the characteristics and behaviors of students who succeed in Internet-based classes. Indeed, a recent review of distance learning research revealed that most studies were anecdotal in nature and only a few involved courses taught via the Internet (Phipps & Merisotis, 1999). For pedagogical reasons the lack of empirical research is unfortunate because the effective design of flexible learning environments that is possible in a technology-rich environment is hampered without an understanding of the characteristics, attitudes, and needs of students (Smith, 1997). Consequently, course design may become technology-driven rather than employing technology as a resource in support of student needs (Trapp, Hammond, & Bray, 1996).

A recent report (McCollum, 1997) is illustrative of a research area that is primarily anecdotal in nature. It described two sections of a statistics course offered by a sociology instructor: one in the conventional format and the second as an online Internet-based course. The instructor randomly assigned students to one of these two sections and reported that students in the virtual classroom collaborated more than in the conventional classroom. Interviews with the Web-based students revealed an overall positive impression of the egalitarian and non-intimidating characteristics of electronic chatrooms. However, this study did not report data on academic performance or the type of communication that occurred in chatroom discussions.

Another study reported that honors students taking an Internet-based statistics course had positive perceptions of the course (Varnhagen, Drake, & Finley, 1997). Once again, the academic performance of these students was not reported.

The present study involved students who chose to register for an Internet-based section of Statistical Methods in Psychology rather than conventional sections of the class. Consequently, students retrieved all course materials (syllabus, quizzes, assignments, etc.) from the course homepage on the university's Internet-server. The Internet-server courseware recorded all online student activity related to the course, including the real-time communication that occurred in electronic chatrooms. Because our mandatory, weekly chats were scheduled for about 1.5 hr, the chatroom log maintained by the Internet-server courseware provided a rich and veridical data base to explore using discourse analysis.

Although Discourse Analysis (DA) has been applied to conventional classroom discussions (Mehan, 1985), we are not aware of any studies investigating the possibility that various aspects of student discourse in electronic chatrooms may relate to Internet-based class performance. Nevertheless, some prior research on asynchronous student communication suggests that certain aspects of student communication in online chats may predict course outcomes. For instance, Wang and Newlin (2000) reported that the overall course homepage hit rate during the first week of the semester correlated with final grades in an Internet-class. They also found that the total number of forum (i.e., electronic bulletin board) postings read and written by students correlated with their final grades in class. These findings raise the possibility that the form and frequency of students' patterns of communication in the electronic chatroom may also relate to course performance.

Two other studies have investigated the effect of asynchronous communication on students' performance; however, these studies involved conventional classes that were supplemented by computer-mediated communication. One study (Pychyl, Clark, & Abarbanel, 1999) found that face-to-face discussions were enhanced when students collaborated on the construction of course-related Web sites. Another study (Althaus, 1997) reported that course grades in a large conventional class improved when students participated in e-mail and listserve (i.e., group-based e-mail distribution lists) study groups.

Given the aforementioned findings, the present study explored the possibility that DA of electronic chatroom discussions would reveal online variables that are predictive of Internet-class performance. Moreover, we explored the possibility that a DA of a chatroom discussion that occurred early in the semester might reveal predictors of students' final grades in the class. If such predictors exist then instructors could then monitor the initial online activity of their cyber-students to obtain early warning signs of later success or failure in the virtual classroom.

Method

Participants

A total of 22 students (19 women and 3 men) completed the 16-week course; 5 withdrew and 1 student had an incomplete grade. Their mean age was 26.8 years. The withdrawal rate (about 10%) was comparable to conventional sections of this class and lower than that typically reported for distance education courses (Phipps & Merisotis,1999). We suspect that our withdrawal rate was due to the fact that we advised all potential students as to the nature of Internet-based instruction by letters, telephone calls, and a mandatory orientation meeting prior to the class.

The Course

Statistical Methods in Psychology is a required laboratory course for all our psychology majors. The catalogue description states that this course discusses "standard scores, confidence intervals, sampling distributions, hypothesis testing, correlation, and regression as applied to research in psychology." The textbook, *Statistics for the Behavioral Sciences* (Thorne & Slane, 1997), was required for all sections of this course. Because of the laboratory component (i.e., extensive exercise problems in statistics and hypothesis testing) the enrollment of all sections was limited to 28 students. Web-based students completed all laboratory assignments using statistical software that they downloaded from the course Web site.

The Internet-based course was delivered as an online "cyber-class." The instructor had prior experience teaching conventional sections of this course and maintained the same course materials and expectations for student performance. However, in contrast to the conventional mode of information delivery, cyber-students retrieved the syllabus, calendar, assignments, midterm exam, and resource links by accessing the course's Web homepage. Real-time communication in the cyber-class occurred during mandatory, weekly lectures held by the instructor in predesignated online chatrooms. Chatroom lectures and discussions were designed to cover new topics as well as answer questions about homework assignments in a way similar to conventional courses. Thus, the instructor would explain a statistical concept and direct students to the relevant pages in the textbook. We also instructed students to print from their Internet browser course materials that the instructor had prepared as Web pages supplementing each week's lecture. The instructor also demonstrated specific statistical analyses and example problems during lectures. These regularly scheduled chats typically lasted about 1.5 hr. We

encouraged interactivity of an asynchronous nature via a cyber-class forum (i.e., electronic bulletin board) and e-mail messages between the students and the instructor. The only two in-real-life (IRL) meetings of the cyber-class were an orientation session at the beginning of the term and a comprehensive final exam given at the end of the semester.

One crucial difference in the instructor's approach to the Internet-based compared to conventional sections of the course concerned the issue of student-based "learning communities." Specifically, a stated goal of the Internet-based course was to foster strong learning communities (i.e., cyber-study groups) in preparation for the midterm exam, quizzes, and homework assignments. We adopted this goal because prior research suggested that distance learners who collaborate with others were more likely to experience higher satisfaction and performe better than cyber-students who did not participate in peer-to-peer interactions (Althaus, 1997; Hiltz, 1993; Kember, Lai, Murphy, & Yuen, 1992; Pychyl et al., 1999). Therefore, our syllabus and homework assignments instructed our cyber-students that "in order to be considered cyber-citizens of good-standing, you should help each other via e-mail, telephone, and student-moderated chatrooms."

Collaboration was also facilitated in that the graded components of the Internet-based course were all "open-student" in addition to being openbook and open note. The exception was the IRL comprehensive final exam, which cyber-students completed on an individual basis. The midterm and final exams were respectively worth 15% and 20% toward the grade in class. Quizzes were worth 9% of the final grade and the remaining 56% of the grade was based on eight homework assignments worth 70 points each. In order to encourage skill mastery of statistical concepts, students could resubmit their homework assignments after obtaining the instructor's

feedback on the original submission. Their homework grade was the average score of the original and resubmission scores.

The Discourse Analysis (DA)

The university's Internet-server courseware maintained a record of all online chatroom activity in the course. The "chatroom logs" downloaded at the end of the semester were veridical transcriptions of the discourse that occurred weekly in the virtual classroom. That is, a continuous record of each person's contribution to the chatroom's discourse was maintained for the entire semester (omitting the messages that individuals sent to one another privately). Each student's remark (total = 3,241) was recorded by the server's courseware as a separate line of text and by the end of the semester there was a total of 8,855 lines of text in the chatroom log (including both instructor and students' remarks). Student remarks rarely exceeded one sentence in length and were typically brief comments such as "yes," "go on," or "ok."

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Insert Table 1 about here

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To ensure high inter-rater reliability (IRR), we trained two independent raters on three weeks of chatroom logs (chosen randomly) using the thirteen DA categories shown in Table 1 (there was also a "miscellaneous" category that accounted for only 3.31% of all coded lines). We applied a hierarchical DA taxonomy whereby any remark could be coded only at one level (i.e., category) of the taxonomy. The raters double-coded a total of 1,478 lines of text (16.69% of the total number of lines) and agreed on 1,315 lines (IRR = .90).

Results

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Insert Table 2 about here

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Table 2 shows the mean overall score for each DA category by the end of the semester (i.e., the accumulated score by Week 16). Inspection of this table indicates that students made an average of 144.73 remarks across the entire semester. When specific DA categories are compared, the most frequent remark (Item 3a--student response to problem/example given in the chatroom lecture; M = 40.50) accounted for 30.00% of all student discourse in the semester's chats. The five most frequent DA categories (Item 3a--student responds to a problem/example given in lecture; Item 3b--student was the first to respond to instructor's question, Item 3c--student responds to lecture status check, Item 6--student responds to a homework issue or question, and Item 9--social remarks) taken together accounted for 76.10% of all student comments across the semester.

There was a high degree of individual variation with respect to each of the DA categories. For instance, one student never responded to a problem/example given in the lecture whereas another student responded 87 times to these questions during the semester. Two students never made any social remarks and one student made 118 comments of a social nature. When we analyzed the semester's total of all chatroom remarks, the frequency of a student's comments ranged from one student who made only five comments to another student who made 509 comments throughout the semester.

When expressed as the percentage correct, the mean scores for the homework assignments (M = 85.19%, SD = 5.99), quizzes (M = 84.32%, SD = 19.28), and the midterm

exam (*M* = 85.41%, *SD* = 8.22) were highly comparable. Students exhibited relatively weaker performance on the comprehensive final exam (*M* = 76.00%, *SD* = 55.46), which was completed individually rather than as a group. Overall, the final grades in the class (*M* = 82.93%, *SD* = 14.78) were in the B-minus range of letter grades and were highly comparable to that of conventional sections of the class. In a conventional section of Statistical Methods concurrently taught by the same instructor, the mean final grade was 84.66%.

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Insert Table 3 about here

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We performed another correlational analysis that included all of the discourse analysis categories. The purpose of this analysis was to determine whether any of the DA categories correlated with class performance by the end of the semester. Table 3 shows the four DA categories (Item 3--student responds to a lecture issue or question, Item 3a--student responds to a problem/example given in lecture; Item 3b--student was the first to respond to instructor's question, Item 3c--student responds to lecture status check) that consistently correlated with the graded components of the class. The only performance measure that did not correlate with any of these DA categories were scores on the final exam. However, the frequency of a student's response to an instructor's question, as well as the number of times a student was the first to respond, were both correlated with all other measures of performance including total grade in class, $r(20) = +.62$, $\underline{p} < .01$ and $r(20) = +.68$, $p < .01$, respectively.

In order to determine whether a DA would reveal early predictors of final class performance, we analyzed the chatroom from Week 3 with respect to the DA categories shown in

Table 1. Week 3 was the earliest possible week for this DA because it involved the first chatroom in which both new lecture material and a previous homework assignment were topics of discussion. A correlational analysis revealed that the total number of student comments (M = 9.57, SD = 6.80) and the frequency which a student responded to a problem/example given in lecture (M = 4.00, SD = 3.78) during Week 3 both correlated with total grade in the class, $r(20)$ = +.55, $p < .01$ and $\underline{r}(20)$ = +.65, $p < .01$, respectively. Interestingly, the degree of students' social activity in the chatroom did not correlate with any measure of class performance. For instance, frequency of social remarks during Week 3 and Week 16 did not correlate with total class grades, $r(20)$ = +.36 and $r(20)$ = + .15, respectively.

Finally, we collected data on students' perceptions of the course using our university's standardized course evaluation survey given at the end of the semester. These data were collected anonymously so it was not possible to correlate student perceptions with any other measure. Nevertheless, overall cyber-student evaluations were highly comparable with the evaluations obtained from conventional sections of Statistical Methods in Psychology taught by the same instructor. For example, the mean score for the summary evaluation item ("overall assessment of instructor") was virtually identical for the Web-based (M = 3.89; maximum = 5) and conventional sections (M = 3.86) of the class.

Discussion

The DA performed on the real-time communication of an electronic chatroom revealed several predictors of cyber-student performance. When we analyzed the overall number of student comments, three DA categories correlated strongly with final class grade: student's total number of comments, the frequency with which a student responded to a status check, and the

number of times a student was the first to respond to the instructor's question. The DA also revealed two early warning indicators of student performance in the virtual classroom. Specifically, when only considering the chatroom discussion from Week 3, the frequency with which a student responded to a problem/example given in the lecture and the total number of student comments correlated with final grades in class. This finding of early predictors of student performance is particularly important given the diminished set of classroom cues (e.g., gestures and facial expressions) that are available to instructors of Internet-based classes. Although more research is needed to explicate fully early predictors of cyber-student performance, it is worth noting that final class grades were correlated with total number of chatroom comments made during both Week 3 and Week 16.

Moreover, the DA indicated that certain types of student discourse were not correlated with any of the graded components of the course. Most notably, the frequency of social remarks, the third most frequent type of student comment, was not correlated with any measure of class performance. The DA also revealed striking individual differences displayed in the communicative styles and overall involvement of students in chatroom discussions.

We also found that final exam scores did not correlate with any of the DA categories. Previous research has documented that the final exam scores of Web-based students are lower than for students in conventional classes taking the same final exam (Wang & Newlin, 2000). Possibly, when Web-based students are tested in an IRL classroom setting they are more likely to experience test-taking anxiety because the conventional testing environment is unlike the study conditions associated with their Internet-based course. Anecdotally, many of our Web-based students expressed feelings of intense anxiety, which is relatively less common for students in

conventional sections of the same class. The notion that test anxiety may have interfered test performance is also corroborated by the fact that final exam scores (M = 76.00%) were considerably lower than any other graded component of the Internet-based class (this pattern is not found in our conventional classes). Consequently, we believe that the high test anxiety of our Web-based students hindered the likelihood of finding correlations between final exam scores and other aspects of class involvement.

A related issue concerns the self-selecting nature of our Internet-based section of students. As in the case with other universities, we had no opportunity to assign students on a random basis to different sections of a class. However, although random assignment was not possible, we believe that the representativeness of our Web-based sample was sufficiently high.

In summary, our findings corroborate previous research (Althaus, 1997; Pychyl, et al., 1999; Wang & Newlin, 2000) indicating that the form and frequency of cyber-students' communicative activity provides critical information regarding their involvement and performance in Internet-based classes. Whereas the earlier research documented the relationship between types of asynchronous communication and class performance, the present study extends this finding to the real-time discourse that occurs in the electronic classroom. Taken together, these findings suggest that instructors of Internet-based classes should take advantage of Internet-server courseware that automatically monitors the online activity (both synchronous and asynchronous) of their students. Using this feature of courseware, educators can increasingly tap the potential of the Internet as a truly interactive tool to assist in the effective design of Internet-based classes and to monitor the online activity of the students who populate these classes.

The DA reported here involved electronic chatrooms that discussed a skills-based subject

area (i.e., Statistical Methods in Psychology). Due to the nature of this topic, discussion was largely instructor-mediated (i.e., the instructor lectured and gave example problems) with less chatroom communication between students. However, other courses of a more content-based nature (e.g., social psychology) would probably elicit greater discussion among students. Future research should investigate whether a DA might reveal predictors of cyber-student success for these types of courses. Additionally, given the greater reliance on cyber-student collaboration in the virtual classroom, DA might prove fruitful when applied to the student-mediated discussions that occur in Web-based learning communities.

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Notes

1. Mary Kosarzycki assisted in the data collection and DA.

2. Portions of the data were presented at the 1999 annual meeting of the Association for the Advancement of Educational Research, Ponte Vedra, FL.

3. Send correspondence concerning this article to Alvin Y. Wang, Department of Psychology, University of Central Florida, Orlando, FL 32816; e-mail: awang@pegasus.cc.ucf.edu.

Table 1

Discourse Analysis Categories.

	Discourse Analysis Category	Example Statements
	Remarks Concerning Lecture Problems/Examples Discussed in Chat Lecture	
1.	Unsolicited Statement by the student about lecture.	“Is this covered on page 330?”
2.	Question by the student about the lecture.	“The standard error refers to the sampling distribution, right?”
3.	Student response to a lecture issue or question.	“Sigma is a population paramenter.”
3a.	Student response to a problem (example) given in lecture.	“The critical z-score is 1.96"
3b.	Student was the first to respond to instructor’s question.	
3c.	Student responded to a lecture status check.	“I got it.”
	Homework Related Remarks	
4.	Unsolicited Statement by the student about homework.	“What are you asking in problem #3?”
5.	Question by the student about the homework.	“So we use operational definitions in the Method Section?”
6.	Student response to a homework issue or question.	“So we use SD in the denominator?”
	Remarks Concerning Course Administration	
7.	Technology issue.	“Do I need winzip to download that file?”
8.	Administrative policy	“How much is the homework worth?”

Social Remarks

9. Social statement, question or comment	“Did anyone see the playoffs last night?”
9a. Emoticon (i.e., emotional icon)	:)

Table 2

Means and Standard Deviations for the Discourse Analysis DA Categories.

Variable	*M*	*SD*
1. Unsolicited statement by the student about lecture.	5.86	7.32
2. Question by the student about the lecture.	6.05	8.10
3. Student response to a lecture issue or question.	1.14	1.49
3a. Student response to a problem (example) given in lecture.	40.50	29.76
3b. Student was the first to respond to instructor's question.	15.27	14.94
3c. Student responded to a lecture status check.	26.05	12.59
4. Unsolicited statement by the student about homework.	.45	.80
5. Question by the student about the homework.	1.41	1.94
6. Student response to a homework issue or question.	10.73	24.02
7. Technology issue.	1.32	2.40
8. Administrative policy	7.14	4.06
9. Social remark	17.64	26.49
9a. Emoticon	.27	.70
Total number of chatroom remarks	144.73	116.05

Note: The means for the DA categories represent the average number of remarks (per student) for the entire semester.

Table 3.

Pearson Correlation Coefficients (r) Between Selected Discourse Analysis Categories (Week 16) and Class Performance.

	HWs	Quiz	Midterm	Final	Total
3. Student response to a lecture issue or question.	.47*	.50*	.37	.11	.35
3a. Student response to a problem (example) given in lecture.	.39	.59*	.42	.17	.38
3b. Student was the first to respond to instructor's question.	.53*	.61*	.61*	.33	.68*
3c. Student responded to a lecture status check.	.70*	.78*	.65*	.39	.62*
Total number of chatroom remarks	.63*	.72*	.53*	.30	.55*

*$p < .01$, 2-tail test.