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Abstract

For over a decade, the learning management system (LMS) has been the primary method of delivering online learning. However, research related instructional design and pedagogical practices within this environment is still in its infancy as compared to face-to-face learning. While several frameworks for understanding pedagogical strategies and activity optimization exist, they do not address granular level issues such as optimal student interaction patterns. This study addresses this issue by exploring a case study of over 1600 online learners at a university in south Texas. Researchers looked at student demographics and activity patterns as they relate to cognitive outcomes.

With 5.6 million students enrolled in online courses in the United States alone and a growth rate ten times greater than face-to-face enrollments, program growth is considered a priority at over 80% of major US institutions of higher education. In 2009, over a quarter of all US college course enrollments were online (Allen & Seaman, 2010). While compelling, this accelerated growth has raised significant questions related to the quality of online instruction in terms of outcomes. One measure of outcomes is student learning and perceived efficacy. In their 2009 study, the US Department of Education isolated 51 common factors across thousands of studies and concluded that, in general, online learning is more effective than face-to-face learning (2009). However, relatively little is known about specific actions within the online environment that impact outcomes. Despite concerns related to inflation, grades remain a prominent standard for assessing program quality. Grades, whether high or low, do not necessarily reflect the rigor of or substance within a program. Standards for grading, and the

overall grading process developed by faculty, departments, or institutions as a whole, can provide further insight (Suskie & Banta, 2009). Given the weight assigned to this metric, this study examines the relationship between student activity and end of course grades.

Growth in the number of students participating in online courses at colleges and universities continues to significantly outpace the overall growth of student enrollment in higher education as a whole (Allen & Seaman, 2010). However, factors that predict student engagement and student achievement in online courses are still difficult to measure. One factor, student presence, may influence academic achievement within online courses.

Obviously, student achievement in online learning has many different definitions and measures. However, striving to understand and design coursework that maximizes opportunities for students to succeed is vital to the continuing growth of online education. In addition, determining which factors may significantly impact student achievement, particularly factors within the student's control, is essential to allow this growing course venue to maintain the highest academic standards and achievement for students as a result.

Background

Online enrollments continue to grow in higher education on both a percentage and numeric basis (Allen & Seaman, 2010). With the increase in distance learning in higher education, especially online learning, there has been an increase in formal research conducted to determine what makes online learning successful; from studies concerning course development and design (Armatas, Holt, & Rice, 2003; Banning & Hughes, 1986; Cook, 2000; Strange & Banning, 2001), hardware and infrastructure (Maher, Skow, & Cicognani, 1999; Whittington & Sclater, 1998), learning outcomes (DeTure, 2004; Hiltz, 1997; Jaffee, 1997), and student attitudes and satisfaction (Hirt, Cain, Bryant, & Williams, 2003; Kretovics, 2003), to faculty-student interaction (Beuchot & Bullen, 2005; Deka & McMurry, 2006; Woods, 2002), the sheer volume of research is staggering. Yet, with the amount of research available, there are still gaps to be filled (Wright & Lawson, 2005).

Student achievement is measured and determined in various ways. Two of the more common measures of student achievement are class grades and rates of retention (Deka & McMurry, 2006). While online student performance, in terms of grades, is noted to be at least on par with grades in face-to-face course performance (Tucker, 2001), and the majority of academic leaders believe that online education provides the same or superior learning outcomes as face-to-face courses (Allen & Seaman, 2006; Hiltz, 2007), retention is a cause for concern (Carr, 2000; Deka & McMurry, 2006). Picciano (2002) notes that student performance, or achievement, is identifiable in various ways, including but not limited to, grades and retention.

It would seem that students' achievement in an online course would be at least partially determined by the number of times they logged in to the course, especially as it could be a good empirical indicator of interaction and participation. However, no empirical research on this aspect of online learning has been reported. Thompson and Savenye (2007) note that more research needs to be conducted to clarify the impact of participation levels on learner performance because the empirical relationship between the two is less than clear. Another study (Picciano, 2002) measured message count to determine a positive, though not significant, correlation with performance. There may be a number of reasons for the lack of empirical research devoted to the number of times a student logged in to a course; however, the applicability of referencing the frequency of a student logging in to an online course is valuable.

One reason for the lack of research devoted to the frequency a student logged in for a

given course may be the relationship that time online has to attendance in a face-to-face course. There is no clear consensus regarding the relationship of attendance in face-to-face courses and student achievement, although there is a working assumption on the part of educators that attendance is important (Jacobson, 2005). In a 1999 study concerning compulsory attendance, St. Clair writes that attendance is influenced by the students' motivational beliefs and the context of the class. St. Clair goes on to assert that "the level of control students have over their environment, how valuable they believe the expected behavior is, and how good they feel about doing something all contribute to the actual decision to do something, be involved, and persist" (1999, p. 178).

That attendance may not be positively related to student achievement does not undermine the role of interaction for online learning. The research devoted to the importance of interaction in web-based learning is extensive, with most concluding that faculty-to-student and student-to-student interaction are important elements of online course design and achievement (Beaudoin, 2002; Picciano, 2002). Woods (2002) noted that researchers stress the importance of a "high degree" of interaction between students and instructors to build strong relationships and foster a sense of community. Further, computer mediated communication (CMC) technologies have become an important element of both face-to-face and online education to increase both the amount and quality of interaction and participation in courses, which in turn affects student achievement (Alavi, 1994; Beuchot & Bullen, 2005; Thompson & Savenye, 2007; Wright & Lawson, 2005).

Beaudoin's 2002 study found that self-reported time spent logged in to a class positively influenced students' perceptions of learning even when the students were not visibly participating by posting messages, participating in synchronous discussions, etc., while logged in. However, the mean course grades for the "invisible" learners were lower than those of high-visibility learners, lending weight to the argument for empirical research. This study, as well as a 2007 study by Zembylas and Vrasidas, highlights that low-visibility participation, and the causes of low-visibility, must be considered. If this is the case, then participation and interaction may not be readily determined by quantity of work; again, this presents a case for empirical research of the frequency of times a student logged in to the course.

Tracking the time of the first login should be compared with the number of attempts that it takes for a student to achieve the task. For example, a student may be logged in for long periods of time and have the correct answer, but getting to that point may have been achieved by making five attempts at reaching that answer. In addition, this student may have waited until the final hours of a looming deadline (Minaeli-Bidgoli, Kashy, Kortemeyer, & Punch, 2003). The earlier the work is completed, the more responsible the student tends to be throughout the duration of the course. This student may have completed the assignment shortly after notification of its deadline but also made one attempt and was only logged in to the course for a short period of time (Minaeli-Bidgoli et al., 2003).

Another approach to monitoring achievement through login times is found in the form of set timeframes that assignments are posted and available for completion by the student. As an endeavor to support its Language Arts department, The College of the Sequoias launched an experimental distance education program in 1996 ("Impacting Distance Learning", 2004). This program utilized a series of changes intended to boost success for distance education. One such change was the implementation of an automatic timer that ticked for weekly quizzes; in other words, a new week's quiz became available at the same time that the previous week's quiz disappeared every Monday on Blackboard, the school's delivery software of choice ("Impacting

Distance Learning", 2004). This tool encouraged students to manage their time better. Limiting the time frame for logging in to Blackboard controlled how many days and opportunities were available for consideration of completing homework. Results from this experiment had a direct positive impact on the Language Arts department, as statewide ranks went from 13.6 points under other offerings to 4.7 points above ("Impacting Distance Learning", 2004).

The Study and Its Context

Activity theory is a "philosophical framework for studying different forms of human praxis as developmental processes, both individual and social levels interlinked at the same time" (Kuutti, as cited in Jonassen, 2002, p. 62). As Jonassen and Rohrer-Murphy explain, activity theory can be used as a lens, to examine human learning and stems from work in the areas of socio-cultural and socio-historical theorists (e.g. Vygotsky, Leont'ev, Luria). Activity theory posits that conscious learning emerges from activity (performance) and is not a precursor to it (Jonassen & Rohrer-Murphy, 2002). We have selected this lens and utilized this particular framework because actions taken by students to participate and engage in the course via their login to the course may determine final student achievement. Additionally, as the study examines online courses, and the students who participate in these classes, it is logical to believe that learning would occur after physically entering the course via the learning management system and not before a student electronically stepped foot into the classroom.

Regression analysis, using the forward entry method, was utilized to analyze the data, as this model allows for a determination of significance as well as the amount of variance associated with each significant variable. These following research questions were examined:

RQ 1: Is there a relationship between the amount of time spent in the online learning environment and student achievement as measured by final course grade?

RQ 2: Is there a relationship between the frequency of participation in the online learning environment and student achievement as measured by final course grade?

Method

A total of 1,631 unique student records from a university in southern Texas were collected over the course of one academic year. All courses were taken in a fully online format, using the Blackboard learning management system. Descriptive statistics were used to provide an overview of the study population. Data were then prepared for regression analysis.

The criterion variable was the grade the student received in the course, expressed as a continuous variable. The predictor variables were gender, ethnicity, course level (i.e. freshman, sophomore, junior, senior or graduate), time spent online, and frequency of logins (sessions) to the Learning Management System (LMS). The data were examined for outliers of more than plus or minus three standard deviations, resulting in the removal of 18 cases, leaving 1,613 that were analyzed. Categorical variables were converted to dummy variables as suggested by Cohen, Cohen, West, and Aiken (2002). In the case of ethnicity, only African American, Asian, Caucasian, and Hispanic had statistically adequate sample sizes. All other ethnicities were collapsed into an "Other" category.

Results

Of the 1,613 students, 928 were female and 685 were male. Ethnically, students were reported belonging to the following classifications, as noted in Table 1.

Table 1
Ethnicity

Ethnic Membership	Total Cases	Percentage
African American	97	6%
Asian	71	4%
Caucasian	380	24%
Hispanic	953	59%
Other	112	7%

By level, students were represented as noted in Table 2:

Table 2
Grade Level

Grade Level	Total Cases	Percentage
Graduate	266	17%
Senior	297	18%
Junior	475	30%
Sophomore	392	24%
Freshman	183	11%

On a per course basis, the mean number of sessions for learners was 91.38 (SD = 22.31). Mean time spent by learners in the LMS, per course, was 1,592.44 minutes (SD = 272.53).

In addition to the standard checks for co-linearity and heteroscedacticity, two initial tests were conducted to insure the independence of the predictor variables. Initial ANOVA testing was used to determine if correlations existed between the number of logins and time spent in LMS. No significant ($p < .05$) relationships were found.

Similarly, two sets of regression tests were conducted to determine if the predictor variables of gender, ethnicity, and level were correlated with two criterion variables: 1) session; and 2) time spent in the LMS (measured in minutes). No significant ($p > .05$) relationships were found. As these initial tests indicated no relationship between the predictor variables, regression testing was implemented.

Forward method linear regression resulted in four predictor variables being statistically significant predictors ($p < .05$). The following table illustrates the relative contributions of each of the predictor variables to the significant predictive model. The *Forward* method in SPSS enters predictor variables one by one in order of decreasing significance. This table, therefore, illustrates the changes in Adjusted R2 as each variable is entered.

Table 3
Contributions of Predictor Variables

Model	R	R Square	Adj R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
					Change Statistics				
1	.317[a]	.101	.100	1.145	.101	303.476	1	2716	.000
2	.363[b]	.132	.131	1.125	.032	98.702	1	2715	.000
3	.374[c]	.140	.139	1.120	.008	24.536	1	2714	.000
4	.380[d]	.145	.143	1.117	.005	14.985	1	2713	.000

a. Predictors: (Constant), Sessions
b. Predictors: (Constant), Sessions, Class_Grad
c. Predictors: (Constant), Sessions, Class_Grad, Time in minutes
d. Predictors: (Constant), Sessions, Class_Grad, Time in minutes, Class_Fresh
e. Dependent Variable: Official Grade in Number

Though the four significant predictor variables accounted for 14.6% of the variance, it is important to note that 10.1% and 3.2% of the variance could be respectively attributed to session and graduate status. Freshman status and cumulative time spent in the LMS (in minutes), accounted for just 0.8% and 0.5% of variance respectively. Thus, while statistically significant, the two later predictor variables can be viewed as having no practical significance.

Conclusions

Although statistical results in social science should never be deemed definitively causal, the sample size in this study warrants further and closer inspection of the impact of frequency of logins (sessions) on student success as measured by grades. While 10.1% of variance is not dramatic, it should still be considered substantial. This is especially true given that factors such as gender and ethnicity, which have been found to play a significant role in success in face-to-face environments, were not found to be significant in this study.

Our finding regarding the number of sessions learners entered corresponds to the basis of the activity theory. A foundational aspect of the activity theory is that activity produces meaningful learning and is not an antecedent to learning. Activity theory tells us that meaningful activity is not accomplished individually; while learners may perform individually, the process of learning involves collaboration and interaction with others. The most common unit of analysis for activity theory is activity, which is the unit of analysis being examined by learners' "sessions" in this paper and accounts for 10.1% of the variance. Given this, it would make sense that those learners in this study who were more "active" achieved a higher level of success as measured by students' final grades.

Status as a graduate student accounted for 3.2% of the variance, which is to be expected. However, the number of sessions students entered a course accounted for 10% of the variance, an unexpected outcome which suggests that it may not be the amount of time in a LMS nor the amount of time per session but rather the rate of activity that is a significant predictor of achievement.

Scientific/Scholarly Significance

Obviously, student achievement in online learning has many different definitions and measures. Achievement is not one-dimensional or easily predicted. However, striving to understand and design coursework that maximizes opportunities for students to succeed is vital to the continuing growth of online education and Asychronous Learning Networks (ALNs). In addition to this, determining which factors may significantly impact student achievement, particularly factors within the student's control, is essential to allow this growing course venue to maintain the highest academic standards and achievement for students as a result. From an institutional and instructional design perspective, the need to promote higher levels of student activity on a consistent basis appears to have an impact on performance.

Though the student population was heavily weighted toward a Hispanic demographic, it is important to reiterate that ethnicity and gender were not significant predictors of performance. However, given similar findings by Boston, Ice and Gibson (2011), with a different demographic of online students, this finding appears to be consistent with emerging research in the field.

Limitations and Directions for Future Research

There is much debate over the significance of grades in academia given the tendency towards inflation; however, this study is informative in that it demonstrates a meaningful degree of variance in grades accounted for by student activity. More research is needed in which the same measures are regressed on more precise or authentic learning outcome measures such as rubric scores or portfolio evaluations. In addition, qualitative work is needed to determine what factors tend to promote higher levels of student activity and if these can be related to instructional design techniques or instructor actions.

As an example, the number of sessions does not inform what specific acts are undertaken in those sessions. It is suggested that future studies capture more granular data; data points that measure specific actions within the LMS during each session. Supplementing such quantitative data, it would be useful to interview students to determine the value that they place on each of the activities undertaken during sessions.

A potential framework for contextualizing future studies might be the Community of Inquiry (Arbaugh et al, 2008), which explains the online learning process as being an interaction of Teaching, Social, and Cognitive Presence. Using this model for classifying the types of interactions could be highly beneficial for understanding which types of activity are most beneficial for the emergence of learning outcomes.

Finally, as previously noted, the finding of no significant relationship between ethnicity or gender and performance is very important but not entirely unexpected. However, as this varies so dramatically from the literature in the face-to-face learning environment, it is hoped that this issue will soon become the focus of in-depth research.

References

Alavi, M. (1994). Computer-mediated collaborative learning: An empirical evaluation. *MIS Quarterly, 18*(2), 159-174.

Allen, I. E., & Seaman, J. (2010). *Class differences: Online education in the United States, 2010*. Retrieved from http://sloanconsortium.org/publications/survey/class_differences

Arbaugh, J. B., Cleveland-Innes, M., Diaz, S. R., Garrison, D. R., Ice, P., Richardson, J. C. & Swan, K. P. (2008). Developing a community of inquiry instrument: Testing a measure of the community of inquiry framework using a multi-institutional sample. *Internet and Higher Education 11*, 133-136.

Arbaugh, J. B. (2000). How classroom environment and student engagement affect learning in Internet-based MBA courses. *Business Communication Quarterly, 63*(9), 9-26.

Armatas, C., Holt, D., & Rice, M. (2003). Impacts of an online-supported, resource-based learning environment: Does one size fit all? *Distance Education, 24*(2), 141-158.

Banning, J. H., & Hughes, B. M. (1986). Designing the campus environment with commuter students. *NASPA Journal, 24,* 16-24.

Beaudoin, M. F. (2002). Learning or lurking? Tracking the "invisible" online student. *Internet and Higher Education, 5,* 147-155.

Beuchot, A., & Bullen, M. (2005). Interaction and interpersonality in online discussion forums. *Distance Education, 26*(1), 67-87.

Boston, W., Ice, P. & Gibson, A. (2011). Comprehensive assessment of student retention in online learning environments. *Online Journal of Distance Learning Administration, 14*(1). Retrieved from http://www.westga.edu/~distance/ojdla/spring141/boston_ice_gibson141.pdf

Carr, S. (2000). As distance education comes of age, the challenge is keeping the students. *Chronicle of Higher Education, 46*(23), A39-A41.

Cohen, P, Cohen, J. West, S. G., & Aiken, L. (2002). *Applied multiple regression: Correlation analysis for the behavioral sciences* (3rd ed.). New Jersey: Routledge.

Cook, K. C. (2000). Online professional communication: Pedagogy, instructional design, and student preference in internet-based education. *Business Communications Quarterly, 63*(2), 106-110.

DeTure, M. (2004). Cognitive style and self-efficacy: Predicting student success in online distance education. *The American Journal of Distance Education, 18*(1), 21-38.

Deka, T. S., & McMurry, P. (2006). Student success in face-to-face and distance teleclass environments: A matter of contact? *International Review of Research in Open and Distance Learning, 7*(1). Retrieved from http://www.irrodl.org/index.php/irrodl/article/view/251/498

Hiltz, S. R. (1997). Impacts of college-level courses via asynchronous learning networks: Some preliminary results. *Journal of Asynchronous Learning Networks, 1*(2). Retrieved from http://www.sloan-c.org/publications/jaln/v1n2/pdf/v1n2_hiltz.pdf

Hirt, J. B., Cain, D., Bryant, B., & Williams, E. (2003). Cyberservices: What's important and how are we doing. *NASPA Journal, 40*(2), 98-118.

Impacting distance learning success rates. (2004). *Academic Exchange Quarterly*, (Winter*).* Retrieved from http://findarticles.com/p/articles/mi_hb3325/is_4_8/ai_n29148973/

Jacobson, E. (2005). Increasing attendance using email: Effect on developmental math performance. *Journal of Developmental Education, 29*(1), 18-26.

Jaffee, D. (1997). Asynchronous learning: Technology and pedagogical strategy in a distance learning course. *Teaching Sociology, 25,* 262-277.

Kretovics, M. (2003). The role of student affairs in distance education: Cyber-services or virtual communities. *Online Journal of Distance Learning Administration, 6*(3). Retrieved from http://www.westga.edu/~distance/ojdla/fall63/kretovics63.html.

Maher, M. L., Skow, B., & Cicognani, A. (1999). Designing the virtual campus. *DesignStudies, 20,* 319-342.

Minaei-Bidgoli, B., Kashy, D., Kortemeyer, G., & Punch, W. (2003). Predicting student performance: An application of data mining methods with the educational web-based system. *Proc. Frontiers in Education,* (33).

Picciano, A. G. (2002). Beyond student perceptions: Issues of interaction, presence, and performance in an online course. *Journal of Asynchronous Learning Networks, 6*(1), 21-40. Retrieved from http://www.aln.org/publications/jaln/v6n1/pdf/v6n1_picciano.pdf

St. Clair, K. L. (1999). A case against compulsory class attendance policies in higher education. *Innovative Higher Education, 29*(3), 171-180.

Strange, C. C., & Banning, J. H. (2001). *Educating by design: Creating campus learning environments that work.* San Francisco: Jossey-Bass.

Suskie, L., & Banta, T. W. (2009). *Assessing student learning: A common sense guide* (2nd ed.). San Francisco, CA: Jossey-Bass.

Thompson, E. W., & Savenye, W. C. (2007). Adult learner participation in an online degree program: A program-level study of voluntary computer-mediated communication. *Distance Education, 28*(3), 299-312.

Tucker, S. (2001). Distance education: Better, worse, or as good as traditional education? *Online Journal of Distance Learning Administration, 4*(4). Retrieved from http://www.westga.edu/~distance/ojdla/winter44/tucker44.html

Whittington, C. D., & Sclater, N. (1998). Building and testing a virtual university. *Computers in Education, 30,* 41-47.

Woods, R. H. (2002). How much communication is enough in online courses? Exploring the relationship between frequency of instructor-initiated personal email and learners' perceptions of and participation in online learning. *International Journal of Instructional Media, 29*(4), 377-394.

Wright, E. R., & Lawson, A. H. (2005). Computer mediated communication and student learning in large introductory sociology classes. *Teaching Sociology, 33,* 122-135.

Zembylas, M., & Vrasidas, C. (2007). Listening for silence in text-based, online encounters. *Distance Education, 28*(1), 5-24.