

Tracking student behavior, persistence, and achievement in online courses

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Abstract

The purpose of this research was to examine student engagement in totally asynchronous online courses through an empirical analysis of student behavior online and its relationship to persistence and achievement. A total of 13 sections of three undergraduate, general education courses provided the setting for the study. Three hundred fifty-four students were used in the data analysis. Using student access computer logs, student behaviors defined as frequency of participation and duration of participation were documented for eight variables. The descriptive data revealed significant differences in online participation between withdrawers and completers and between successful completers and non-successful completers. A multiple regression analysis was used to evaluate how well student participation measures predicted achievement. Approximately 31% of the variability in achievement was accounted for by student participation measures, and three of the eight variables were statistically significant.

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1. Introduction and background

The number of U.S. students enrolling in postsecondary distance education courses more than tripled from FY1995 to FY2001 (Greene, Waits, & Lewis, 2003). According to the Sloan Consortium, over 1.9 million students took at least one online course during Fall 2003 (Allen & Seaman, 2004), and 81% of all U.S. institutions of higher education offered at least one fully online or blended course (Allen & Seaman, 2003). Considering the rapid growth in online education, a key concern of educators and the public is the quality and effectiveness of online learning (Nachmias, 2002; Peled & Rashty, 1999); consequently, recent studies have emphasized the importance of evaluating student behavior online to better understand student learning and achievement in the virtual environment (Nachmias & Segev, 2003; Rafaeli & Ravid, 1997; Zaiane & Luo, 2001). The purpose of this research was to evaluate student engagement in online courses through an empirical analysis of student learning behavior and its relationship to persistence and achievement.

1.1. Review of the literature

Two bodies of literature are important to this study: research addressing the problem of retention in online learning and research on student behavior in the online environment. Current research shows that student attrition is an ongoing problem in online courses (Carr, 2000; Diaz, 2002; Kemp, 2002; Parker, 1999; Whittington, 1995). In reviewing the literature, Rovai (2003) found that the earliest models of retention observed traditional students in traditional learning environments and the models included student background variables, academic and social variables, and student goals. Early models included psychological variables (Fishbein & Ajzen, 1975), while later models examined persistence through an investigation of student–institution fit (Bean & Metzner, 1985; Pascarella & Terenzini, 1991; Tinto, 1975, 1987, 1993). Clearly, these models have implications for studies of online persistence, and some of the variables in the models based on traditional educational environments are important in studies of persistence in online education. For example, Tinto's work on traditional populations included grade point average as an important measure of successful academic integration, and subsequent studies of online populations have also demonstrated the relationship between high school grade point average and retention (Diaz, 2002; Murtaugh, Burns, & Schuster, 1999; Nesler, 1999; Snyder, Hackett, Stewart, & Smith, 2002).

Similarly, other research of online populations examined student psychological and social variables and their impact on attrition or retention. Dille and Mezack (1991), Liu, Vavelle, and Andris (2002), Morris, Wu, and Finnegan (2005) and Parker (1999) found a relationship between student internal locus of control and course completion. Our work found a strong relationship between locus of control, financial assistance, and course completion (Morris et al., 2005).

The creation of learning communities is a dominant theme in the literature of teaching and learning online. Palloff and Pratt (1999, 2001) in oft-cited books have written extensively on the importance of participation, student discussions, and creating meaningful asynchronous learning environments to enhance student learning. Consequently, research into the usage of interactive tools and effectiveness of discussions was the purpose of several studies (Davidson-Sivers, Muilenburg, & Tanner, 2001; Hara, Bonk, & Angeli, 2000; McKlin, Harmon, Evans, & Jones, 2001). Weisskirch and Milburn (2003) investigated the use of the electronic bulletin board by college students, and they found that only messages directed to faculty were associated with higher grades. Nachmias and

Segev (2003) found a wide range of differences in students' access to online content, and Zaiane (2001) emphasized the importance of discriminating between the behaviors of different learners online.

Although the body of research labeled “no significant difference” has documented to a large extent that differences in learning between traditional classrooms and online courses are not significant (Russell, 1999), much less research has focused on the differences in and relationship between and student achievement and behavior in the online setting. Perhaps it is more difficult to examine the differences in student learning within a classroom and specifically within the online classroom, than between two learning formats. To examine student behaviors online, several researchers emphasized the usefulness of computer log analysis (logged, machine-collected usage statistics) (Peled & Rashty, 1999; Rafaeli & Ravid, 1997; Zaiane & Luo, 2001).

Using student logs, Rafaeli and Ravid (1997) examined the correlations between student achievement and usage behavior measures in the online environment and found that student achievement was positively correlated with their actual reading amount. Using regression analysis, they found that online usage behavior variables were able to predict 20% of the variance in the student grade. This study furthers the research on the influence of student online behaviors on academic achievement and performance; such studies are needed to assess and create research-based guidelines for effective online learning. Studies of actual online student behavior are important to identify for students and faculty the behaviors that lead to persistence and achievement in the online environment.

1.2. Research questions

The purpose of this study was to examine the differences in student participation in online courses and to develop a model to assess the relationship between student online behavior and achievement. Specifically, this research asks,

- What is the relationship of student participation to student persistence and achievement online?
- What are the differences and similarities between completers and withdrawers in various measures of student behavior online?
- How accurately can measures of student participation predict achievement in online courses?

In this research, we examine student behavior online, not through an assessment of the quality of student work, but by tracking what students do online and how long they spend on each activity.

2. Research design

2.1. Study population and context

The study population included students enrolled in undergraduate courses offered through eCore[®], the electronic core curriculum of the University System of Georgia (USG). These fully online courses are developed collaboratively by University System faculty and instructional design teams and are offered by five USG institutions. Data were collected over three semesters for three courses: English

Composition II (4 sections), U.S. History to 1865 (7 sections), and Introduction to Geology (2 sections). Each course contained between 147 and 314 pages of content accessible to enrolled students. Over the three semesters, 423 students enrolled in 13 sections across the three courses, yielding a total of 137 withdrawers, 72 non-successful completers, and 214 successful completers. Overall, 74% of the students were female, 25% minority, 38% upper division students, and less than 10% transient students.

To examine persistence, students who enrolled in the selected courses were classified either as *withdrawers* or *completers*. Students completing the official withdrawal process were classified as withdrawers. *Completers* were categorized into two *achievement* categories: *successful completers* or *non-successful completers*. Successful completers completed the course receiving a grade of A, B, or C. Non-successful completers received a grade of D, F, or an incomplete.

For the purposes of this study, *student participation* was defined as student engagement in specific learning activities online. *Participation* included viewing course content, viewing discussions, creating new discussion posts and responding to discussion posts. Participation was documented through four *frequency variables* (i.e., number of content pages viewed, number of discussion posts read, number of original posts, and number of follow-up posts) and four *duration variables* (i.e., seconds spent viewing content pages, seconds spent reading discussions, seconds spent creating original posts, and seconds spent creating follow-up posts).

2.2. Data collection and procedures

This study analyzed student access tracking logs found in archived online courses. Data collected on each student included which content pages were visited, what tools were used, and which discussions were read, created and replied to. Each piece of data included a timestamp that allowed researchers to calculate the amount of time spent on a task.

Access log data for each enrolled student was exported into an Excel spreadsheet and SPSS for analysis. Subsequently, frequency and duration for the variables of participation were calculated for each student. Individual data were then aggregated by and across courses for successful completers, non-successful completers, and withdrawers. Over three semesters, the enrolled students viewed over 198,000 discussions and over 99,000 content pages; they created over 5500 original posts and 9500 follow-up posts; yielding over 300,000 coded activities. Tables 1 and 2 show the frequency (number) and duration (time) of the four types of online behavior variables by the three categories of students.

Table 1

Frequency of student participation for withdrawers, successful completers, and non-successful completers ($N=354$)

Student Behavior Variable	Withdrawers ($N=70$)	Successful completers ($N=214$)	Non-successful completers ($N=70$)
	Mean	Mean	Mean
Number of content pages viewed	60.07	383.81	194.64
Number of discussion posts viewed	129.50	800.76	252.09
Number of original posts	2.70	22.63	11.43
Number of follow-up posts	3.13	42.02	8.51

Table 2

Duration of student participation for withdrawers, successful completers, and non-successful completers ($N=354$)

Student Behavior Variable*	Withdrawers ($N=70$)	Successful completers ($N=214$)	Non-successful completers ($N=70$)
	Mean	Mean	Mean
Hours spent viewing discussion pages	2.69	19.18	6.24
Hours spent viewing content	2.01	20.25	8.74
Hours spent creating original posts	.08	.87	.39
Hours spent creating follow-up posts	.17	1.35	.29

*Seconds in data collection converted to hours for data presentation.

Missing data (i.e., students who enrolled but did not login to online sections) reduced the total number of students for this analysis to 354.

3. Data analyses

Statistical analyses were conducted to explore the relationship of student participation to persistence and achievement. Specifically, *t*-tests were used to determine whether completers and withdrawers differed significantly from each other in frequency and duration of participation. Multiple regression was used to assess the relationship between students' achievement and participation.

3.1. *T*-tests

A total of 354 of 423 students (84%) were used to conduct this analysis after excluding missing data: 70 students were withdrawers and 284 were completers. Completers in all three courses were more engaged in learning activities than students who withdrew. *T*-tests of frequency of student participation showed a statistically significant difference in completers and withdrawers in all of the variables that measured frequency of course participation (see Table 3). Across the three courses, completers had a greater number of original posts, follow-up posts, discussions viewed, and content pages viewed. Withdrawers had significantly lower participation than completers in all four measures ($p<.01$). It was predicted that those who withdrew would have fewer "hits" in viewing pages or discussions and fewer

Table 3

Differences in student participation by frequency of activity between withdrawers and completers ($N=354$)

Student Behavior Variable	Withdrawers ($N=70$)		Completers ($N=284$)		<i>t</i>	<i>p</i>
	Mean	SD	Mean	SD		
Number of content pages viewed	60.07	60.11	337.18	212.09	−19.12*	.00
Number of discussion posts viewed	129.50	200.91	665.52	771.57	−10.37*	.00
Number of original posts	2.70	3.60	19.87	25.69	−10.84*	.00
Number of follow-up posts	3.13	5.21	33.76	77.87	−6.57*	.00

* $p<.01$.

Table 4

Differences in student participation by duration of activity between withdrawers and completers ($N=354$)

Student Behavior Variable**	Withdrawers ($N=70$)		Completers ($N=284$)		<i>t</i>	<i>p</i>
	Mean	SD	Mean	SD		
Hours spent on viewing discussion pages	2.69	5.36	15.99	18.62	−10.40*	.00
Hours spent on viewing content	2.01	2.67	17.41	23.04	−10.41*	.00
Hours spent on original posts	.08	.21	.75	1.13	−9.20*	.00
Hours spent on follow-up posts	.17	.35	1.09	2.58	−5.78*	.00

* $p < .01$ **seconds converted to hours for data presentation.

original or follow-up posts, because they generally left the course before it was completed, often early in the term.

Table 4 shows the average time on task for withdrawers and completers. Again, in examining the variables of (1) time (i.e., seconds) spent on content pages, (2) time spent on viewing discussions, (3) time spent on original posts, and (4) time spent on follow-up posts, *t*-tests revealed that in every case there were significant differences between completers and withdrawers.

In summary, completers had significantly higher student participation than withdrawers as measured by frequency of participation and duration (or time on task).

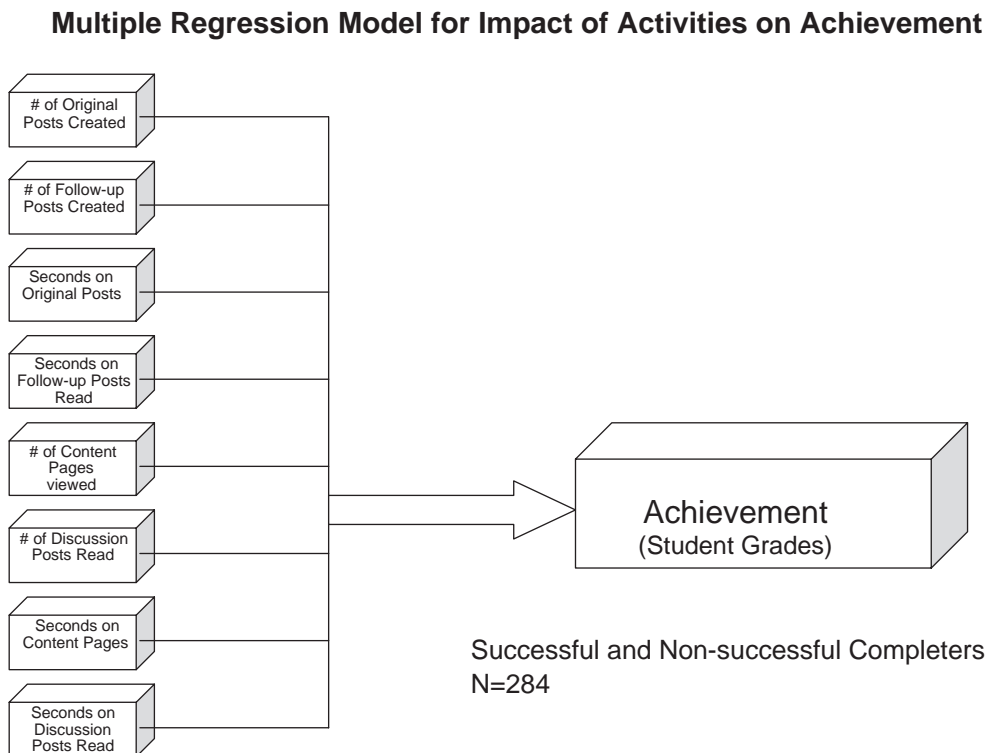


Fig. 1. Model of 8 independent and 1 dependent variables.

Table 5

Multiple regression analysis summary for student participation ($N=284$)

Variables	<i>B</i>	<i>SE B</i>	β
Number of discussion posts viewed	.000	.00	.21*
Number of content pages viewed	.002	.01	.32*
Number of original posts	.005	.00	.09
Number of follow-up posts	.000	.00	-.02
Seconds on viewing discussion pages	.000	.00	.22*
Seconds on viewing content	.000	.00	.01
Seconds on creating original posts	.000	.00	-.04
Seconds on creating follow-up posts	.000	.00	-.05

 $R^2 = .31$.* $p < .01$.

3.2. Multiple regression

The descriptive data revealed significant differences in online participation between successful completers and non-successful completers. This observation raised another question: specifically, how accurately can achievement be predicted from a linear combination of student participation measures for students in online learning courses? Consequently, a multiple regression analysis was conducted to evaluate how well student participation measures predicted achievement. The continuous and predicted independent variables included: number of discussion posts viewed, number of content pages viewed, number of original posts, number of follow-up posts, seconds on viewing discussion pages, seconds on viewing content, seconds on creating original posts, and seconds on creating follow-up posts. The dependent variable was achievement as measured by instructor assigned end-of-course grades. For analysis, the student grades were transformed and treated as a continuous dependent variable (Fig. 1).

Data from 284 students was used in this analysis — 70 were non-successful completers and 214 were successful completers. As shown in Table 5, the linear combination of student activities was significantly related to their achievement, $F(8, 275) = 15.4$, $p = .000$. The multiple squared correlation coefficient was .31, indicating that approximately 31% of the variability in achievement was accounted for by student

Table 6

The bivariate and partial correlations of variables with student grade

Variables	Correlation between each variable and student grade	Correlation between each variable and student grade after controlling for all other variables
Number of discussion posts viewed	.35*	.16*
Number of content pages viewed	.42*	.26*
Number of original posts	.18*	.09
Number of follow-up posts	.24*	-.01
Seconds on viewing discussion pages	.37*	.16*
Seconds on viewing content	.33*	.08
Seconds on creating original posts	.17*	-.03
Seconds on creating follow-up posts	.24*	-.03

* $p < .01$.

participation measures. Three of the eight variables were statistically significant ($p < .01$) and served as good predictors of final grades: number of discussion posts viewed, number of content pages viewed, and seconds viewing discussions.

As shown in Table 6, all of the bivariate correlations between student participation measures and course grades were positive and statistically significant ($p < .01$). The partial correlations for the above three predictors were also significant. Moreover, the number of discussion posts viewed accounted for 12% ($.35^2 = .12$) of the variation in achievement; number of content pages viewed accounted for 18% ($.42^2 = .18$) of variability in achievement, and seconds spent viewing discussions accounted for 14% ($.37^2 = .14$) of variability in achievement.

4. Conclusions and implications

This study tracked student behavior in three lower division online courses (13 sections) over three semesters. Completers engaged in online learning activities with greater frequency and greater amounts of time than unsuccessful, withdrawing students. Not surprisingly, there was a statistically significant difference in the behaviors of completers and withdrawers. The finding of significant differences in participation measures between completers and withdrawers was expected: when students withdraw they are no longer participating. But, the data show that those students who did not persist did not participate while enrolled to any meaningful degree, either viewing content or viewing and participating in discussions.

Although we cannot fully explain withdrawal behavior from this research, our previous research (Morris et al., 2005) suggests that one significant factor in persistence (i.e., course completion) is student motivation. From this study, we surmise that those who withdrew after being in the course for a limited time were not sufficiently motivated to engage in online learning tasks to complete the course. Of course, we recognize that other personal (e.g., illness, finances) or academic factors (e.g., under-prepared) may have accounted for students' withdrawals.

Approximately one-third of the students who completed the courses were unsuccessful completers, defined as receiving a grade of D, F, or incomplete. These students were of particular interest in this study. The unsuccessful students were enrolled throughout the term and had the same opportunity as successful completers to read content pages and engage in discussions and postings. Yet, our data show that unsuccessful students were far less active in participation than successful students. We conclude that active participation online is important to complete successfully. Perhaps, however, those who did not withdraw but were unsuccessful were also insufficiently motivated (or prepared) to engage meaningfully in online course activities.

We conclude from this research that the time spent on task and frequency of participation are important for successful online learning. While the eight variables used in the model explained 31% of the variation in achievement, three variables were statistically significant, and were good predictors of final grades: number of discussion posts viewed, number of content pages viewed, and seconds on viewing discussion pages. Tables 1 and 2 show the extent and intensity of involvement of successful students in the course. For example, successful students viewed on average almost 400 content pages and 800 discussion posts. Successful students spent almost 40 h viewing discussion and content pages during a semester, compared to only 15 h by non-successful completers. Interestingly, creating and replying to discussion posts did not emerge as significant within the model.

Comparisons between the classroom setting and the online setting are not easily drawn. Although instructors in a face-to-face class may assert that participating in discussion matters, it is virtually impossible to empirically establish the amount and quality of student contribution to in-class discussions. Therefore, faculty members are left to judge subjectively “how much” someone participates. In this study, although the quality of discussion was not assessed, the consistency and type of engagement was assessed, and it seemed to differentiate among withdrawers, successful, and non-successful students.

This research partially supports the principle suggested by [Palloff and Pratt \(1999\)](#) along with others that participation in discussions in the online environment is important to successful online learning. This research found that successful students spent time reading discussion posts and viewed a greater number of discussion posts than unsuccessful students. Are our findings on the importance of reading discussions, and secondarily on creating discussion and follow-up posts, justification for requiring all students to participate in discussions? Again, our findings are not conclusive but they do suggest that successful students engage in this type of behavior with greater frequency and duration than non-successful students.

This study also suggests that successful students link their online activities to doing what is important to earn passing grades, that is, repeatedly visiting content pages throughout the course. The data suggest that “savvy students” likely decided that time spent viewing content pages was more important than creating original posts or follow-up discussion posts, although successful completers did both in relatively high numbers. Clearly, this study did not examine the role of discussions in making the content meaningful.

This research suggests that perhaps online instructors can facilitate student success by using the tools available to the instructor to track where students are going in the course, how often, and when. If the instructor emphasizes his/her managerial role ([Berge, 1995](#)), as well as pedagogical role, by directing students to important content pages, giving feedback on participation, and helping students to understand the layout of a course, it is possible that more students might be retained and be successful in the online classroom.

One limitation of this study was the lack of attention to the quality of the online discussion. Future research would benefit from a larger database that would permit (1) an investigation of high participation students/low achievement students and (2) an analysis of the interaction of the quantity and quality of online discussions. This research presents a component of a larger research study that also includes interviews of faculty and students regarding their perceptions of teaching and learning in the online environment and the analysis of faculty behavior in the online environment.

In conclusion, this study would appear to be documenting the obvious — students who are more engaged with the content and discussions in an online course will persist and complete successfully. However, such studies provide a necessary basis for understanding the complex interactions between students, faculty, course materials and course structures. As more institutions offer online courses to handle burgeoning enrollments, and as students increasingly expect alternatives to face-to-face courses, it becomes imperative to understand what constitutes and encourages successful student behavior in this environment. Today’s academic enterprise systems provide a unique opportunity to study student behavior across and between courses and terms. Data collected by these systems provide researchers with opportunities to track not only where a student goes online within a course, but also how much time they spend at various destinations, how often they return, and the various tools they use. By studying this data, researchers may assist faculty in tailoring their teaching to optimize student success; guide instructional designers in developing learning resources and organizing courses that facilitate

engagement; and help students to understand more completely their own studying and learning behaviors.

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