THE EFFECT OF STUDENT ENGAGEMENT ON GRADES IN ONLINE COURSES

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Abstract - In the past decades, online learning has experienced tremendous growth and changed the landscape of higher education. The institutions and educators must better understand how students' interactions with online course content and peers impact learning and academic performance. With the development of learning analytics, students' learning behaviors are automatically recorded by learning analytics embedded in the learning management system that provides the opportunity to monitor students' learning, participation, and progress in the online classrooms. The objective of this study was to explore the relationship between student engagement and academic performance in the online entry-level and capstone graduate courses in health care administration. Four duration variables, times spent in the entire course, discussion boards, the library and writing center resources, and course tools, were selected and used to measure student engagement. Results show that significant difference in student engagement between entry-level and capstone graduate courses was obtained. High achievers in the entry-level course spent significantly longer time than their peers, but such a finding was not statistically different in capstone courses. The limitations of this study and future research studies were detailed to conclude this paper.

Index Terms - Student engagement, student success, learning analytics, online education, learning management system.

I. INTRODUCTION

With the innovation of the Internet and computer-mediated communication technologies, distance learning in the higher education has grown and become popular in the field of education. Online courses and programs provide flexible learning opportunities that transcend the boundaries of time and space, broadening access to education [1]–[3].Online learning has become an indispensable modality of learning in higher education[1], [4]. Despite the continual growth of online courses and programs, a significant challenge for higher education institutions is that student attrition rates in online courses and programs were 10 to 20% higher than those of the traditional face-to-face classrooms[2], [5]. Th high attrition rate is one of the main concerns facing administrators because it has significant financial and quality impacts on institutions [6]. It is critically important that higher education institutions take actions to identify causes of attrition and improve outcomes to benefit all students throughout their learning journey[6].

Structurally, this paper begins with an introduction. The second section organizes a brief literature review in which two primary concepts associated with the framework are explored: student success and learning analytics/learning management systems. The third section includes research questions, research design, and data collection and analysis methods. The results sectionfocuses on initial findings from the collected data. The fifth sectionpresents discussions and conclusions of the findings. This paper ends with limitations of this research study and suggestions for future directions.

II. LITERATURE REVIEW

A. Student Success in the Online Learning

Online courses by no means are ease to pass. In order to survive in the online environment, learners need to overcome many challenges such as physical separation, feeling of isolation, lack of support, feeling of disconnection from the university culture, and more [7], [8]. These challenges could affect students' behavior, retention, and desire to complete the degree [7].

In the online learning, students are expected to be self-motivated and self-directed [8]. Online learners need to take an active role in identifying their learning needs, formulating learning goals, implementing proper learning strategies, and evaluating their learning process and outcomes [8], [9]. For those learners who successfully achievein online courses, they tend to have a fair understanding of their responsibilities and study materials needed to complete the courses and/or program. Successful learners actively take charge of their online learning, carefully review the course content, often access to course announcements, complete their assignments on time, raise questions whenever needed, and thoughtfully communicate with others [4], [8]. Students take on self-directed and collaborative learning by actively engaging in the creation of knowledge with their peers.Active learning occurs while students think about what they are doing and are engaging and collaborating with other students to accomplish meaningful learning activities [7].

In contrast, unsuccessful students habitually exhibit the lack of time-management, self-directed, and life-copying skills [4]. As Mah [10] observed, the incapability to manage academic demands is associated with insufficient study skills for higher education, for example, academic writing. And yet,

many instructors often expect first-year students to enter with certain study skills. However, studies demonstrated that not all students are academically prepared for higher education in the areas of digital literacy, independent studying, and time management [10].

Student retention and success is a high priority in the higher education institutions [6], [7], [10]. In response to this vital issue, many institutions have offered a wide range of academic direct and/or indirect support programs, such as summer bridge programs,student success orientation, first-year seminars, mentoring programs, tutoring on demand, learning communities, welcome back events, and finish line outreach in an attempt to improve student retention [7], [10], [11]. It is also imperative that institutions track students' learning outcomes in the educational process, determine how to improve students' academic performances, and help students success in the online learning. Taking advantage of the advanced technology, many institutions have been implementing systems of data collection and assessment to demonstrate their commitment to accountability, effectiveness, efficiency, and productivity [7], [12].

B. Learning Management Systems and Learning Analytics

The Learning Management Systems (LMSs) are web-based platforms that integrate tools and materials to support learning [12]. The systems have provided an infrastructure that smoothly supports online courses [3]. LMSs such as Blackboard Learn,Canvas, and Moodlehave the capacity ofcollectingsophisticated user's activity and interaction data, for instance the number and duration of visits to course site or discussion boards, time on quiz or feedback, LMS tools accessed, messages read or posted, and content pages visited [4], [12], [13].LMSs enable learning and broader digitalization of interactions, for example libraries, student services, course tools, and participations; LMSscan examine the extent to which students are using the various tools in the online environment [12].

LMSs provide a range of opportunities to collect and analyze data with the intention of improving the student's experience [9].The data are captured in real time and can be mined at any stage of course progression [12], which is non-intrusive and does not require intervention from faculty or administrative staff. All of the data can be representative of learner's behaviors [4], [13], [14].Many captured data points are indicative of student engagement in learning activities that might contribute to their academic performance and learning in a course [14]. Research studies have revealed that LMSs can boost students' sense of community, sustain the learning communities [12], demonstrate a strong impact on knowledge acquisition, [15] andimprove students' engagement and success [1].Therefore, LMSs have become a core enterprise component in many higher educational institutions [12].

Learning analytics (LA) is a tool embedded in a Learning Management System and has offered the opportunity to track, store, and analyze students' learning activities with sophisticated analytic tools within the online environments [16]. According to Siemens &Gašević[17], at the 1st International Conference on Learning Analytics and Knowledge 2011, learning analytics was defined as "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." It is a multi-disciplinary methodology based on data processing, educational data mining, technology-learning enhancement, and visualization [16], [18]. Most significantly, a learning analytics approach combines data collation with statistical techniques and predictive modeling to achieve greater success—specifically in student learning [13]. LA can be used for a variety of purposes central to the notion of student retention and success [4], [6].The use of LA is to be seen as critical to student success and achieving institutional effectiveness [18]. More and more higher education institutions implement LA to optimize student success.

The collected data can serve as predictors and indicators of student's progress to predict and advise on learning, inform pedagogical practice, and develop policy [13], [14]. Leveraging LA is a dynamic and interactive process [6]. For instance, LA can alert faculty and advisors when intervention is needed [6], [10], [13], [16]; permit personalization of the learning environment [4], [20]; provide input for continuous improvement in course design and delivery [13];enhance instructor performance [16]; and support decision-making and strategic planning about resource allocations for educational excellence[1], [6], [14], [19].

C. Student Success and LMS Data

The dynamics within higher education is changing and becoming gradually complex [14]. Universities are embracing an increasingly diverse student population in which students' learning behaviors vary from one to another [13]. Some students always move ahead of the course requirements while others work according to the course schedule. Due to job demands, family obligations, and/or personal commitments, some other students may wrestle with getting their work done by the due dates [13].In order to support students within a course, instructors need to understand what the students are doing, how they are interacting with the course materials and peers, and where the problems arise [12], [15], [18].Since students' behaviors and patterns affect their performance, Instructors need to have in-depth knowledge of students' behavior and explore different

patterns of their behavior, which in turn will enhance the learning process[15].

LA imbedded in LMS magnifies the imperative to gain understandings about how the delivery of course materials can augment the learning process [3].The instructors can useunprecedented amounts of digital dataabout learners' activities and interests [1], detailing how students spent time in the courses related to the usage of the tools [1], the participation in learning activities, and the performance on quizzes and exams [4]. The analytics can help instructors understand typical patterns of students' usages and their correlation to students' grades [1],allowing instructors to make better use of the data to improve learning outcomes [1], [9], [16].LA also enables instructors to intervene when it is appropriate and enhance educational opportunities since the data provide information about very specific variables [14].

III. RESEARCH METHODOLOGIES

The purpose of this study was to examine the differences in student engagement between entry-level and capstone courses and assess the relationship between student online behavior and achievement. Specifically, this research asked,

1.Are there any differences in student engagementbetween entry-level and capstone courses?

2. Are thereany differences in student engagement among high achievers, achievers and low achievers in the capstone course?

3. Are thereany differences in student engagement among high achievers, achievers and low achievers in the entry-level course?

The study population included learners enrolled in the entry-level and capstone courses of the master's program in health care administration at a university located in the southwestern region of the United States. The master's program in health care administration offers fully online 6-week courses. The university has the standardized course syllabi, course designs, and course shells to incorporate the same components into the classrooms. Data were collected from all studiedclasses offered during a one-year period. Students in these two selected courses earned grades based upon the quality of the discussion postings, their participation in 11 discussion boards, and the written assignments or other assessments such as multimedia creations.Students were classified as high achievers, achievers, or low achievers. Students completing the course with a grade of A were classified as high achievers. Achievers completed the course receiving a grade of B. Low achievers received a grade of C, and F, or an incomplete upon the completion of the course.

For the purposes of this study, student engagementwas defined as student's participation in specific learning activities. Student engagementwas specifically documented through four duration variables: total time spent in the course, time spent creating new discussion posts and responding to discussion posts, time spent using library and writing center resources, and time spent using course tools. Course tools mainly comprise gradebook and email in this study.

The data used in this study were collected from LMS platform and exported into an Excel spreadsheet and SPSS for analysis. Subsequently, durations for four variables of student engagement were calculated and expressed as hours. The data were then aggregated by and across courses for high achievers, achievers, or low achievers. ANOVA was used to compare means between and among groups.An alpha level of $p < 0.05$ was employed as the criterion of statistical significance for comparative tests.

IV. RESULTS

The first research question sought to determine if there were any differences in student engagement between entry-level and capstone courses. Data extracted from entry-level and capstone courses during a one-year period were analyzed and displayed in Table 1. The sample included 395 students from the entry-level course and 265 students from the capstone course. All four variables exhibited significant differences between two courses. Moreover, data analyses indicated that students in both courses visited and studied on a regular basis, but their times spentin the entire class, discussion boards, library& writing center, and course tools varied widely.

Table I Durations of Student Engagement Variables in Entry-Level and Capstone Courses

Duration (hrs)	Entry-Level Course (n = 395) Mean (Standard Deviation)	Capstone Course (n = 265) Mean (Standard Deviation)	*p*-value
Entire Course	84.00 (39.74)	29.56 (36.36)	0.000*
Discussion Boards	34.76 (16.94)	14.04 (17.17)	0.000*
Library & Writing Center	3.63 (6.41)	0.46 (2.31)	0.000*
Course Tools	14.90 (16.32)	4.22 (8.11)	0.000*

The second research question sought to ascertain if there were any differences in student engagement among high achievers, achievers, and low achievers in the capstone courses. There were 139 high achievers, 89 achievers, and 37 low achievers in the capstone course. On average, high achievers spent a total of 30.49 hours in the entire course versus 30.98 hours from achievers, and 22.64 hours from low achievers. The times spent in 11 discussion boards were recorded as high achievers: 14.64 hours, achievers: 14.31 hours and low achievers: 11.15 hours. In terms of the average time using the library and writing center services, achievers had the longest

hour, 0.61, followed by 0.40 from high achievers, and 0.32 from low achievers. High achievers had a mean of 4.45 hours spent on course tools while achievers spent 4.25 hours and low achievers had the lowest mean time, 3.22 hours, using course tools. Table 2 reveals that there was no statistically significant difference among high achievers, achievers, and low achievers observed in the four studied variables from the capstone course.

Table II ANOVA Output For Student Engagement Variables In The Capstone Course

Student Engagement Variables	Mean Square Between Groups	Mean Square Within Groups	F Statistic	*p*-value
The Entire Course	1035.43	1324.05	0.78	0.46
Discussion Boards	182.24	295.55	0.62	0.54
Library & Writing Center	1.61	5.35	0.30	0.74
Course Tools	22.19	66.18	0.34	0.72

The third research question sought to investigate if there were any differences in student engagement among high achievers, achievers and low achievers in the entry-level course.

There were 177 high achievers, 149 achievers, and 69 low achievers in the entry-level course. On average, high achievers spent a total of 91.49 hours in the entire course versus 79.84 hours from achievers, and 73.76 hours from low achievers.

The times spent in 11 discussion boards were recorded as high achievers: 37.94 hours, achievers: 33.28 hours and low achievers: 29.79 hours. Regarding the average time using the library and writing center services, high achievers had the longest hour, 4.61, followed by 2.85 from achievers, and 2.82 from low achievers. High achievers had a mean of 17.00 hours spent on course tools while achievers spent 17.17 hours and low achievers had the lowest mean time, 16.05 hours, using course tools. Apart from course tools, there were significantly different engagements among high achievers, achievers, and low achievers as shown in Table 3.

Table III ANOVA Output For Student Engagement Variables In The Entry-Level Course

Student Engagement Variables	Mean Square Between Groups	Mean Square Within Groups	F Statistic	*p*-value
Entire Course	9866.54	1537.17	6.42	0.002*
11 Discussion Boards	1910.88	278.59	6.86	0.001*
Library & Writing Center	152.14	40.48	3.76	0.024*
Course Tools	31.15	267.52	0.12	0.890

When the data were further analyzed to explore the differences between groups by the variable, entire course, statistically different times spent were observed from the comparisons between high achievers and achievers as well as high achievers and low achievers as seen in Table 4.Even though achievers spent more time than low achievers did in the entire course, the p-value is greater than the significance level of 0.05. Thus, there was no real difference between the means ofachievers and low achievers.

Table IV ANOVA Output For Entire Course Variable In The Entry-Level Course

	Mean	*p*-value
High Achievers	91.49	0.008*
Achievers	79.84	
High Achievers	91.49	0.002*
Low Achievers	73.76	
Achievers	79.84	0.287
Low Achievers	73.76	

Similar results were obtained for the variable, discussion boards as presented in Table 5.Compared to achievers and low achievers, high achievers spent significantly longer time creating their posts as well as reading and responding totheir peers' posts in the discussion boards. The difference between the mean times spent in the discussion boards of achievers and low achievers was not significant.

Table V ANOVA Output For Discussion Boards Variable In The Entry-Level Course

	Mean	*p*-value
High Achievers	37.94	0.015*
Achievers	33.28	
High Achievers	37.94	0.001*
Low Achievers	29.79	
Achievers	33.28	0.145
Low Achievers	29.79	

Table 6 illustrates that compared to achievers and low achievers, high achievers spent significantly longer time using the university library and writing center.

Table VI ANOVA Output For Library & Writing Center Variable In The Entry-Level Course

	Mean	p-value
High Achievers	4.61	0.018*
Achievers	2.85	
High Achievers	4.61	0.080
Low Achievers	2.82	
Achievers	2.85	0.961
Low Achievers	2.82	

DISCUSSIONS AND CONCLUSIONS

A. Discussions

This study tracked student engagement in the online graduate entry-level and capstone courses in health care administration over a one-year period. Not surprisingly, there were statistically significant differences in the behaviors of students in the entry-level and capstone courses. In the online education, many learners who were out of school for a number of years and returned to school for pursuing a master's degree. They need to not only get themselves familiarized with the LMS platform but also re-learn the basics for the graduate study. Each student is different, and everyone has aunique background and learning curve to overcome. Consequently, students taking entry-level course could spend more time in each area of the classroom. After completing 11 graduate courses, learners enrolling in the capstone course have accumulated needed knowledge, skills, and study strategies, being able to better manage their tasks, time, and resources.Therefore, their behavior patterns of engagement would be substantially different from those of entry-level graduate students.

It is interesting to uncover that there was nostatistically significant difference among high achievers, achievers, and low achievers when four duration variables were investigated in the capstone course. However, compared to achievers and low achievers, high achievers still spent longer time in discussion boards and course tools.It is also of interest to know that achievers indeed spent more time than high achievers did in the entire 6-week course and using the library and writing center resources although it is not significant in the statistical term.

The findings of significant differences in threeengagement measures, entire course, discussion boards,and library &writing center,between high achievers and achievers or low achievers were expected in the entry-level course.It is well-established that successful online learning is based on the premise that learners take charge of their own learning adaptively regulate their cognitive and metacognitive behaviors during learning [9], [16].In this study, high achievers in the entry-level course, who spent more time on the tasks and engaged in online learning activities performed better than their peers, achievers and low achievers. The results are consistent and similar to those obtained in other studies [1], [12], [20]-[22].The finding from this study also supportsMcfadyen and Dawson'sfindings that time spent on the tools within the online classroom does not necessarily correlate with grades earned [12].

Students need to engage with each other in a discussion that will allow them to share their ideas and learn from each other. Time spent in discussion boards is one of the key variables to explain the student's final grade [12].It iswithout a doubtthat high academic achievement has a positive relationship with the numbers of posts and time spent creating responses and replying to others' posts in discussion boards.Successful students have the tendency ofspending a greater amount of time in discussion boards enthusiastically [12]. In the current study,high achieversin the entry-level course spent significantly longer time in discussion boards than their peers,which is consistent with Macfadyen and Dawson's study[12].

An educational institution should have research-based interventions focused on students' learning when they transition from the previous educational level to the currentdegree program [7].In response to the high attrition rate and diverse students' critical needs, the University has offered just-in-time solutions, including 24/7 access to the University Library and Writing Center. Students can easily access to the library and writing center from the online classrooms that they enroll. Students can also contact librarians through a live chat feature that is accessible through the library's website. Within the library, there is a student support service, AskAshord, that is available 24/7 and contains answers to questions most frequently asked by students. These questions include financial aids, transcripts, scheduling, as well as email addresses and other contact information for support staff [11]. Aside from the information regarding academic writing and APA, the writing center also provides live tutoring and paper assignment review, which allows students to speak with a writing tutor and receive feedback. The paper review focuses on the development of higher level writing skills.Based upon a 14-month analysis by the University Assessment Department, the users of paper review had higher pass rates, higher three-month persistence rates, better grades, and lower drop rates compared with those of students who chose not to use the service [11].The results from this study indicated that high achievers in the entry-level course spent significantly longer time using the library and writing center services than their fellow students, which coincides with the findings generated from the University.

B. Conclusions

The results of this study are in congruence with previous empirical studies. This study also showed the possibility of using proper indicators to measure and improve student retention andsuccess. Indicators should be constructed on solid evidence-based research, so that institutions and educators can investigate students' online behavior and decide what interventions should be implemented to enhance student learning and support student success.

LIMITATIONS AND FUTURE RESEARCH

A. Limitations

There are three main limitations in the study. First, the findings of this study should not be generalized to other online courses in different programs at the same university or other universities since this study is limited by its focus on data derived from two fully online graduate coursesin the same program within one institution.Even though the student engagement is unrelated to the degree itself, it ispossible thatstudents' degrees or areas of study could impact on the results since personal characteristics of studentsin different degree programs could have different behavior pattern in the LMS.

Second, students' job status, family issues, and other factors could be potential confounding factors that affect student's engagement and achievement. The research context of the present study is a non-traditional university, and students are adult learners who have wrestled with the schoolwork along with the demands of the job, family, and other life commitments [2].From time to time, any of the issues might surface and impact students' participations in the 6-week classes.

Third, there is a lack of triangulation.This study did not involve other data collection methods such as surveys or interview. This study directly focused on the learning analytics approach to investigate the relationship betweenstudent engagement and student achievement across two different courses. Thus, the exact reasons for not participating in the classrooms are unknown.Furthermore, there is no evidence to show that how many hours students have spent outside the classroom reading journal articles, searching other resources, and engaging in other learning activities that contribute tostudent success.

B. Future Research

This study has limitations that could be addressed and further investigated in future research. First, future research could replicate the same research design with a larger populationto include other courses in the same program, so thata better understanding could be obtained as to when students start changing their behavior patterns during a program.Second, the current study did not ascertain the difference in behavior patterns based upon student demographics. Thus, future research could include the use of students' background information and student records to increase the predictability of students' behaviors and performance.

Third,this research study sought to analyze quantifiable behaviors including time spent in the discussion board, rather than actual discussion content since time spent in the discussion board is animportant indicator in student engagement.Although this is a suitable methodology,It is a challenge in the current study to explain why high achieverin the capstone courses did not spend significant longer time in the classroom when comparing to their peers.To meet this challenge, it would be necessary to triangulate the quantitative data with qualitative data and other types of data collection such as interviews or survey on student overall online activities[21]. Especially for students in the capstone course, the qualitative analysis on students' posts could assess students' accumulative knowledge, which in turn might shed light on substantive variances between high achievers and achievers or low achievers.

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