PERKS OF BEING A WALLFLOWER: LEARNING WITHOUT ENGAGING IN DISCUSSION FORUMS

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Abstract: While much has been written about student engagement as measured by *interactions* in online discussion forums and its relationship to student success, little, if any, research has been done to connect student engagement as measured by *non-interactions* in online discussion forums and its relationship to student success. Learning Management Systems (LMSs) have the ability to measure student engagement by tracking the frequency of discussion forum posts and replies (interactions), and the frequency of discussion forum views (non-interactions). This initial exploratory study sought to determine whether relationships existed between students' frequency of discussion forum activities—posts, replies, and views—and student success. Correlation and regression analyses were performed to determine type and strength of relationships. Non-probability purposive sampling was used to recruit 38 participants. Data showed meaningful findings, which yielded statistically significant, modest or moderate positive partial relationships in discussion forums posts, replies, and views, and student success. This study attempted to fill the gap in the literature by identifying additional measures of student engagement in online environments. Results from the study can potentially inform administrators and educators in making data-based decision to improve teaching and learning practices, thus increasing retention and graduation rates.

INTRODUCTION

A wallflower is a term used to describe a person who from shyness or unpopularity remains on the sidelines of a social event, such as a dance (Wallflower, 2014). Although wallflowers do not participate in the activities, wallflowers are engaged and notice everything that is happening around them. Administrators and educators have long understood the importance of student engagement and its relationship to student success. Student engagement is measured by the amount of time and effort a student puts forth in academically purposeful activities (Kuh, 2001), such as studying for an exam, participating in class discussions, and interacting with peers. LMSs are capable of measuring how students engage with peers and educational content by tracking the number of times a student posts, replies, and views discussion forums. In addition, LMSs are capable of calculating student success rates.

Educators have access to vast amounts of data. Knowing which information is related to levels of student engagement will help identify online behaviors related to student success. Recently, research has focused on obvious online interactions such as posting and replying to discussion forums, but little, if any, has been done to study the non-interactions of online engagement. In this study, the researchers sought to determine whether relationships exist between students' frequency of discussion forum activities—such as posting and replying (interactions), and viewing (non-interactions)—and students' success.

The following research question and sub-questions informed the study:
Research Question: What is the relationship between students' level of engagement as measured in discussion forum activities and students' success in an online course?

- Research Sub-question #1: What is the relationship between students' frequency of discussion forum posts and students' success?
- Research Sub-question #2: What is the relationship between students' frequency of discussion forum replies and students' success?
- Research Sub-question #3: What is the relationship between students' frequency of discussion forum views and students' success?

This study will help administrators and educators identify LMS data that measure student engagement. Beer, Clark, and Jones (2010) claim that identifying early indicators of student engagement will give institutions the ability to measure factors that can inform and improve current teaching practices, thus increasing retention and graduation rates. The process of extracting, analyzing, and interpreting data to gain insights into student learning has been termed *learning analytics* (Bienkowski, Feng, & Means, 2012). Administrators who initiate the use of analytics at their institutions can

harvest real-time student data that can potentially help educators track student progress to determine whether teaching practices need to be adapted to promote student engagement, and ultimately identify students who are at risk of failure.

Key Definitions

Student engagement: the amount of time and energy a student invests in educationally purposeful activities and the effort institutions devote to using effective educational practices (Kuh, 2001).

Frequency of discussion forum posts: the total number of original posts a student makes to a discussion forum. Posts may be made under the same topic or under a different topic, so long as it begins a new threaded discussion with a new topic for discussion for that student. Responses to previously posted threads or replies do not count as posts.

Frequency of discussion forum replies: the total number of times a student replies to a discussion forum. Replies may be to another student's original post, a follow-up response to a previously posed question, or a response to another person's reply that continues the same topic of discussion. It does not begin a new threaded discussion or a new topic for discussion.

Frequency of discussion forum views: the total number of times a student visits a discussion forum but does not contribute to the postings. Each visit is counted when a student leaves the page and returns whether during the same log in or subsequent log ins.

THEORETICAL FRAMEWORK AND LITERATURE REVIEW

In order to better understand how data extracted and analyzed from an LMS can be used as early indicators for student engagement, relevant literature will be reviewed. An overview of student engagement is presented, including student engagement in discussion forums, and how learning analytics can be used to track student engagement levels.

Student Engagement

Student engagement has been studied extensively for the past 40 years and has been used to describe a variety of student behaviors. Hu and Kuh (2002) assert that student engagement is "the most important factor in student learning and personal development during college" (p. 555). Many researchers have offered various meanings of engagement, starting with Astin's (1984) definition of student involvement as the degree to which students are involved in school-related matters by "the investments of physical and psychological energy in various objects" (p. 519). Skinner and Belmont (1993) describe engagement as the intensity and quality of behavioral and emotional involvement during learning activities. According to Kuh (2001, 2004, 2009), engagement is the amount of time and effort students invest in academic activities related to student learning outcomes. As evidenced in the literature, many researchers agree that student engagement reflects the amount of time and effort a student puts forth into educational activities and is directly related to a variety of desired student outcomes (Astin, 1984; Kuh, 2004; Kuh, Cruce, Shoup, Kiinzie, and Gonyea, 2008; Skinner & Belmont, 1993). In essence, the more time and energy a student spends participating in meaningful activities, the more engaged he/she is in his/her education.

In traditional face-to-face classrooms, simple measurements of student engagement typically involve observing students' behavior through attendance, eye contact, posture, and asking questions. However, in online environments, it is much more difficult to monitor student engagement given the subtlety of students' behavior (Romero & Ventura, 2007). LMSs record every mouse click from each student within the system. The data may be tracked for analysis and used to gauge a student's level of involvement (Beer et al., 2010). Rapuano and Zoino (2006) inform readers about LMSs' ability to retrieve detailed data on learner scores, choices on questions, and navigation habits, which provide important data on students' engagement behavior. Although this may be true, Beer et al. (2010) argue that while LMS data has the potential to measure student engagement, research into how this can be done is still in its infancy.

Student Engagement and Discussion Forums

Hu and Kuh (2002) assert that student engagement is a function of interaction; more than 80% of interaction that occurs in an LMS occurs in the discussion forums (Dawson, Macfadyen, & Lockyer, 2009). Student engagement is related positively to student interaction with instructors and other students. Many empirical studies have explored interactions in discussion forums. One of the earliest studies using discussion forums to increase student engagement was Persell's (2002) "Using Focused Web-based Discussions to Enhance Student Engagement and Deep Understanding." This study addressed pedagogical problems in her weekly senior sociology seminar where students came to class not having read the course readings; therefore, they were not ready to discuss the issues on a deeper level. In addition, not all students participated in discussions. To acquire greater participation, to get students to read course material, and to think and write about the issues more analytically and sociologically, Persell used discussion forums to get "staters", students who initiated posts, to report about the reading before class, "responders" replied to staters' posts by extending ideas, and

then "integrators" combined previous ideas and posted additional questions. Persell counted the number of times students referred to their peers by name in the discussion boards to assess the degree of student engagement. Results of the study revealed that students became more engaged by the end of the semester by referring to their peers by name 100% of the time compared to 30% during the first week of school.

In 2009, three separate studies assessing student interaction in discussion boards were performed, and each study had similar results. Dawson et al. (2009) correlated learning dispositions with student LMS data to identify patterns of student achievement in first-year medical students at the University of Wollongong in Australia. Results showed a strong correlation between student achievement and participation in discussion forums. Sher (2009) implemented regression analysis to analyze the relationships between student-student and student-instructor interactions in asynchronous discussion forums with student learning and satisfaction. The researcher concluded that interaction variables contributed significantly to student learning and satisfaction. Bliss and Lawrence (2009) provided further evidence by evaluating 11,596 message posts from 14 online undergraduate Mathematics courses at Empire State College in the winter 2008 term. Student participation was calculated by the number of students participating in a thread divided by total number of students enrolled in the course. The researchers confirmed findings of earlier studies that suggest guidelines, feedback, and instructor presence are correlated with greater student participation.

More recent studies have explored ways to increase student interactions in discussion forum posts. Ertmer, Sadaf, and Ertmer (2011) examined relationships between question types and critical thinking levels, as described by Bloom's taxonomy (elucidated previously), to levels of student interactions in online discussion forums represented in number of responses per student, average number of student-student sequences, and average number of threads for each question. The study's results showed that higher-order thinking questions produced a higher frequency of student interaction.

Tracking Student Behavior: Learning Analytics

Learning analytics are starting to emerge in the educational landscape as online techniques to improve student outcomes. The International Conference on Learning Analytics began meeting annually since 2010 and its professional society was founded in 2011 (Bienkowski et al., 2012).

According to the First International Conference on Learning Analytics and Knowledge, "learning analytics is the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs" (gsiemens, 2010, para 5). Johnson, Adams, and Cummins (2012) assert that learning analytics applies mainly to monitoring and predicting student performance and recognizing at-risk behaviors so that interventions may be put into place. Several institutions and researchers have begun applying learning analytics into their research projects. For instance, the Society for Learning Analytics Research (SoLAR) is offering a free online course introducing learning analytics at Athabasca University. Harvard University has developed a software called *Learning Catalytics* that provides real-time feedback while students are in class by grouping students together based on questions posed (Learning Catalytics, n.d.). In 2007, Purdue University initiated their Signals project, which gathers information from a variety of sources, such as the course management systems and gradebook, to generate an at-risk profile and target those students for outreach (Johnson et al., 2012). The University of Maryland has also made use of data extracted from Blackboard, their institution's LMS, and developed a program called *CheckMyActivity*, which allows students to access their data to check and regulate their progress at any time (Lonn, Krumm, Waddington, & Teasley, 2012). These studies will help faculty to better understand their students' needs and tailor instruction to meet those needs.

Limited studies have been performed correlating mined student LMS data and student engagement. Saenz, Hatch, Bekoski, Kim, Lee, and Valdez (2011) used data mining techniques to extract a large array of data from 663 community colleges' LMSs and more than 320,000 students to explore patterns of engagement between similar and dissimilar groups. This study found the most distinguishing factor between similar and dissimilar groups was students who utilized the college's student services, McWilliam, and Tan (2008) used academic analytics to look at a range of institutional data and create a visual model of student engagement/effort based on faculty activity level. Network analysis was performed on course discussion boards to discover patterns of student-student and student-instructor interactions to visualize student engagement and the likelihood of success (Macfadyen & Dawson, 2010). Although only a small number of studies have used data mining and academic analytic techniques to explore the relationship between student LMS data and student success, there have been no studies to date investigating the correlation between students' perceived level of engagement and students' actual levels of engagement as measured by an LMS. Long and Siemens (2011) have expressed their amazement regarding the remarkably ineffective use of data in higher education, an institution that has historically collected vast amounts of data. Macfadyen and Dawson (2010) add that "there are few examples that demonstrate successful and systematic application of academic analytics across an institution in order to inform and enhance teaching and learning practices" (p. 590)

METHODS

This initial exploratory study sought to determine whether relationships exist between students' frequency of discussion forum posts, frequency of discussion forum replies, and frequency of discussion forum views and students' success. The target population for this study was undergraduate students who enrolled in one of six online courses offered during the spring 2013 quarter of a large, public university. Non-probability, purposive sampling technique was used to select 38 participants. A correlation design was used to determine the types and strengths of relationships (Popham, 1999), if any, between students' levels of engagement as measured by the LMS and student success.

Existing LMS data for the study were retrieved retroactively and obtained by the researchers 2 weeks after final grades were submitted to the Registrar's Office. By logging on to the online course and visiting the LMS's Report Logs, the researchers were able to retrieve required LMS data, such as frequency of discussion forum posts, frequency of discussion forum replies, frequency of discussion forum views, and student success rates.

Success rates were determined by examining students' achievement of course objectives based on total points earned compared to total points possible. Students earned points from a variety of activities, such as posting and replying to discussion forums, completing online assignments, taking online quizzes, and finishing an in-class final exam. Scores were either automatically updated via computer-graded online assessments or manually entered by the course instructor into the LMS's gradebook. Students' percentages were calculated by the system and determined by dividing accumulated points earned by the total points possible and then multiplied by 100 for all course activities.

FINDINGS

Discussion forum posts were measured as original threads that initiated a topic for discussion. Discussion forum replies were measured as responses to either an original post or a secondary reply and did not initiate a topic for discussion. Discussion forum views were measured by the number of times a student visited a discussion forum page but did not necessarily contribute to the forum. Frequency data were numeric variables on a ratio level of measurement.

Table 1 summarizes students' actual level of engagement with the number of responses (*N*), minimum value (Min.), maximum value (Max.), mean, median, mode, standard deviation (*SD*), and skewness for frequency of discussion forum posts, replies, and views.

Table 1:*Descriptive Statistics on Students' Actual Level of Engagement as Measured by LMS Data*

Variable	*N*	Range	Mean	Median	Mode	SD	Skewness
Freq. of Forum Posts	38	0-31	13.16	10.00	10.00	7.621	.872
Freq. of Forum Replies	38	1-50	20.37	17.50	16.00	11.129	.596
Freq. of Forum Views	38	29-483	200.74	187.50	29.00	118.474	.762

Frequency of discussion forum posts, or the number of times a student posted on a discussion forum, for the 38 respondents ranged from 0 to 31. The mean frequency of discussion forum posts was 13.16 with a standard deviation of 7.62. This meant that if all the respondents had the same frequency of discussion forum posts, they would have posted 13.16 times with a + or - variation of 7.62. The mode was 10.00; therefore, the most common frequency of discussion forum posts was 10.00. The median frequency of discussion forum posts was 10.00, which meant that half of the respondents posted on a discussion forum 10.00 times or less and the other half of the respondents posted on a discussion forum 10.00 times or more. The range of frequency of discussion forum posts was 31. This meant that 31 points separated the highest frequency of discussion forum views of 31 and the lowest frequency of discussion forum views of 0. The coefficient of skewness was .872, which indicated an asymmetric distribution with the tail extending towards the right or positively skewed.

Frequency of discussion forum replies, or the number of times a student replied to an original post of discussion forum or a reply to an original post, for the 38 respondents ranged from 1 to 50. The mean frequency of discussion forum replies was 20.37 with a standard deviation of 11.13. This meant that if all the respondents had the same frequency of discussion forum replies, they would have replied 20.37 times with a + or - variation of 11.13. The mode was 16.00; therefore, the most common frequency of discussion forum replies was 16.00. The median frequency of discussion forum posts was 17.50, which meant that half of the respondents replied to a discussion forum post or reply 17.50 times or less and the other half of the respondents replied to a discussion forum post or reply 17.50 times or more. The range

of frequency of discussion forum posts was 49. This meant that 49 points separated the highest frequency of discussion forum replies of 50 and the lowest frequency of discussion forum views of 1. The coefficient of skewness was .596, which indicated an asymmetric distribution with the tail extending towards the right or positively skewed.

Frequency of discussion forum views, or the number of times a student viewed a discussion forum post, for the 38 respondents ranged from 29 to 483. The mean frequency of discussion forum views was 200.74 with a standard deviation of 118.47. This meant that if all the respondents had the same frequency of discussion forum views, they would have viewed the forums 200.74 times with a + or - variation of 118.47. The mode was 29.00; therefore, the most common frequency of discussion forum views was 29.00. The median frequency of discussion forum views was 187.50, which meant that half of the respondents viewed a discussion forum page 187.50 times or less and the other half of the respondents viewed a discussion forum page 187.50 times or more. The range of frequency of discussion forum home page views was 454. This meant that 454 points separate the highest frequency of discussion forum views of 483 and the lowest frequency of discussion forum views of 29. The coefficient of skewness was .762, which indicated an asymmetric distribution with the tail extending towards the right or positively skewed.

Students' success rates were determined by examining their achievement of course objectives based on total points earned compared to total points possible. Points were earned from a variety of activities, such as completing assignments, posting and replying on discussion forums, and taking online quizzes and exams. Students' percentages were calculated by dividing accumulated points earned by total points possible

Table 2 summarizes students' success scores with the number of responses (*N*), minimum value (Min.), maximum value (Max.), mean, median, mode, standard deviation (Std. Dev.), and coefficient of skewness. Student success scores, or the total points earned divided by the total points possible, for the 38 respondents ranged from 44 to 92. The mean student success score was 76.97 with a standard deviation of 11.33. This meant that if all the respondents had the same student success score, they would have scored 76.97 with a + or - variation of 11.33. The mode was 75.00; therefore, the most common student success score was 75.00. The median student success score was 76.97, which meant that half of the respondents had a student success score of 76.97 or less and the other half of the respondents had a student success score of 76.97 or more. The range of student success scores was 48. This meant that 48 points separated the highest student success score of 92 and the lowest student success score of 44. The coefficient of skewness was -1.276, which indicated an asymmetric distribution with the tail extending towards the left or negatively skewed.

Table 2:*Descriptive Statistics for Students Success*

Variable	*N*	Range	Mean	Median	Mode	SD	Skewness
Student Success Scores	38	44-92	76.97	78.00	75.00	11.33	-1.276

Correlation and Regression Analyses

Table 3 summarizes the findings when performing correlation and regression analysis for student success (DV) and frequency of discussion forum posts. Plotting the regression equation for frequency of discussion forum posts the Y value was student success (DV), and the X value was frequency of discussion forum posts (IV). The y-intercept was $\alpha = 67.176$. The regression coefficient (or slope of the line) was $\beta = 0.745$. Therefore, the regression equation was expressed as $Y = 67.176 + 0.745X$. The correlation coefficient *r* for the relation between frequency of discussion forum posts and student success was $r(36) = 0.501$ ($p = 0.001$). The relationship between frequency of discussion forum posts and student success was a modest or moderate positive relationship. An increase in frequency of discussion forum posts (IV) had a modest or moderate association with an increase in student success (DV). The coefficient of determination R^2 for the proportion of variance of one variable predicted from the other variable was $R^2 = 0.251$; therefore, 25.1% of the variation in student success (DV) can be accounted for by the variation in frequency of discussion forum posts (IV). The ratio of the variance that determines whether two variances—student success and frequency of discussion forum posts—are equal was F-ratio = 12.050 ($p = 0.001$). Since the F-ratio was greater than the F distribution critical value at $p = 0.01$, then the F-ratio was significant and indicated an overall goodness of fit of the regression equation.

Table 3 :*Regression Analyses to Determine Whether Relationships Exist Between Frequency of Discussion Forum Posts, Replies, and Views (IVs) and Student Success (DV)*

Criterion (DV)	Predictor (IV)	*p*-value	α	β	*r*	R^2	F
Student Success	Forum Posts	0.001***	67.176	0.745	0.501	0.251	12.050***
Student Success	Forum Replies	0.000***	65.079	0.584	0.574	0.329	17.650***
Student Success	Forum Views	0.015**	69.427	0.038	0.393	0.154	6.578***

Note. * significant at $\alpha \leq 0.10$, $p < 0.10$; ** significant at $\alpha \leq 0.05$, $p < 0.05$, *** significant at $\alpha \leq 0.01$, $p < 0.01$.

Correlation and regression analysis was performed for student success (DV) and frequency of discussion forum replies. Plotting the regression equation for frequency of discussion forum replies the Y value was student success (DV), and the X value was frequency of discussion forum replies (IV). The y-intercept was $\alpha = 65.079$. The regression coefficient (or slope of the line) was $\beta = 0.584$. Therefore, the regression equation was expressed as $Y = 65.079 + 0.584X$. The correlation coefficient *r* for the relation between frequency of discussion forum replies and student success was $r(36) = 0.574$ ($p = 0.000$). The relationship between frequency of discussion forum replies and student success was a modest or moderate positive relationship. An increase in frequency of discussion forum replies (IV) had a modest or moderate association with an increase in student success (DV). The coefficient of determination R^2 for the proportion of variance of one variable predicted from the other variable was $R^2 = 0.329$; therefore, 32.9% of the variation in student success (DV) can be accounted for by the variation in frequency of discussion forum replies (IV). The ratio of the variance that determines whether two variances—student success and frequency of discussion forum replies—are equal was F-ratio = 17.650 ($p = 0.000$). Since the F-ratio was greater than the F distribution critical value at $p = 0.01$, then the F-ratio was significant and indicated an overall goodness of fit of the regression equation.

Correlation and regression analysis was performed to determine type and strength of relationship between student success (DV) and frequency of discussion forum views (discussion forum views is defined as the original posting for that discussion thread). Plotting the regression equation for frequency of discussion forum views the Y value was student success (DV), and the X value was frequency of discussion forum views (IV). The y-intercept was $\alpha = 69.427$. The regression coefficient (or slope of the line) was $\beta = 0.038$. Therefore, the regression equation was expressed as $Y = 69.427 + 0.038X$. The correlation coefficient *r* for the relation between frequency of discussion forum views and student success was $r(36) = 0.393$ ($p = 0.015$). The relationship between frequency of discussion forum views and student success was a modest or moderate positive relationship. An increase in frequency of discussion forum views (IV) had a modest or moderate association with an increase in student success (DV). The coefficient of determination R^2 for the proportion of variance of one variable predicted from the other variable was $R^2 = 0.154$; therefore, 15.4% of the variation in student success (DV) can be accounted for by the variation in frequency of discussion forum views (IV). The ratio of the variance that determines whether two variances—student success and frequency of discussion forum views—are equal was F-ratio = 6.578 ($p = 0.015$). Since the F-ratio was greater than the F distribution critical value at $p = 0.05$, then the F-ratio was significant and indicated an overall goodness of fit of the regression equation.

CONCLUSIONS

After collection and analyses of data, the guiding research questions explored whether relationships existed between students' frequency of discussion forum activity—posts and replies (interactions) and views (non-interactions)—and students' success. Students who had higher frequencies of discussion forum posts, discussion forum replies, and discussion forum views had higher rates of student success. The first two findings are not surprising since research has found positive relationships between student interactions in discussion forums, such as discussion forum posts and replies, and student success. For example, Hu and Kuh (2002) assert that student engagement is a function of student interactions. Dawson et al. (2009) argue that more than 80% of student interactions occur in the discussion forums of an LMS. Dixson (2010) claims that highly engaged students are more likely to use discussion forums to interact with other students and the instructor than less engaged students. Furthermore, Beer et al. (2010) add that discussion forums have the ability to promote student interaction and engagement, thus increasing the likelihood of student success.

Surprisingly, students who had higher frequency of discussion forum views—meaning they visited the discussion forum pages without adding to the conversation—also had high rates of success. There are no previous studies that support students who do not actually contribute to the discussion, yet benefit by reading other students' posts and replies.

This initial exploratory study attempts to fill the gap in the literature by focusing on students who find success in online environments but may not necessarily contribute to discussion forums—like wallflowers at a dance who have fun at a

social event but may not necessarily participate in the activities. The above findings suggest that educators need to do more than just require students to post and reply to discussion forums. Instructors should incorporate teaching techniques to ensure students view previous posts and replies found within discussion forums. For example, instructors could create exam questions that directly tie into discussion forum topics, or create prompts that require students to read previous posts and or replies in order to participate. Practices that promote student interaction and non-interactions in online environments could be initiated at the administration level as well. Administrators could also help increase online student success by offering professional development opportunities for faculty. Professional development can help educators realize unconventional ways to increase student engagement within LMSs, thus increasing student success.

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