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How Undergraduates' Involvement Affects Sense of Belonging in Courses that Use Technology

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Abstract

In order to increase the number of American degree recipients in science, technology, engineering and mathematics (STEM), academics must continually develop ways to improve students' interest, retention, and success in fields like engineering. Prior researchers have studied the use of educational technology as a way to improve student outcomes. Previous scholars have also investigated students' perceptions of the usefulness of technology. However, it is unclear if a statistically significant relationship exists between students' involvement in courses that use technology and their sense of belonging to others on campus. It is also unclear if differences exist in students' perceptions of technology by race/ethnicity or gender. The present study addressed this gap by examining the relationship between technology use, students' class involvement, and their sense of belonging – feelings of connectedness to others. This investigation sought to answer the following research questions: (a) Are there differences in undergraduates' involvement in courses that use technology by college major, race/ethnicity, or gender? (b) Are there differences in undergraduates' feelings of connectedness to others on campus due to technology by college major, race/ethnicity, or gender? (c) What is the relationship between students' involvement in technology-based courses and perceptions of technology's impact on their feelings of connectedness to others on campus? Data was analyzed for close to 500 students using a 2013 national administration of the EDUCAUSE Center for Analysis and Research (ECAR) Study of Undergraduate Students and Information Technology Survey Questionnaire. Findings from this analysis suggest that (a) students who get more involved in courses that use technology are significantly more likely to believe that technology makes them feel connected to others on campus – indicating a sense of belonging, and (b) students who identify as female, part-time or non-engineering majors are more likely to believe that technology makes them feel more connected to others on campus.

Introduction

Recent reports indicate the U.S. needs more skilled workers in scientific and technology-based careers to occupy positions in its progressively technical workforce.[1,2,3] Increasing the number of skilled workers in science, technology, engineering and mathematics (STEM) can potentially improve the nation's global competitiveness and help tackle emerging environmental and societal challenges of the 21st century. Certainly, efforts can be made to increase student interest and success in STEM fields like engineering. Educators should focus on methods for improving curriculum, instruction, and the overall classroom environment. Additionally, students must be provided with the skills they need to compete in an increasingly interconnected and technological world.

Prior researchers have investigated students' perceptions of the usefulness of technology. Most students consistently agree that technology "helps them feel connected" to other students, their teachers, and their institutions.[4,5,6] In previous years, the majority of students also agree they get "more actively involved in courses that use technology." [5] Less students still feel this way.[4]

On average, students have a positive attitude towards the statement "I feel that Internet/Web technology will be useful for my learning." [7] Over two-thirds (2/3) of individuals believe technology "helps them achieve their academic outcomes," "prepares them for future educational plans" and "prepares them for the workforce." [6] Furthermore, a majority of students believe the most important devices to their academic success are laptops, followed by printers, thumb drives, and desktop computers. [6]

When compared to non-engineering students, engineering majors are more likely to agree that computers and other information technologies improve their learning, provide convenience, and cause them to be more engaged in courses.[8] To date, no extant research examines differences in perceived usefulness of technology across race/ethnicity and gender. Despite existing research on students' perceptions of the usefulness of technology, it is unclear if a relationship exists between students' involvement in courses that use technology and their feelings of connectedness to others. It is also unclear if differences exist in students' perceptions of technology by race/ethnicity or gender. The present study addressed this gap.

Purpose

The purpose of the present study was to determine how undergraduates' involvement in courses that use technology affects their sense of belonging (e.g., feelings of connectedness) to others on campus (e.g., students, professors, and institution). This investigation examined the relationship between technology (e.g., public websites, personalized online tutoring tools, and electronic communication media), students' class involvement in courses that use technology, and their feelings of connectedness to others on campus. A multi-step approach (i.e., descriptive statistics, independent samples t-tests, and hierarchical linear regression) was used to analyze survey data from nearly 500 undergraduate students. The following research questions were addressed: (a) Are there differences in undergraduates' involvement in courses that use technology by college major (i.e., non-engineering fields compared to engineering and architecture), race/ethnicity (i.e., non-White and White), or gender (i.e., female and male)? (b) Are there differences in undergraduates' feelings of connectedness to others on campus due to technology by college major, race/ethnicity, or gender? (c) What is the relationship between students' involvement in technology-based courses and perceptions of technology's impact on their feelings of connectedness to others on campus?

Literature Review

Positive outcomes from college students' technology use. Higher education researchers have arrived at a number of positive findings about the influence of technology use on college students. In a study of over 3,800 first-year undergraduates at 18 four-year and 5 two-year colleges/universities, students' computer use has positive effects on student development outcomes.[9] For example, freshmen four-year students with the highest levels of overall precollege cognitive development have significant, positive first-year cognitive gains from email use.

Other researchers have uncovered links between students' use of technology and their intellectual development. In a study of over 700 students at a large, public, research university, a

modest, but statistically significant link exists between students' technology use and related learning outcomes.[10] Specifically, students with higher reported levels of technology usage have significantly greater self-reported gains in college. Also, students who use technology for tasks such as searching the internet for course material and analyzing data with a computer report higher perceived gains in intellectual development.

Scholars have also determined that the extent and ways in which students use technology is positively related to their psychosocial development. For example, in a study of nearly 500 undergraduates at a large research institution in the Southeast, students who reported higher levels of computer use for academics and email use have significantly higher levels of educational involvement.[11] This positive relationship also holds true for students who frequently talk on a cell phone or use a personal digital assistant (PDA). It's possible that students use cell phones and PDAs for some academic matters, thus increasing educational involvement.

Researchers have also found that using Twitter for various types of academic and co-curricular discussions is positively related to student's academic and psychosocial development. In a study of 125 first-year students enrolled in multiple sections of a seminar course for pre-health professionals at a single institution, students who took courses that use Twitter have a significantly greater increase in engagement than those who took traditional courses.[12] Also, through analysis of survey data which included select items from the National Survey of Student Engagement (NSSE), students have significantly higher semester grade point averages when taking courses that employ Twitter compared to traditional courses. Hence, using Twitter in educationally purposeful ways is beneficial for students.

Negative outcomes from college students' technology use. Higher education researchers have also revealed the negative effects of social media and leisure technology use on students' development. For example, the amount of time students use Facebook and watch DVDs are both negatively correlated with students' psychosocial development – specifically with regard to peer relationships.[11] In addition, the amount of time students spend watching DVDs, using instant messaging, Facebook, an iPod or a Gameboy all have significant negative effects on their educational involvement.[11] Other scholars found similar results concerning the negative effects of Facebook use on educational involvement.[13]

Scholars have discovered other negative findings about the influence of technology use on college students. For example, email use by Hispanic 4-year college students has significant negative effects on first-year reading comprehension. Email use represented students' electronic interactions with faculty/peers. However, results from this study also showed that precollege cognitive development in four-year college students reduces the negative effects of email use on overall first-year cognitive development.

Differences in college students' experiences by major, race/ethnicity, and gender. In previous studies, differences arose in students' perceived usefulness of technology by major. For example, engineering and business majors agree that technology use in classes "increases their understanding of complex concepts and provides more opportunity for practice and reinforcement." [14] Engineering students are also more likely to agree that C&IT improves their

learning, provides convenience, and causes them to be more engaged in courses.[8] More research is needed to understand any differences in perceived usefulness by race/ethnicity and, or gender.

When focusing on race/ethnicity, Black and Latino students frequently struggle to find a sense of belonging in STEM majors leading to lower rates of academic and social satisfaction.[15] As underrepresented racial/ethnic minorities (URMs), Black and Latino students also report feeling "invisible" in the classroom, where they receive inadequate social and academic support.[16] Belonging is important for URM students because they experience academic success and greater satisfaction when their need to belong is met.[15-17] One strategy for helping students develop a sense of belonging is engagement in the campus community, which is also linked to student success.[17]

Theoretical Framework

Students' involvement in academic and social activities is positively associated with their sense of belonging in college.[15] More specifically, students' frequency of interactions with faculty members outside of class is statistically and positively linked to their sense of belonging. Given the purpose of this study and the aforementioned positive outcomes, Strayhorn's sense of belonging theory was a suitable framework for conducting this study.[15]

Sense of belonging is "a basic human need and motivation, sufficient to influence behavior." [15] In college, it can consist of students' feelings of connectedness to others on campus or their experience of mattering. Sense of belonging takes on heightened importance (a) in certain contexts (e.g., classroom), (b) at certain times (e.g., early adulthood), and (c) among certain groups of people (e.g., underrepresented racial/ethnic minorities). Using this framework, the present study seeks to investigate the relationship between students' involvement in courses that use technology and their feelings of connectedness to others.

Method

Data Source. Data was drawn from the 2013 national administration of the EDUCAUSE Center for Analysis and Research (ECAR) Study of Undergraduate Students and Information Technology Survey Questionnaire. The 2013 ECAR survey consists of 40 items which assess students' academic experiences along with their attitudes toward and experiences with technology.[5]

Sample. The analytic sample consisted of 476 respondents from a large, public, research, 4-year, predominantly White institution (PWI) in the Midwest. Of the willing respondents, the majority were female (58.0%) and White (71.4%). Most of the study respondents were freshmen (46.4%), between the ages of 18-24 (88.9%), full-time students (87.6%), and off campus residents (55.7%). In terms of college major, many students were in the health sciences (13.2%) followed by engineering and architecture (12.8%) along with business (12.8%). Table 1 presents descriptive statistics for the sample.

Table 1
Description of sample (N=476)

Variables	%
Academic	
College classification	
Freshman, first-year	46.4
Sophomore, second-year	2.1
Junior, third-year	13.0
Senior, fourth-year	33.6
Missing	4.8
Enrollment status	
Full-time	87.6
Part-time	10.1
Missing	2.3
Residency status	
On campus	43.3
Off campus	55.7
Missing	1.1
Current or intended major	
Business, management, marketing	12.8
Engineering and architecture	12.8
Health sciences	13.2
Other	60.4
Missing	0.8
Demographic	
Sex of student	
Female	58.0
Male	39.7
Missing	2.3
Race/Ethnicity	
African American/Black	5.0
Asian/Pacific Islander	12.2
Hispanic	1.5
Other/Multi-Racial	6.3
White	71.4
Missing	3.5
Age of student	
18-24	88.9
25^{+}	11.1

Measures. The dependent variable – Feeling of Connectedness to Others on Campus due to Technology – assesses students' level of agreement about connectedness. For example, students were asked, "To what extent do you agree with the statement: Technology makes me feel more connected to other students?" Each item was placed on a 6-point Likert scale ranging from 0 (*don't know)* to 5 (*strongly agree*). The overall dependent variable is a composite scale that was computed by averaging three items related to students' feelings of connected to others on campus. Thus, the mean composite score also ranged from 0 to 5. The alpha reliability coefficient of the scale was acceptable (3 items, $\alpha = 0.82$). Students' were allowed to individually interpret and define the term "technology" since a rigid definition was not provided on the questionnaire.

The independent variable used in this study – Involvement in Technology-Based Courses – assesses students' level of agreement about course involvement. For example, students were asked, "To what extent do you agree with the statement: I get more actively involved in courses that use technology?" Responses ranged along a 6-point Likert scale, from 0 (*don't know)* to 5 (*strongly agree*). Students' were allowed to individually interpret and define the phrase "use technology" since a rigid definition was not provided on the questionnaire.

To increase the rigor of the analysis, a series of potentially confounding variables were controlled for such as age, college classification, gender, race/ethnicity, enrollment status, residency, and major.

Data Analysis. A multi-step approach was used to analyze data and answer the aforementioned research questions. First, descriptive statistics were computed to describe the research sample and their responses to specific survey items. Next, independent samples *t*-tests were conducted to evaluate the relationship between students' major and their (a) level of agreement that they are more involved in courses that use technology, along with their (b) feeling of connectedness to others on campus. For independent samples *t*-tests, assumptions about equal variances were assessed using Levene's test of variance equality. Bivariate correlations were then employed to estimate the magnitude and direction of statistical relationships among the variables. Pearson's correlation coefficient, *r*, was used to estimate effect size. Last, hierarchical linear regression analysis was used to estimate the net effect of student's involvement in courses that use technology on their feelings of connectedness to others on campus.

Results

Descriptive statistics indicate the mean value for students' level of agreement that they are more actively involved in courses that use technology is 3.17 ($SD = 1.16$). The mean value for student's response concerning the extent to which technology makes them feel more connected to their institution is 3.58 ($SD = 1.09$). By comparison, students reported a mean value of 3.26 ($SD = 1.16$) for their professors and a mean value of 3.31 ($SD = 1.14$) for other students. Table 2 presents means and standard deviations for all of the independent and dependent variables in the analysis.

Table 2
Descriptive statistics for feelings of connectedness and course involvement

	M	SD
Involvement in Technology-Based Courses		
Students are more involved in courses that use technology	3.17	1.16
Feeling of Connectedness to Others on Campus due to Technology		
Technology makes students feel more connected to others on campus	3.38	0.97
The institution	3.58	1.09
Their professors	3.26	1.16
Other students	3.31	1.14

Findings from independent samples *t*-test show no statistically significant differences by students' major in terms of the level to which students agree they are more involved in courses that use technology, $t(465) = -0.21$, $p = 0.84$. Also, no statistically significant differences exist by race/ethnicity or gender in terms of the level to which students agree they are more involved in courses that use technology, $t(464) = 0.79$, $p = 0.43$; $t(456) = 0.85$, $p = 0.40$.

However, statistically significant differences exist by gender in terms of the level to which students believe technology makes them feel more connected to others on campus, $t(451) = -2.09$, $p < 0.05$. Female students ($M = 3.47$, $SD = 0.92$) more strongly believe that technology makes them feel more connected to others on campus than males ($M = 3.28$, $SD = 0.99$). Statistically significant differences also exist by students' major in terms of the level to which they believe technology makes them feel more connected to others on campus, $t(459) = 2.69$, $p < 0.01$. Non-engineering students ($M = 3.43$, $SD = 0.96$) more strongly believe that technology makes them feel more connected to others on campus than students majoring in engineering and architecture ($M = 3.07$, $SD = 1.00$).

More specifically, statistically significant differences exist by students' major in terms of the level to which they believe technology makes them feel more connected to other students, $t(464) = 2.51$, $p < 0.05$. Non-engineering students ($M = 3.36$, $SD = 1.14$) more strongly believe that technology makes them feel more connected to other students on campus than students majoring in engineering and architecture ($M = 2.97$, $SD = 1.10$). Statistically significant differences also exist between students' major in terms of the level to which they believe technology makes them feel more connected to their professors, $t(465) = 3.32$, $p < 0.01$. Non-engineering students ($M = 3.33$, $SD = 1.14$) more strongly believe that technology makes them feel more connected to their professors on campus than students majoring in engineering and architecture ($M = 2.80$, $SD = 1.19$). Table 3 provides a summary of the significant results by college major.

Table 3
Statistically significant results from t-tests for variables by major

Independent Variable	Non-Engineering (*N=407*) M	SD	Engineering (*N=60*) M	SD
Feeling of Connectedness to Others on Campus due to Technology; $t(459) = 2.69$, $p < 0.01$	**3.43**	**0.96**	3.07	1.00
Feeling of Connectedness to Other Students on Campus due to Technology; $t(464) = 2.51$, $p < 0.05$	**3.36**	**1.14**	2.97	1.10
Feeling of Connectedness to Professors on Campus due to Technology; $t(465) = 3.32$, $p < 0.01$	**3.33**	**1.14**	2.80	1.19

A positive correlation and medium effect size was discovered in terms of student's perception of the extent to which technology makes them feel more connected to others on campus and their willingness to get involved in courses that use technology ($r = 0.474$, $p < 0.01$). A positive correlation and small effect size was found between female students and their feelings of connectedness to others on campus due to technology ($r = 0.098$, $p < 0.05$). A negative correlation and small effect size was found between engineering along with architecture students and their feelings of connectedness to others on campus due to technology ($r = - 0.124$, $p < 0.01$). Additionally, a negative correlation and small effect size was found between full-time students and their feelings of connectedness to others on campus due to technology ($r = - 0.113$, $p < 0.05$). Table 4 provides more detailed correlation results for the sample.

Table 4
Correlation results for independent and dependent variables

	1	2	3	4	5	6	7	8	9
Feeling of Connectedness to Others on Campus due to Technology	1								
Age: 18-24	- 0.018	1							
Class: Freshman	0.042	- 0.249**	1						
Gender: Female	0.098*	- 0.018	0.016	1					
Ethnicity/Race: White	- 0.021	- 0.021	- 0.063	0.011	1				
Enrollment: Full-time	- 0.113*	- 0.412**	0.228**	0.051	- 0.025	1			
Residency: Off Campus	- 0.076	0.300**	- 0.740**	0.021	- 0.011	- 0.241**	1		
Major: Engineering and Architecture	- 0.124**	- 0.057	- 0.017	- 0.191**	- 0.051	0.069	0.058	1	
Involvement in Technology-Based Courses	0.474**	0.024	- 0.073	- 0.040	- 0.037	- 0.037	0.009	0.010	1

* indicates statistical significance at $p < 0.05$ ** indicates statistical significance at $p < 0.01$

The final hierarchical regression model revealed that the combination of independent variables were statistically significant predictors of the dependent variable; with the final model accounting for 27% of the variance in the extent to which technology makes students feel more connected to others on campus ($R^2 = 0.266$, $R^2_{adj} = 0.252$, $F_{8,440} = 19.543$, $p < 0.001$). Student demographics accounted for some of the variance in the model ($\Delta R^2 = 0.048$, $p < 0.01$). However, students' involvement in technology-based courses explained the majority of the variance ($\Delta R^2 = 0.218$, $p < 0.001$).

When holding all other independent variables constant, female students rate their feelings of connectedness to others on campus due to technology 0.21 points higher than males. In addition, when holding all other independent variables constant, part-time students rate their feelings of connectedness to others on campus due to technology 0.40 points higher than full-time students. When holding all other independent variables constant, non-engineering students rate their feelings of connectedness to others on campus due to technology 0.29 points higher than engineering and architecture students. Lastly, when holding all other independent variables constant, students who get more involved in technology-based courses rate their feelings of connectedness to others on campus due to technology 0.40 points higher than those who do not get more involved. Table 5 contains detailed hierarchical linear regression results.

Table 5
Regression results predicting feelings of connectedness to others on campus

	Step 1		*Step 2*	
Variables	*B*	*SE*	*B*	*SE*
Constant	3.985	0.233	2.469	0.245
Age: 18-24	- 0.212	0.164	- 0.187	0.145
Class: Freshman	- 0.013	0.136	0.096	0.120
Gender: Female	0.172	0.095	0.208*	0.083
Ethnicity/Race: White	- 0.116	0.108	- 0.048	0.095
Enrollment: Full-time	- 0.496**	0.166	- 0.397**	0.146
Residency: Off Campus	- 0.169	0.139	- 0.101	0.122
Major: Engineering and Architecture	- 0.281*	0.138	- 0.294*	0.121
Involvement in Technology-Based Courses			0.397**	0.035

* indicates statistical significance at $p < 0.05$ ** indicates statistical significance at $p < 0.01$

Delimitations

As with all social science research, this study was not without delimitations. First, when focusing on the study's sample, all solicited participants were students from the same large, public, research, 4-year, predominantly White institution (PWI) in the Midwest. As a result, it was possible that students from this single institution may differ in some important way from students at other colleges and universities. Therefore, results from this study may be unique to this institution.

Secondly, the chosen instrument for this study may limit the accuracy of the results. This analysis relied on a questionnaire which collects student self-reported data about technology. Self-reports are widely used in educational research despite a few challenges to their internal validity. They are generally considered valid if the information requested is known by the participants, if the questions are phrased clearly, and if students deem the question worthy of a response.[18] Although questions about students' perceptions of the usefulness of technology were phrased clearly, students' were allowed to individually interpret and define the term technology.

Despite the aforementioned delimitations, findings from this study add important insights to the extant literature on educational technology, course involvement, and undergraduate students. Unlike previous analyses, the present study proved a statistically significant relationship exists between students' involvement in courses that use technology and their sense of belonging to others on campus.

Discussion

This study sought to examine the relationship between technology, students' class involvement, and their feelings of connectedness to other students, professors, and the institution. As previously highlighted in the results section, if students get more actively involved in technology-based courses then they are more likely to believe that technology makes them feel more connected to others on campus. Students who identify as female, part-time or non-engineering majors are more likely to believe that technology makes them feel more connected to others on campus.

The positive relationship between students' involvement in courses that use technology and their feelings of connectedness to others on campus due to technology strengthened claims made by Dahlstrom, Walker and Dziuban.[4,5,6] This study's results also supported Kuh's findings regarding the link between campus engagement and sense of belonging.[17] Unlike conclusions drawn by Salaway, Katz, and Caruso, this study indicates that engineering and architecture majors less strongly believe technology offers certain educational benefits than non-engineering majors.[8]

Administrators, faculty, and staff can use findings from this study to inform their decisions regarding the use of technology on campus. Since students benefit from being actively involved in technology-based courses, administrators and staff should purchase proven educational technology (e.g., computers, software, adaptive learning tools, and course monitoring systems). However, purchasing technology is not enough; they must also train employees to use new technology and make technology accessible to students throughout campus facilities.

Administrators and staff can then use technology as a way to successfully connect with students, promote campus involvement, and provide information on campus resources. If students are engaged and feel like they belong, then they are more likely to persist and graduate.[15, 17]

Faculty should provide students with opportunities to use classroom technology when designing and instructing courses. Faculty should also encourage students to use technology as a means for communicating and connecting with peers and instructors. Findings from prior research studies can help faculty understand evidence-based practices for effectively using various types of educational technology. Using evidence-based practices is important since fewer students report being actively involved in courses that use technology than in previous years.[4] If students are actively involved and feel like they belong, then faculty can facilitate greater levels of student learning and satisfaction.[15]

In summary, the context in which technology is used affects where and with whom students feel a sense of connectedness. Students' demographic characteristics can also influence their feelings of connectedness due to technology. It is possible that technological tools help ease students' apprehensions about interacting with other students or their professors on campus, especially in the classroom. Future tests can be conducted with additional variables and populations to determine if other predictions can be made about undergraduate students and technology.

Bibliography

[1] President's Council of Advisors on Science and Technology (PCAST). (2012). *Engage to excel: Producing one million additional college graduates with degrees in science, technology, engineering, and mathematics*. A Report by the President's Council of Advisors on Science and Technology. Retrieved from http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-engage-to-excel-v11.pdf

[2] President's Council of Advisors on Science and Technology (PCAST). (2010). *Prepare and inspire: K-12 education in science, technology, engineering, and math (STEM) for America's future. A Report by the President's Council of Advisors on Science and Technology*. Retrieved from http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-stemed-report.pdf

[3] U.S. News (2012, April 27). U.S. news announces first-ever national STEM convention. *U.S. News.* Retrieved from http://www.usnews.com/news/blogs/stem-education/2012/04/27/us-news-announces-first-ever-national-stem-convention

[4] Dahlstrom, E., Brooks, D. C., Grajek, S. & Reeves, J. (2015, December). *ECAR Study of Undergraduate Students and Information Technology, 2015 (Research Report).* Louisville, CO: EDUCAUSE Center for Analysis and Research. Retrieved from http://www.educause.edu/library/resources/2015-student-and-faculty-technology-research-studies

[5] Dahlstrom, E., Walker, J. D. & Dziuban, C. (2013, September). *ECAR Study of Undergraduate Students and Information Technology, 2013 (Research Report).* Louisville, CO: EDUCAUSE Center for Analysis and Research. Retrieved from http://www.educause.edu/library/resources/ecar-study-undergraduate-students-and-information-technology-2013

[6] Dahlstrom, E., Walker, J. D. & Dziuban, C. (2012, September). *ECAR Study of Undergraduate Students and Information Technology, 2012 (Research Report)*. Louisville, CO: EDUCAUSE Center for Analysis and Research. Retrieved from http://www.educause.edu/library/resources/ecar-study-undergraduate-students-and-information-technology-2012

[7] Ali, A., & Elfessi, A. (2004). Examining students' performance and attitudes towards the use of information technology in a virtual and conventional setting. *Journal of Interactive Online Learning*, *2*(3), 1-9.

[8] Salaway, G., Katz, R. N., & Caruso, J. B. (2006). *The ECAR study of undergraduate students and information technology, 2006.* Boulder, CO: EDUCAUSE Center for Applied Research. Retrieved from http://www.educause.edu/library/resources/ecar-study-undergraduate-students-and-information-technology-2006

[9] Flowers, L., Pascarella, E. T., & Pierson, C. T. (2000). Information technology use and cognitive outcomes in the first year of college. *Journal of Higher Education*, 637-667.

[10] Strayhorn, T. L. (2006). College in the information age: Gains associated with students' use of technology. *Journal of Interactive Online Learning*, *5*(2), 143-155.

[11] Lloyd, J. M., Dean, L. A., & Cooper, D. L. (2007). Students' technology use and its effects on peer relationships, academic involvement, and healthy lifestyles. *NASPA Journal*, *44*(3), 481-495.

[12] Junco, R., Heiberger, G., & Loken, E. (2010). The effect of Twitter on college student engagement and grades. *Journal of Computer Assisted Learning*, *27*(2), 119-132.

[13] Junco, R. (2012). The relationship between frequency of Facebook use, participation in Facebook activities, and student engagement. *Computers & Education*, *58*(1), 162-171.

[14] Kvavik, R. B. & Caruso, J. B. (2005). *ECAR study of students and information technology 2005: Convenience, connection, control, and learning.* Boulder, CO: EDUCAUSE Center for Applied Research. Retrieved from http://www.educause.edu/library/resources/ecar-study-students-and-information-technology-2005-convenience-connection-control-and-learning

[15] Strayhorn, T. L. (2012). *College students' sense of belonging: A key to educational success*. New York, NY: Routledge.

[16] Strayhorn, T. L., Long, L. L., III, Kitchen, J. A., Williams, M. S., & Stentz, M. (2013). Academic and social barriers to Black and Latino male collegians' success in engineering and related STEM fields. Proceedings from *2013 American Society of Engineering Education* (*ASEE) Annual Conference and Exposition.* Atlanta, GA.

[17] Kuh, G. D. (1995). The other curriculum: Out-of-class experiences associated with student learning and personal development. *Journal of Higher Education*, *66*, 123-155.

[18] Pace, C. R. (1985). *The credibility of student self-reports*. Los Angeles: University of California Center for the Study of Evaluation.