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Information and Communication Technology Use Among College Students as it Relates to Health and Wellness: Phase I of a Mixed Methods Study

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Abstract

Health and wellness are essential to college student retention and success. Previous studies have explored factors that affect college student health, primarily through surveys and quantitative measures. Correlations between technology use and aspects of college student wellness have been discovered and supported in the literature. The current study investigated the influence of information and communication technology (ICT) use on college student wellness (with particular focus on mental health), using an explanatory sequential mixed methods design. During this first phase of the study, a random sample of 225 students (undergraduate and graduate) completed an online survey, and the resulting data was analyzed using SPSS software (Statistical Package for the Social Sciences). A multi-item scale was created and used to assess participants' use of ICTs and their preferred modes of communication, as well as their views about ICT use in society. The State/Trait Anxiety Scale and Beck Depression Inventory were utilized in order to assess self-reported mental and behavioral health. Correlations, as well as predictive values from multiple regressions, were found among variables such as preferred communication style, hours of technology use, and levels of state/trait anxiety and depression. These quantitative results were used to discuss initial recommendations and implications for higher education. During the second phase of this study, students will be purposively sampled for follow-up interviews, in order to qualitatively study the factors related to college student wellness in greater detail; this qualitative portion will be reported in a subsequent article.

Note: For the purposes of this article, the terms "wellness" and "physical and mental health" will be used interchangeably.

Introduction and Review of the Literature

Previous research has identified various factors that influence college student wellness, including significant correlations among excessive technology use, psychological problems, and symptoms of physical illness (King, Delfabbro, & Griffiths, 2012; Nyer et al., 2013). While

quantitative studies have explored technology use as it relates to health, very few qualitative or mixed methods studies have been conducted in this area. The current article represents the first phase of a larger explanatory-sequential mixed-methods study that will investigate the use of information and communication technologies (ICTs) among college students as it relates to their physical and mental health. Student retention and success are important to the survival of colleges and universities (Byrd & McKinney, 2012); therefore, students, faculty, staff, and administrators must work together in order to better understand and improve student wellness on campus. The purpose of this quantitative phase of the study was to develop and coalesce survey instruments in order to analyze factors that influence college student wellness (primarily mental health, yet also physical health, as the two are closely connected). In the forthcoming second phase of this study, participants will be purposively selected from the sample of Phase I survey respondents; they will be invited to complete qualitative interviews or provide written responses to the same open-ended interview questions (if in-person interviews are not possible for certain participants).

History

Implementing student health services on college and university campuses was a gradual process, and the integration of specific mental health services was particularly lengthy and arduous. In 1861, Amherst College became the first academic institution in the United States to have a center for student health (Kraft, 2011). Even after student health services became more common on campuses, the aspect of mental health still received little or no attention. In 1910, Princeton College created the first on-campus mental health service center, largely due to the efforts of neurobiologist and psychiatrist, Stewart Paton. Following Princeton's lead, it took 40 additional years until mental health and counseling services became widespread on college and university campuses (Kraft, 2011).

Over time, concerning trends related to physical and mental health have increased, including a five-fold rise in the use of psychotropic medications during the ten-year period from 1992 to 2002 (Schwartz, 2006). Additionally, there are several important legal issues associated with college student wellness, including access to mental health records, involuntary hospitalization after suicide attempts, an increase in single parent students, as well as diversity and discrimination concerns (e.g., race, sexual orientation) (Jodoin & Robertson, 2013; Kraft, 2011). Considering the tumultuous history of campus health services, the literature clearly supports continued research on college student physical and mental health.

Surveys and Statistics

The Cooperative Institutional Research Program (CIRP) gathers data on first-year college students in its annual report, *The American Freshman: National Norms* (AFNN). The AFNN is the longest-running and largest survey of students in American colleges and universities. In 2010, the AFNN analyzed information from 201,818 freshman students across the United States; they self-reported an increase in anxiety, depression, substance abuse, and other mental health disorders, as compared to AFNN reports from past years (Pryor, Hurtado, DeAngelo, Blake, & Tran, 2010). Parallel to those findings, Gallagher (2012) conducted a national survey and found that over 90% of counseling center directors reported higher incidence of students with severe psychological disorders, medication issues, and crisis situations. There has been speculation that

the increase in mental health issues may simply be caused by decreased resiliency among the current generation of college students (Garza, Bain, & Kupczynski, 2014). However, contrasting evidence is triangulated in the literature, with students, health professionals, faculty, student affairs personnel, and administrators all reporting higher numbers of complex behavioral/mental health issues on university campuses (Byrd, & McKinney, 2012; Dikel, 2014; Eagan et al., 2014; Gallagher, 2012; Iarovici, 2014; Nyer et al., 2013; Winger & Olson, 2015; Zhou et al., 2013).

In 2014, the AFNN survey included data from 153,015 college freshman students; the report found that their average self-rated level of mental/emotional health was 50.7%, the lowest level documented since the AFNN began in 1966 (Eagan et al., 2014). College and university counseling centers reported the highest recorded number of student visits and extended wait times, indicating that there is still much work to do in order to improve mental health on campus (Misner, 2014). The heightened prevalence and incidence of mental health issues may be influenced by several factors, including: enhanced diagnostic processes, a gradual decrease in stigma surrounding mental health (allowing individuals to more readily seek professional help), demographic shifts in the college student population (e.g., family, work, culture), as well as technology use (Eagan et al., 2014; Gallagher, 2012; Kraft, 2011; Winger & Olson, 2015).

Factors Influencing College Student Wellness and Success

Family. Today, nearly one quarter of American college students have dependent children, placing an array of responsibilities and stressors on individuals who are trying to complete degrees. The college dropout rate for parents (53%) is significantly higher than for non-parents (31%). In spite of these obstacles, students who are also parents tend to have higher GPA's than students without children (Institute for Women's Policy Research, 2013).

Work. The "traditional college student" historically enrolled at a university immediately upon completion of high school, relying upon their family financially and typically not working in addition to their higher education. Now, the majority of students work part or full-time alongside a full course load toward their degree program (Iarovici, 2014). Working students report spending higher amounts of money as an upside of employment, yet they also report increased levels of anxiety, depression, and stress, as compared to students who are not working while attending college (Mounsey, Vandehey, & Diekhoff, 2013).

Culture. In legal terms, individuals are considered "adults" at the age of 18, yet it is understood that college students do not instantly become adults as they cross that threshold. Psychologist Jeffrey Arnett has researched individuals between the ages of 18 and 29 years around the nation; he coined the term "emerging adulthood" to describe this age span. During this time, emerging adults exhibit instability, identity exploration, feeling "in-between," self-focus, and contemplation of life's possibilities (2001). Needless to say, the current "culture of college students" is far different than it was decades ago, and it will continue to grow and shift as individuals use new technologies and interact with one another in varying ways.

Communication style and technology use. Researchers have examined the productive and distractive use of technology in the college classroom (Burns & Lohenry, 2010; Caravello, Jiménez, Kahl, Brachio, & Morote, 2015; Case & Pape, 2013; Chen, 2013; Olson & Winger, 2013). Further, studies have started to explore how technology affects the way that students

interact with others and how that affects their physical and mental health (Ferraro et al., 2012; Melton, Bigham, Bland, Bird, & Fairman, 2014). King, Delfabbro, and Griffiths (2012) discovered significant correlations between technology use and health, such as participants who reported excessive time on the Internet and digital technologies also had higher levels of anxiety and psychological distress. In a 2015 study by Winger and Olson, faculty members and student affairs personnel reported numerous concerning behaviors among college students, including over-reliance on technology and lack of attention related to use of devices.

Methodology

Much of the previous research on college student wellness (physical and mental health) has been conducted through quantitative studies (Eagan et al., 2014; Gallagher, 2012; Iarovici, 2014; Kraft, 2011; Melton et al., 2014; Zhou, Hong, Zhang, & Taisheng, 2013). These studies have produced valid and generalizable data regarding factors that affect various aspects of college students wellness. However, few studies have delved further into the reasons underlying the correlations and predictors found through quantitative survey data. Thus, the methodological approach for the current study was to utilize an explanatory sequential mixed methods design in order to leverage the strengths of both quantitative and qualitative research. The purpose of the current quantitative phase of the study was to explore any significant correlations and predictive values that may exist and use those findings to inform further investigation during the future qualitative phase. The second phase of this study will utilize semi-structured interview questions to gather in-depth qualitative data about college student technology use as it relates to wellness. For the second phase, the methodological lens of phenomenography will be adopted, as this part of the study will seek to examine the qualitative variances in how individuals experience a phenomenon (use of ICTs), with consideration for the continually shifting "culture of college students" (Alsop & Tompsett, 2006; Marton, 1986; Ornek, 2008; Tan & Prosser, 2004).

Participants and Procedure

With approval from the Institutional Review Board (IRB) at a Midwestern research university, the Office of Institutional Research generated a random sample of 1,800 undergraduate students and 400 graduate students. Unique links to an online survey were sent to each of the 2,200 students with an invitation to participate. In the email invitation, the survey was entitled, "Technology Use Among College Students"; the IRB supported the omission of details about assessing physical and mental health in the introduction and consent form, so that participants were not primed for that topic at the outset of the survey. Completion of the survey took an average of 19 minutes, and 225 participants finished the survey. The participants who completed the survey included 131 undergraduate and 94 graduate students, with 137 female students, 86 male students, and 2 students identifying as "other." The average age of participants was 32.08 years (M = 32.08, SD = 10.64, Mode = 23). In general, older undergraduate students and graduate students were more likely to complete the survey; it is postulated that this response rate was related to the "research karma effect," whereby students who are also conducting research are more likely to participate in fellow students' research studies. Participants represented six distinct races (Native American, Hispanic/Latino, Indian, Black/African American, White/Caucasian, and Mixed) as well as seven different colleges (fields of study)

across the university. Regarding the marital status of participants, there were 110 single, 3 engaged, 88 married/domestic partnership, 1 separated, 20 divorced, and 2 widowed. Out of the 225 total participants, 205 students reported working part-time or full-time in addition to their coursework, with 72 of those students working 40 or more hours per week.

Measures

Communication preferences and perspectives. Immediately following the demographic questions, various items and Likert-type scales were used to gather descriptive data and frequency distributions related to participants' technology use, including the following:

1. Which devices do you currently own? (e.g., smartphone, desktop/laptop computer, tablet, others)
2. How many hours per day do you spend using each device, approximately?
3. Approximately how many text messages do you send and receive each day?
4. Which social media/social networking services do you currently use (e.g., Facebook, Twitter, Instagram, Snapchat, Pinterest, LinkedIn)
5. How many hours per day do you spend using each social media/social networking service, approximately?
6. Please rate how well you like to communicate via (__*insert mode of communication* – e.g., talking in-person, talking on the phone, texting, sending/receiving private messages, posting and exchanging comments on social media sites___), as it relates to the following groups of people… (__*insert group* – e.g., parents, siblings, friends, colleagues __)
7. Please rate how you feel about the following aspects of (__*insert mode of communication* – e.g., talking in-person, talking on the phone, texting__) …
   a. "Good for exchanging complex, emotional messages"
   b. "Susceptible to communication errors (e.g., easily misinterpreted)"
   c. "Good for quick, concise messages"
   d. "Good for professional communication"

Note: **Question 6** used a five-point Likert-type scale (1 = I do not use this form of communication, 2 = I strongly avoid using this form of communication with this group, 3 = I do not prefer to use this form of communication, but will use it when necessary, 4 = I use this form of communication a fair amount, 5 = I use this form of communication frequently). **Question 7** used a five-point Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4 = Agree, 5 = Strongly Agree).

In addition to these descriptive questions, a new multi-item scale was created in order to further assess participants' use of ICTs and their preferred modes of communication, as well as their views about ICT use in modern society. The *Communication Preferences and Perspectives Scale (CPPS)* was comprised of seven items that were used to assess participants' preference for modes of communication (i.e., synchronous/in-person vs. asynchronous technology), as well as their views of communication in modern society (see Table 1). Four items measured participants' individual preferences for communicating (e.g., "I feel more comfortable when I am interacting with someone face-to-face, and I am able to read non-verbal body language"), while the remaining three items evaluated their views of communication in society as a whole (e.g., I believe that new technology and forms of communication, for example texting and social media,

have only impacted humans positively"). Participants were asked to, "Please indicate how you feel about the following statements related to different forms of communication," and to rate it based on a 5-point Likert scale (1 = *Strongly Disagree,* 5 = *Strongly Agree*).

In order to test the quality of the scale, an exploratory factor analysis was conducted on the seven items. Results from the analysis showed that the scale loaded on two factors, named *Personal Preferences (*CommP_1, CommP_2, CommP_3_R, and CommP_4_R) and *Perceptions of Communication in Society* (CommP_5, CommP_6, and CommP_7_R), with factor loadings of .44 to .73. Internal reliability was sound, with desirable Cronbach's alpha levels for *Personal Preferences* (α = .780) and *Perceptions of Communication in Society* (α = .771). In addition, all scale items approached normality (i.e., skewness and kurtosis less than or equal to $\pm$1.00).

The first four items related to personal preferences were summed to create the variable Personal_Self_Comm, and the last three items related to communication in society were summed to create the variable Society_General_Comm. Descriptive statistics for Personal_Self_Comm approached normality with a skewness of -.458 and a kurtosis of -.611 (M = 14.43, SD = 3.05). Descriptive statistics for Society_General_Comm also approached normality with a skewness of -.662 and a kurtosis of -.102 (M = 11.30, SD = 2.50).

Table 1

Communication Preferences and Perspectives Scale (CPPS)

Name	Item	*M*	*SD*
	Personal Preferences for Modes of Communication		
CommP_1	Generally, I prefer to speak with people synchronously (face-to-face, phone, audio/video conference) as opposed to asynchronous forms (texting, emailing, writing).	3.85	1.00
CommP_2	I feel more comfortable when I am interacting with someone face-to-face, and I am able to read non-verbal body language.	4.04	0.92
CommP_3_R	Talking with people face-to-face makes me nervous.	3.40	1.04
CommP_4_R	When I use written communication (text, email, letters), I feel more comfortable than when I speak to someone in-person.	2.92	1.05
	Perceptions of Communication in Society		
CommP_5	I think that modern communication technologies (e.g., texting, email, social media sites) have negatively impacted humans' ability to interact with one another (as compared to older methods, such as face-to-face and telephone).	3.83	1.09
CommP_6	I am concerned about the interpersonal skills of people in our modern society, due to over-reliance on new communication technologies (such as texting, emailing, social networking).	3.93	1.06
CommP_7_R	I believe that new technology and forms of communication (e.g., texting, social media) have only impacted humans positively.	3.60	0.78

Note: Participants responded on a five-point Likert scale (1 = *Strongly Disagree* … 5 = *Strongly Agree*). "_R" = reverse-coded items.

State/Trait Anxiety Inventory for Adults (STAI). The STAI is a 40-item scale that measures state and trait level anxiety in participants. Form Y-1 includes the first 20 items that ask participants to "indicate how you feel *right now, at this moment,"* (e.g., I feel calm, I feel tense) and rate it on a four-point scale (1 = Not at all, 2 = Somewhat, 3 = Moderately so, 4 = Very much so). Form Y-2 includes the other 20 items that ask participants to "indicate how you *generally feel,"* (e.g., I feel pleasant, I feel like a failure) and rate it on a four-point scale (1 = Almost never, 2 = Sometimes, 3 = Often, 4 = Almost always).

The STAI is a commonly used tool for assessing levels of anxiety with solid validity and reliability scores since its original version was created in 1968 (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). Using the current response set, a factor analysis was conducted on the

Form Y-1 items and the Form Y-2 items separately, and resulting scree plots clearly indicated one factor for each subscale (Form Y-1 items = state anxiety, Form Y-2 items = trait anxiety). With the current survey data, a reliability analysis was conducted on the STAI items that garnered expected high reliability scores for both Form Y-1 (α = .893) and Form Y-2 (α = .882). After running descriptive statistics on individual items from this scale, the following items showed non-normal attributes:

State_6_upset: Skewness = 3.105, Kurtosis = 10.089
State_7_misfortune: Skewness = 1.150
State_12_nervous: Skewness = 1.585, Kurtosis = 2.007
State_13_jittery: Skewness = 1.745, Kurtosis = 2.455
State_17_worried: Skewness = 1.261, Kurtosis = 1.037
State_18_confused: Skewness = 1.345
Trait_25_failure: Skewness = 1.408, Kurtosis = 1.976
Trait_31_disturbing: Skewness = 1.842, Kurtosis = 3.088
Trait_35_inadequate: Skewness = 1.305, Kurtosis = 1.375

These non-normal attributes were considered throughout further analyses; however, all items were kept for analyses, as the STAI is a well-established scale, and the reliability analysis indicated that removal of any item would not improve the Cronbach's alpha level.

When the items from the Form Y-1 (state anxiety) were summed to create State_Anx_Total, the descriptive statistics were only moderately non-normal with a skewness of .902 and a kurtosis of 1.661 (M = 35.02, SD = 9.59). The Form Y-2 items (trait anxiety) were summed to create Trait_Anx_Total and produced descriptive statistics that approached normality, with a skewness of .639 and a kurtosis of -.085 (M = 36.09, SD = 8.38).

Beck Depression Inventory (BDI-II). The BDI-II includes 21 items related to different aspects of depression (e.g., sadness, guilty feelings, loss of pleasure). Each item includes four statements, valued 0, 1, 2, or 3. Participants are asked to "pick out the *one statement* in each group that best describes the way you have been feeling during the *past two weeks, including today*." For example, statement options for *Loss of Pleasure* include 0 = I get as much pleasure as I ever did from the things I enjoy, 1 = I don't enjoy things as much as I used to, 2 = I get very little pleasure from the things I used to enjoy, and 3 = I can't get any pleasure from the things I used to enjoy. Scores for all 21 items were totaled to produce the self-reported level of depression, with higher numbers indicating more severe depression.

Various forms and updates of the BDI have shown strong validity and reliability since the original inventory was developed in 1961 (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961). A factor analysis was conducted only to check the current response set, and the scree plot clearly indicated one factor (depression). Using the response set from the current study, the 21-item scale produced an expected strong internal reliability score (α = .825). After running descriptive statistics on the individual items from this scale, it was discovered that the response set produced non-normal results for nearly all items (skewness from 1.0 to 6.0 and kurtosis from 1.5 to 18.5). While these results are concerning, they are not necessarily surprising, as participants may have been unlikely to self-report nearly any symptoms of depression (e.g., mostly zero scores, a few ones). If the hypothesized stigma altered participants' responses, it is understandable that the dataset for this particular study produced non-normal descriptive statistics for the BDI items.

The 21 items from the BDI were summed to create the BDI_Total variable, which produced anticipated non-normal descriptive statistics with a skewness of 2.016 and a kurtosis of 6.609 (M = 4.57, SD = 4.80). Caution was utilized when including items from this scale in further analyses; however, the BDI scale will be kept intact because it is also a well-established scale. Additionally, the reliability analysis for the BDI scale indicated that removal of any items would not improve the Cronbach's alpha level.

Self-reported mental, physical, and social health. Following all of the other scales, the last item on the survey asked participants to reflect on how they believe that ICT use has influenced their mental, physical, and social health. The question included operational definitions after each of the three terms, and asked participants to rate their perceived levels of health outcomes on a 7-point Likert-type scale (1 = strong negative influence, 2 = negative influence, 3 = slight negative influence, 4 = Neither positive, nor negative, 5 = slight positive influence, 6 = positive influence, 7 = strong positive influence):

1. How do you feel that your use of information and communication technologies (e.g., smartphones, computers, social media) has affected the following aspects of your well-being?
    a. *Mental & Emotional Health* – Being able to self-reflect and cope with the challenges of life. The ability to recognize and share feelings such as sadness, anger, or stress, as well as happiness, hope, and love in a productive manner.
    b. *Physical Health* – Maintaining a healthy quality of life, that allows for regular, daily activities without excessive fatigue or physical stress. Examples include sustaining a healthy diet, good sleep patterns, and regular exercise.
    c. *Social Health* – Effectively and meaningfully connecting with other people. For example, establishing and maintaining positive relationships with colleagues/ coworkers, family, and friends.

This final question was intentionally placed at the end of the survey (instead of priming them at the start), after participants had completed all demographic and descriptive questions, as well as the mental health scale (STAI and BDI). After completing all of those questions, it was hoped that participants would be reflecting on the associations between their technology use and their wellness when they answered this directly worded, concluding set of health outcome statements. Preliminary descriptive statistics and correlations were explored with the data from this final question, yet they will not be specifically reported in this article. Instead, the findings from the self-reported mental, physical, and social health statements will be used to inform interview questions for participants during the upcoming qualitative phase of the study.

Results

Demographics

Group differences were examined using *t*-tests to determine if student status (undergraduate vs. graduate) affected participants' preferred styles of communication (Personal_Self_Comm) and/or participants' perceptions of communication in society as a whole (Society_General_Comm). Results indicated that there was not a significant difference in

preferred styles of communication for undergraduate as compared to graduate students. Considering the typical age range of undergraduate students as opposed to graduate students, age might have been a covariate that influenced the relationship between student status and preferred styles of communication. Thus, the bivariate correlations among age, gender and preferred style of communication were examined and found to be non-significant. Nonetheless, conceptually, age would seem to be a possible influence on preferred style of communication; thus, an ANCOVA was utilized to measure whether student status impacts preferred communication style, when controlling for age. The ANCOVA indicated that controlling for age enhanced the significance level of student status related to its impact on preferred style of communication. However, student status was still not a statistically significant variable, suggesting that it was not a major influence on preferred style of communication for this sample of college students.

Correlations

As an initial exploration of associations among variables, bivariate correlations were run in SPSS. Several significant correlations resulted from the analyses (see Table 2).

Table 2

Correlations Among Communication Preferences/Perceptions and Mental Health

Scales	1	2	3	4	5
1. Preferred style of communication (Personal_Self_Comm)	-				
2. View of communication in society (Society_General_Comm)	.19**	-			
3. State anxiety	-.22*	-.02	-		
4. Trait anxiety	-.29**	-.05	.68**	-	
5. Depression	-.19**	.05	.56**	.78**	-
Range	6 - 20	4-15	20-77	21-68	0-36
M	14.21	11.36	37.70	37.45	5.60
SD	3.11	2.45	9.63	9.86	6.53
Skewness	-.44	-.72	.33	.81	2.07
Kurtosis	-.57	.03	.39	.25	4.99
Cronbach's alpha	.78	.77	.88	.60	.90

* $p < .05$ (2-tailed), ** $p < .01$ (2-tailed)

The expected largest positive correlation was between state anxiety level and trait anxiety level, which suggests that participants with higher anxiety at the time of response also have higher levels of anxiety in general. State anxiety level also produced a strong positive correlation with level of depression, while trait anxiety level had an even stronger positive correlation with depression. Preferred style of communication was positively correlated with perception of communication in society, suggesting that participants who preferred synchronous, in-person

interactions also believed that modern society needs to practice more in-person communication. Personal preference for in-person communication also had a significant negative correlation with state and trait anxiety levels, suggesting that participants who preferred synchronous communication (high Personal_Self_Comm) also reported lower levels of state and trait anxiety. Based on support from literature on mental health, including the author's prior studies, these correlations were anticipated and will be further investigated to determine predictive qualities of these variables in multiple regression analyses.

Regressions. Simultaneous and hierarchical multiple regressions were utilized in order to examine how demographic variables, preferred styles of communication, and/or perceptions of communication in society might predict levels of anxiety (considering the significant correlations among preferred style of communication, state anxiety, trait anxiety, and depression). As an exploratory analysis, several possible predictor variables were included and a less stringent significance level of $p < .10$ was adopted in order to avoid Type II errors.

For the first simultaneous multiple regression, total hours on devices, total hours on social media sites, preferred style of communication, and perception of communication in society were entered as independent variables, with state anxiety as the dependent variable. Preferred style of communication was found to be the only significant predictor of state anxiety ($\beta = -.214$, $p < .10$).

The second simultaneous multiple regression tested total hours on devices, total hours on social media sites, preferred style of communication, and perception of communication in society as possible predictors of trait anxiety. As with state anxiety, preferred style of communication was the only significant predictor of trait anxiety ($\beta = -.273$, $p < .10$).

The third simultaneous multiple regression tested total hours on devices, total hours on social media sites, preferred style of communication, and perception of communication in society as possible predictors of depression. Preferred style of communication was a significant predictor of depression ($\beta = -.214$, $p < .10$); hours spent on devices was also a significant predictor of depression ($\beta = -.161$, $p < .10$).

To further examine the predictive effects of each independent variable, they were entered into hierarchical multiple regressions in the following order: student status, age, total hours on devices, total hours on social media sites, preferred style of communication, and lastly, view of communication in society. The results indicated that preferred style of communication was still the only significant predictor of state and trait anxiety, and preferred style of communication and hours on devices both predicted levels of depression. In the hierarchical models, demographic variables accounted for a small amount of variance when added in order. Overall, the hierarchical multiple regressions did not add to the findings; thus, only the results from the simultaneous multiple regressions are displayed in Table 3.

Table 3

Regressions of Technology Use and Communication Preferences and Perspectives on Levels of State Anxiety, Trait Anxiety, and Depression

	Hours per day on devices	Hours per day on social media sites	Preferred style of communication	View/perspective of communication in society
State anxiety	-.03	-.04	-.21*	-.00
Trait anxiety	-.09	.06	-.28*	.04
Depression	-.161*	.068	-.21**	.07

* $p < .05$ (2-tailed), ** $p < .01$ (2-tailed)

Discussion

The results of the current study have conceptual and practical contributions to the literature related to college student wellness, as well as the literature related to communication and technology. First, the *Communication Preferences and Perceptions Scale (CPPS)* was created in order to measure both preferred style of communication (Factor 1) and perception of communication in society as a whole (Factor 2). The two factors in this scale both produced sound reliabilities, and preferred style of communication correlated meaningfully with levels of state and trait anxiety. Analyses of demographic variables also revealed that graduate students are more likely than undergraduate students to prefer synchronous, in-person communication (over asynchronous, technology-based communication).

Second, results from multiple regression analyses indicated that preferred style of communication significantly predicted state anxiety and trait anxiety, as well as levels of depression. The number of hours that students spent on devices was also significantly predictive of depression scores on the BDI. These findings suggest that individuals who prefer synchronous, in-person communication styles have lower levels of anxiety and depression than individuals who prefer asynchronous, technology-based communication styles. Findings from this study have important implications for teaching and learning, as well as for facilitation of effective and healthy interactions among college students, faculty, staff, and administrators.

Limitations

A limitation of the study was the fact that the student sample was drawn from only one university. Random sampling was utilized in order to gain the most representative sample from this university, yet these results still may not be generalizable to other colleges and universities. The self-report nature of the *Communication Preferences and Perspectives* survey instrument could be viewed as a limitation, yet it provided a basis for future expansion and refinement of the scale (using this dataset as a pilot study). The statements in the scale also described attributes of communication style and technology use that may be used to design future experimental or quasi-experimental studies (e.g., observation of participants using ICTs to communicate).

In addition, the postulated "research karma effect" resulted in a higher than expected number of graduate students and undergraduate junior and senior students who completed the survey (as compared to the lower number of undergraduate freshman and sophomore students), considering the random sample of all students. This phenomenon must be considered when examining the quantitative results from this first phase of the study. During the second phase of the study, students of different ages and class levels will be purposively sampled, in order to delve deeper into issues of technology use and health and garner qualitatively valid and reliable data from the interview questions.

Implications and Future Directions

The major implication from Phase I of this study is the potential for further exploration and research related to ICT use and wellness among college students. During this initial quantitative phase of a mixed methods study, the survey data highlighted correlations and predictive regressions among factors related to college student technology use, communication style, state/trait anxiety, as well as depression. Participants who reported a preference for asynchronous, technology-mediated communication also indicated higher levels of state and trait anxiety, in addition to higher levels of depression. As new technologies continue to emerge at a rapid pace, changing the ways that individuals communicate with one another, the results of this study will be important to consider for college students, as well other individuals in modern society.

Findings from Phase I of the current study support the literature on physical and mental health and point to new topics that should be the focus of continued research (Dikel, 2014; Jayaprakash, Moody, Lauria, Regan, & Baron, 2014; Kraft, 2011; Stupnisky, Perry, Renaud, & Hladkyj, 2013; Winger & Olson, 2015; Zhou et al., 2013). Further research should investigate the predictive relationship of communication style on various aspects of mental health through further quantitative analyses. In addition, a qualitative analysis should investigate the details of why communication style seems to affect levels of anxiety and depression (e.g., through interviews, observations, and/or other rigorous qualitative methods).

By developing the *Communication Preferences and Perspectives Scale (CPPS)*, the current study provided a basis for quantitatively analyzing participants' preferred modes of communication, as well as overall perceptions of communication in society. As information and communication technologies (ICTs) continue to expand, there will be a growing need for tools to assess the ways that humans interact; thus, the refinement and improvement of scales such as the *CPPS* will valuable to researchers and practitioners.

The goal of the current study was to add to the literature on the factors that affect college student health and wellness. Students, faculty, staff, and administrators stand to benefit from the current mixed methods study, in addition to future research on college student physical and mental health. As more is understood about the factors that influence college student health and wellness, all stakeholders in higher education should work together in order to create effective and healthy campus learning environments. By doing so, colleges and universities have the potential to improve student academic performance, increase student retention and graduations rates, as well as enhance overall student wellness.

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