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Impact of Technology Devices on College Students' Stress Levels of Using Technology

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As a part of a larger study, the purpose of this exploratory study was to assess college students' stress levels of using technology. Forty-four males (11.3%) and 345 females (88.5%) participated in the study by filling out an online survey voluntarily and anonymously. This was an exploratory survey of college students' feelings about technology, specifically if the participants experienced negative feelings about technology use in the college classroom. The researchers used descriptive data analyses to investigate how frequently college students go online or use e-mails. When using one-way Analysis of Variances (ANOVAs), a significant difference was found between the relationship improvement and college students who went online or used e-mails at different frequency levels. Although we know technology can positively impact students' lives and educational opportunities, it is important to recognize there are some negative effects as well. College instructors should be aware of students' need and desire to be connected, as well as their need to disconnect. Recommendations are provided to help instructors think about their students' needs when using of technology in their classrooms.

Keywords: technology, college student, stress level

INTRODUCTION

The college classroom environment is rapidly changing. The use of technology in online, hybrid, and face-to-face classes is causing shifts in approaches to teaching and instruction in higher education. Many have viewed these changes as positive for college students and instructors alike. However, as such technology use is more widespread, concerns have been voiced that technology use may not be perceived positively by all. Questions have arisen such as: "Do all learners utilize technology with positive results?"

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and "Has technology use created negative feelings in learners?" The answers to these questions are complex and may be quite unique to each college classroom, learner, and the type of technology used.

COLLEGE STUDENTS' ACCESSIBILITY TO AND USE OF INTERNET AND TECHNOLOGY DEVICES

The use of cell phones, mobile devices, and the Internet are part of everyday life and this is not likely to change in the future. There are two generally opposing views in higher education of Internet and technology use. One is positive and views the technology and the Internet as informative, convenient and resourceful, while the other is negative and views technology use as potentially problematic and disruptive. There is growing evidence that Internet and cell phone use is negatively impacting academic performance, and physical health and well being for college students (Lepp et al., 2014; Harwood, Dooley, Scott & Joiner, 2014).

The current generation of college students is used for multitasking with these technologies and has created an expectation for speed and immediacy of response or information (Oblinger & Oblinger, 2006). However, immediacy and ease of accessibility does not always ensure accuracy or reliability. While technology and cell phones may offer some benefits, users are often not able to limit their use to meet specific goals, thus undermining their legitimacy (Karpinski, Kirschner, Ozer, & Mellot, 2013). For example, computers and cell phones often assist students in their academic studies, but they may also distract them. Wentworth and Middleton (2014) found that students, who spent less time on their computer, had a higher Grade Point Average (GPA) and spent more time studying. Additionally, students who reported a high frequency of cell phone usage reported a lower GPA (Lepp, Barkley, and Karpinski, 2014). These findings suggest that students who spend more time using their computers and cell phones may spend less time in class, studying and completing homework. It may be that they use their devices as a distraction from academics or they are using their cell phone in class and paying less attention. This is consistent with several studies that have found multitasking to be associated with lower academic performance (Lepp et al., 2014; Rosen et al., 2013; Karpinski et al., 2013; Wentworth & Middleton, 2014).

COLLEGE STUDENTS' RELATIONSHIP AND STRESS CAUSED BY THEIR ACCESSIBILITY TO AND USE OF TECHNOLOGY AND INTERNET

The Internet and technology has promoted and reinforced social interactions with an emphasis on immediacy and constant feedback (Lenhart, Rainie & Lewis, 2001; Prensky, 2001). College students of today seem to have created a dependency on feeling connected (Crittenden, 2002) in both social and academic settings. This dependency has begun to take a toll on their happiness and well-being. Lepp, Barkley, Sanders, Rebolt and Gates (2013) found students reporting higher usage of cell phones also reported less physical activity and more sedentary behaviors. These sedentary activities can impact both physical and emotional health because they are keeping students from participating in activities that may help them feel productive and healthy. Lepp et al. (2014) found that as cell phone use increased among college students so did their anxiety and their life satisfaction decreased. The culture and environment college students live in can create a dependence or addiction to technology. Wang (2001) found this dependence to be characterized by extended use, stress, or anxiety when not available. He also found that dependence caused an interference with academic or social activities and to be due to social influences rather than personality or pathology. College students' anxiety related to using technology and cell phones may increase because of their perceived obligation to stay in constant contact with some social networks (Lepp, Barkley & Karpinski, 2014; Lepp et al., 2013; Merlo,

2008). Some users may find it difficult to disconnect for their own quiet time because their cell phones are always present. For those students more prone to stress, staying connected through their technology devices may be a way to manage stress and depression, but it is also likely to create a dependence or level of involvement with their devices that increase their stress and depression (Harwood et al., 2014).

The role of technology use in higher education needs further discussion and exploration. College classrooms should be positive learning environments in which learners are able to critically examine information and form judgments about the content learned. Today's college students are multimodal. They are used to learning by doing and engaging in a rich environment of imagery and sound (Metros, 2008). However, the perceived demand of constantly being connected takes a toll on college students' well-being. Understanding how technology is used, the extent of involvement with technology in the classroom, and the impact upon the individual learner is critical to improving the learning environment. A balance between technology use and other activities or needed solitude is necessary. However, due to the limited existing literature on the college students' stress or relationship improvement caused by their accessibility to and use of internet and technology devices, the authors developed this preliminary survey to investigate college students' accessibility to and usage about technology and internet. Specifically, the authors wanted to find out the cause-effect (1) between the frequency of going online or using e-mails and college students' relationship improvement, (2) between the frequency of going online or using e-mails and stress levels, (3) between the accessibility of technology and college students' relationship improvement, (4) between the number of technology devices college students own and their relationship improvement, (5) between the number of technology devices college students own and their stress levels, and (6) between the accessibility of technology and college students' stress levels.

PURPOSE AND RESEARCH QUESTIONS OF THE STUDY

The purpose of this exploratory study was to find out the impact of technology on college students' stress, distraction, and addiction levels. The research questions were: (1) How frequently do college students go online or use e-mails? (2) Is there any significant difference in the mean scores of the relationship improvement of college students among those going online or using e-mails more or less frequently? (3) Is there any significant difference in the mean scores of the stress levels of college students among those going online or using e-mails more or less frequently? (4) Is there any significant difference in the mean scores of the stress levels of college students caused by unavailability of technology for one day among those going online or using e-mails more or less frequently? (5) Are there any significant differences in the mean scores of the relationship improvement of college students among those who own different number of technology devices? (6) Are there any significant differences in the mean scores of the stress levels of college students using technology among those who own different number of technology devices? (7) Are there any significant differences in the mean scores of the stress levels of college students caused by unavailability of technology for one day among those who own different number of technology devices?

METHODS

Similar to the study entitled "Impact of technology devices on college students' comfortable levels of using technology" published in *the International Journal of Technology in Teaching and Learning* (Zhang, Fallon, & Russo, 2014), this paper is a

part of a larger study, focusing on a different set of data from a much larger database to answer a different set of research questions. The authors used descriptive analyses and one-way Analysis of Variances (ANOVAs) to answer the research questions.

PARTICIPANTS

Forty-four males (11.3%) and 345 females (88.5%) participated in the study by filling out an online survey voluntarily and anonymously. They were all undergraduate students who took introductory family studies courses from a public university located in northeast of the United States. The majority of them were traditional college students, ranging from 18 to 23 years of age *(n* = 376, 96.4%). One hundred and twelve participants reported as freshman (28.7%), 116 sophomores (29.7%), 108 juniors (27.7%), and 53 seniors (13.6%) (Zhang, Fallon, & Russo, 2014; Fallon, Russo, & Zhang, 2014).

SURVEY INSTRUMENT DEVELOPMENT

A survey instrument was developed to understand the usage of current and available technology devices for college student and its impact on college students' life, including their learning. Survey items were selected and adapted from a variety of instruments measuring technology use, including the Princeton Survey, Research Associates International for The Pew, Internet and American Life Project (Zhang, Fallon, & Russo, 2014; Fallon, Russo, & Zhang, 2014).

DATA ANALYSES PROCEDURE

The authors selected the items from the survey instrument related to this study to answer the seven research questions. The data analysis procedure was lined up with each of the seven research questions and explained in details as follows.

To answer Research Question One "*How frequently do college students go online or use e-mails?*", four choices were given to answer the question of "how often do you, personally, go online or use e-mails?": "several times a day (3 or more)," "once or twice a week," "less often," or "don't know." The participants' answers to this question were coded as 2 (several times a day) or 1 (once or twice a week, less often, or don't know). Descriptive analysis was used to analyze the frequency and percentage of college students' frequency levels of going online or using e-mails.

To answer Research Question Two "*Is there any significant difference in the mean scores of the relationship improvement of college students among those going online or using e-mails more or less frequently?*", the authors used five questions in a 1-5 Likert Scale to ask about the participants' relationship improvement of using technology. The participants were asked to rate whether each of the five statements described them from 1 (don't know), 2 (not at all), 3 (only a little), 4 (some), or 5 (a lot). The five questions were: (1) "How much, if at all, does the internet improve your relationships with your friends?" (2) "How much, if at all, does the internet improve your relationships with your family?" (3) "How much, if at all, does the internet improve your relationships with your boyfriend/girlfriend?" (4) "How much, if at all, does the internet help you get information about things that are hard to talk about with other people?" (5) "How much, if at all, does the internet help you make new friends?" The participants' answers to these questions were coded one through five as they were indicated in the Likert Scale. The higher a participant rated the statement, the more he/she may feel that the use of technology improved his/her relationship in that specific aspect. Thus, the mean score of each participant's answers to all five questions was calculated (from the possible minimum of one to the possible maximum of five). The higher the mean score, the more the participant felt that the use of technology helped improve his/her relationship. The participants were divided into two groups based on the frequency of their usage of technology devices they

owned: Group One went online or used e-mails several times a day, while Group Two less often. Then a one-way Analysis of Variance (ANOVA) was conducted to see if there was any significant difference in the mean scores of the relationship improvement of college students among those went online or used e-mails more or less frequently.

To answer Research Question Three "*Is there any significant difference in the mean scores of the stress levels of college students among those going online or using e-mails more or less frequently?*", the authors used 12 questions in a 1-5 Likert Scale to ask about the participants' stress level of using technology. The participants were asked to rate whether each of the 12 statements described them from 1 (not at all), 2 (not too well), 3 (well), 4 (somewhat), or 5 (very well). The 12 questions were: (1) "It is stressful to own and manage all of the different electronic devices I have;" (2) "I feel annoyed by having to respond to intrusions from my electronic devices;" (3) "I believe I'm less productive because of all of y electronic devices;" (4) "If my electronic devices are not available I feel stressed;" (5) "The devices make my life more complicated;" (6) "Communicating is more difficult when I consider my use of technology;" (7) "There is more conflict in my relationships on-line when I consider my use of technology;" (8) "It's too easy to misunderstand what others meant when I consider my use of technology;" (9) "There is more misinformation about others when I consider my use of technology;" (10) "I feel more stressed when technology not available;" (11) "I become addictive when I consider my use of technology;" and (12) "Technology causes too many distractions." The participants' answers to these questions were coded one through five as they were indicated in the Likert Scale. The higher a participant rated the statement, the more stress he/she may feel towards using technology in that specific aspect. Thus, the mean score of each participant's answers to all 12 questions was calculated (from the possible minimum of one to the possible maximum of five). The higher the mean score, the more stress the participant felt when using technology. Then a one-way ANOVA was conducted to see if there were any significant differences in the mean scores of the stress levels of college students using technology among those went online or used e-mails more or less frequently.

To answer Research Question Four "*Is there any significant difference in the mean scores of the stress levels of college students caused by unavailability of technology for one day among those going online or using e-mails more or less frequently?*", the authors used four questions in a 1-5 Likert Scale to ask about the participants' stress level caused by the lack of/inaccessibility of technology for one day. The participants were asked to rate whether each of the four statements described them from 1 (not at all), 2 (not too well), 3 (well), 4 (somewhat), or 5 (very well): (1) "Create stress in my life;" (2) "Make me feel isolated;" (3) "Cause conflict in my relationship;" and (4) "Cause problems." The participants' answers to these questions were coded one through five as they were indicated in the Likert Scale. The higher a participant rated the statement, the more stress he/she may feel caused by the lack of technology for one day in that specific aspect. Thus, the mean score of each participant's answers to all four questions was calculated (from the possible minimum of one to the possible maximum of five). The higher the mean score, the more stress the participant felt due to the lack of technology for one day. Then a one-way ANOVA was conducted to see if there were any significant differences in the mean scores of the stress levels of college students caused by unavailability of technology for one day among those went online or used e-mails more or less frequently.

Five questions were asked to seek information on college students' possession of technology: "Do you have the following (desktop computer, laptop computer, cell phone, personal digital assistant device, and/or television set)?" The participants' answers to these questions were coded as 1 (two or less devices), 2 (three devices), 3 (four devices), and 4

(five devices). Descriptive analyses were used to analyze the frequency and percentage of college students' possession of different types of technology.

To answer Research Questions Five "*Are there any significant differences in the mean scores of the relationship improvement of college students among those who own different number of technology devices?*", similar data coding and analysis procedure to Research Question Two was used. The participants' ratings regarding their relationship improvement of using technology to the five questions were coded one through five as they were indicated in the Likert Scale. The mean score of each participant's answers to all five questions was calculated. The higher the mean score, the more the participant felt that the ownership to different number of technology devices helped improve his/her relationship. The participants were divided into two groups based on the frequency of their usage of technology devices they owned: Group One owned three or more technology devices, while Group Two owned less. Then, one-way ANOVAs were conducted to see if there were any significant differences in the mean scores of the relationship improvement of college students among those who owned different number of technology devices.

To answer Research Questions Six *"Are there any significant differences in the mean scores of the stress levels of college students using technology among those who own different number of technology devices?*", similar data coding and analysis procedure to Research Question Three was used. The participants' ratings regarding their stress level of using technology to the 12 questions were coded one through five as they were indicated in the Likert Scale. The mean score of each participant's answers to all 12 questions was calculated. The higher the mean score, the more stress the participant felt when using technology. Then one-way ANOVAs were conducted to see if there were any significant differences in the mean scores of the stress levels of college students using technology.

To answer Research Questions Seven *"Are there any significant differences in the mean scores of the stress levels of college students caused by unavailability of technology for one day among those who own different number of technology devices?*", similar data coding and analysis procedure to Research Question Four was used. The participants' ratings regarding their stress level of using technology to the four questions were coded one through five as they were indicated in the Likert Scale. The mean score of each participant's answers to all four questions was calculated. The higher the mean score, the more stress the participant felt due to the lack of technology for one day. Then one-way ANOVA were conducted to see if there were any significant differences in the mean scores of the stress levels of college students caused by unavailability of technology for one day among those who own different number of technology devices.

RELIABILITY AND VALIDITY

After data collection, the authors computed a standardized Cronbach's alpha for the internal consistency among all the survey items, and the reliability was .714 for total survey. To increase content validity, expert appraisal of the survey instrument was sought. A three-member panel of experts in education and technology examined the face and content validity of the final version of the survey instrument. Their comments were incorporated into the discussion section of this paper. No additional pilot testing of the instrument was completed (Zhang, Fallon, & Russo, 2014; Fallon, Russo, & Zhang, 2014).

RESULTS

The authors reported the descriptive analyses results with the frequency and percentage of the survey items to answer Research Question One "How frequently do college students go online or use e-mails?" In addition, they conducted one-way Analysis of Variances (ANOVAs) to answer the rest of the Research Questions: (2) Is there any significant

difference in the mean scores of the relationship improvement of college students among those going online or using e-mails more or less frequently? (3) Is there any significant difference in the mean scores of the stress levels of college students among those going online or using e-mails more or less frequently? (4) Is there any significant difference in the mean scores of the stress levels of college students caused by unavailability of technology for one day among those going online or using e-mails more or less frequently? (5) Are there any significant differences in the mean scores of the relationship improvement of college students among those who own different number of technology devices? (6) Are there any significant differences in the mean scores of the stress levels of college students using technology among those who own different number of technology devices? (7) Are there any significant differences in the mean scores of the stress levels of college students caused by unavailability of technology for one day among those who own different number of technology devices?

DESCRIPTIVE ANALYSES FOR RESEARCH QUESTION ONE

Among 389 participants, the majority of the participants reported going online or using e-mails at least three times a day (n = 362, 92.8%). Among the technology devices of a desktop computer, laptop computer, cell phone, personal digital assistant (PDA), and/or television set, 178 participants reported to own three (45.6%), 128 owned four (32.8%), and 25 owned all five (6.4%). To sum up, the college students who participated in this study indicated different numbers regarding the possession of different technology devices, while the majority of them reported access and usage of internet/e-mails. Tables One and Two reported the descriptive analyses results for Research Question One.

Table 1. *Descriptive Analyses by Frequency of Going Online or Using E-mails, and Possession of Technology Devices*

Variable	Frequency n	Percentage (%)
Frequency of Going Online or Using E-mails		
Three times or more per day	362	92.8
Two times or less per day	27	6.9
Possession of Technology Devices (Desktop Computer, Laptop Computer, Cell Phone, TV at School, PDA)		
All five devices	25	6.4
Four devices	128	32.8
Three devices	178	45.6
Two or less	58	14.9

Table 2. *More Detailed Descriptive Analyses by Frequency of Going Online or Using E-mails, Possession of Technology Devices, Mean of Relationship Improvement, Mean of Stress Levels, and Mean of Stress Caused by Lack of Technology for one day*

Variables	Sum (N)	Mean	Standard Error	Standard Deviation
Frequency of Going Online or Using E-mails	389	1.93	.013	.254
Possession of Technology Devices	389	1.31	.041	.801
Mean of Relationship Improvement	389	2.28	.038	.747
Mean of Stress Levels In General	390	1.30	.014	.272
Mean of Stress Caused by Lack of Technology for one day	388	.323	.012	.227

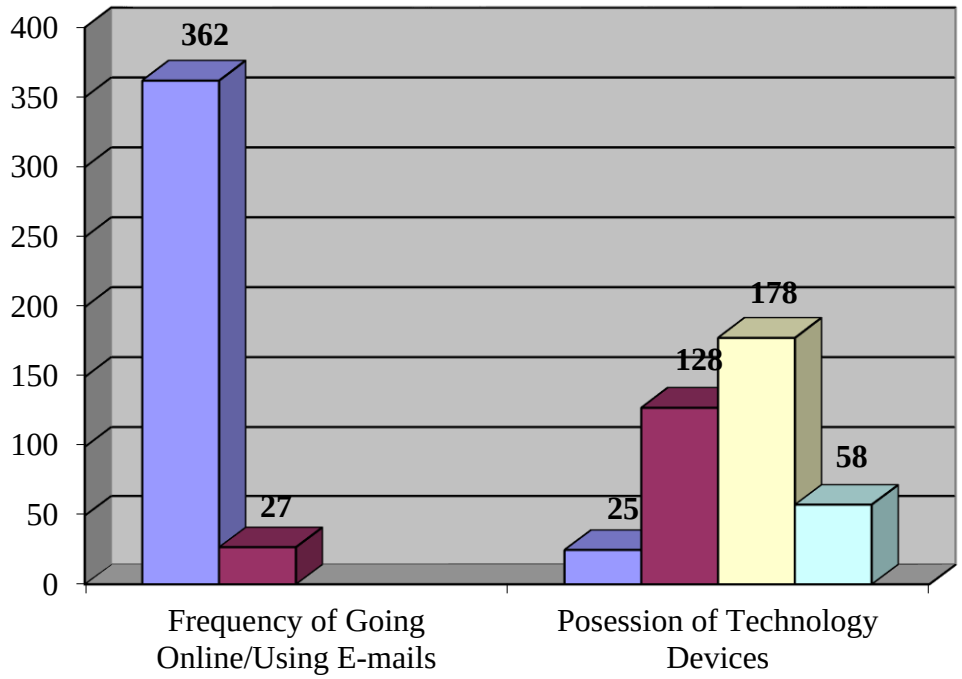

Figure 1. College Students' Frequency of Going Online/Using E-mails, and Possession of Technology Devices

INFERENTIAL ANALYSES FOR RESEARCH QUESTION TWO THROUGH SEVEN

The authors used one-way ANOVAs to investigate whether or not there was any significant difference in the mean scores of the relationship improvement, the stress levels of using technology, and the stress levels of college students caused by unavailability of technology for one day among those going online or using e-mails more or less frequently. Similarly, they used one-way ANOVAs to investigate whether or not there was any significant difference in the mean scores of the relationship improvement, the stress levels of using technology, and the stress levels of college students caused by unavailability of technology for one day among those who own different number of technology devices. A significant difference was found in the mean scores of relationship improvement and college students who went online or used e-mails at different frequency levels ($F_{(1, 387)}$ = 9.035**, p = .003). The more often the participants went online or sent e-mails, the more likely they felt the improvement of relationship. However, no significant differences were found in the other hypotheses for Research Questions Three, Four, Five, Six, and Seven. Table Three reported the inferential analyses results for Research Questions Two through Seven.

Table 3. *One-Way ANOVA Analyses in Mean of the Relationship Improvement, Stress Levels of Using Technology, and Stress Caused by One-Day Without Technology by the Frequency of Going Online/Using E-mails, and by the Possession of Technology Devices*

	Sum of Squares	df	Mean Square	F	Sig

By the Frequency of Going Online or Using E-mails						
Mean of Relationship Improvement	Between Groups	4.935	1	4.935	9.035**	.003
	Within Groups	211.396	387	.546		
	Total	216.331	388			
Mean of Stress of Using Technology	Between Groups	.020	1	.020	.284	.594
	Within Groups	27.763	387	.072		
	Total	27.784	388			
Mean of Stress Caused by One-Day Without Technology	Between Groups	.117	1	.117	2.275	.132
	Within Groups	19.888	386	.052		
	Total	20.006	387			
By the Possession of Technology Devices						
Mean of Relationship Improvement	Between Groups	1.346	3	.449	.803	.493
	Within Groups	214.986	385	.558		
	Total	216.331	388			
Mean of Stress of Using Technology	Between Groups	.541	3	.180	2.549	.055
	Within Groups	27.242	385	.071		
	Total	27.784	388			
Mean of Stress Caused by One-Day Without Technology	Between Groups	.296	3	.099	1.925	.125
	Within Groups	19.709	384	.051		
	Total	20.006	387			

Note: ** indicates that the mean difference is significant at the 0.01 level.

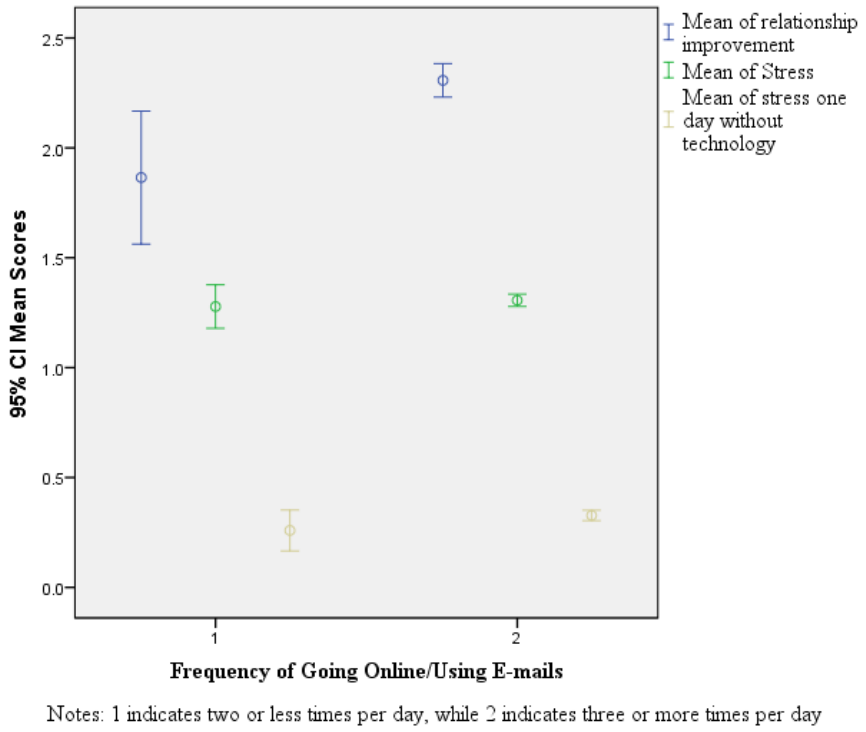

Figure 2. The Mean Scores of the Relationship Improvement, Stress of Using Technology, and Stress Caused by Lack of Technology for one day Based on the Frequency of Going Online/Using E-mails

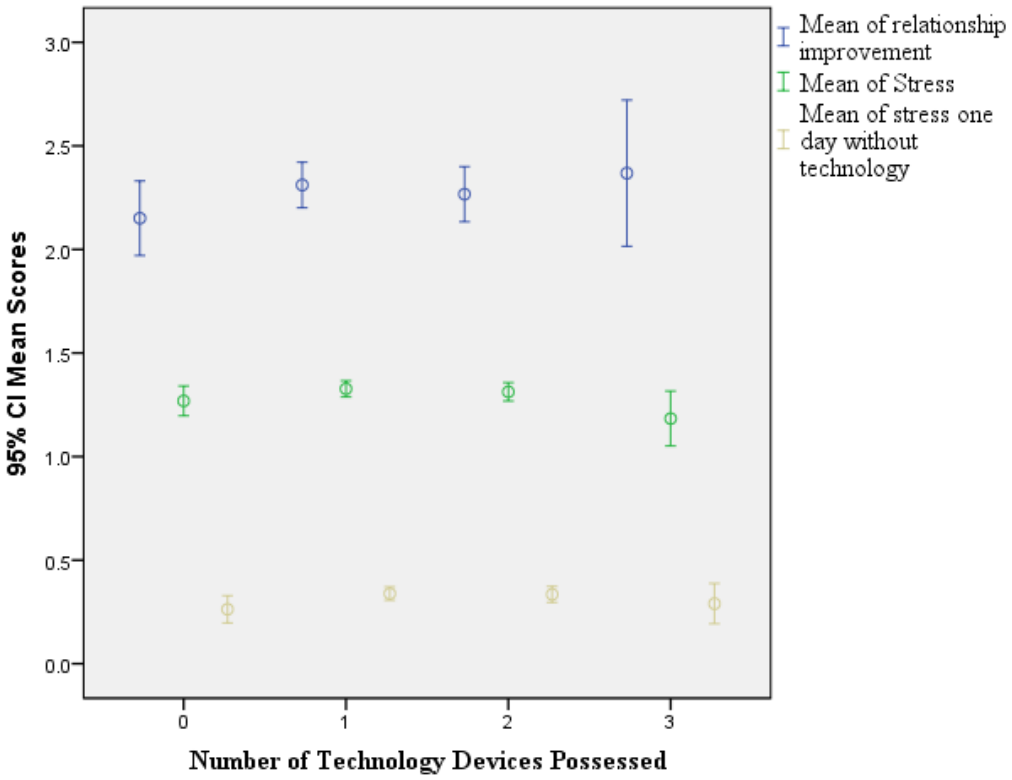

Figure 3. The Mean Scores of the Relationship Improvement, Stress of Using Technology, and Stress Caused by Lack of Technology for one day Based on the Number of Technology Devices Possessed

Due to the fact that no significant difference was found for Research Questions Three to Seven, the authors decided to conduct correlation coefficiency tests in order to explore more about the relationships between variables. They tried to find out whether or not the mean scores of the relationship improvement, stress levels of college students using technology, and stress caused by lack of technology for one day was correlated with the frequency of going online/using e-mails. Similarly, correlation coefficiency was also used to find out whether or not the mean scores of the relationship improvement, stress levels of college students using technology, and stress caused by lack of technology for one day was correlated with the number of technology devices they owned. Correlations were found between the mean scores of the relationship improvement and the frequency of college students went online or used e-mails (r = .15**, p = .003).

Table 4. *Correlation Analyses Between the Means of Relationship Improvement, Stress Levels of Using Technology, Stress Caused by Lack of Technology for one day and the Frequency of Going Online/Using E-mails or the Number of Technology Devices Owned*

Variable	*Mean Score of Relationship Improvement*	*Mean Score of the Stress Levels of Using Technology*	*Mean Score of Stress Caused by Lack of Technology for one day*

Frequency of Going Online/Using E-mails (3 or more times vs. 2 or less times per day)	Pearson Correlation	.151**	.027	.077
	Sig. (2-tailed)	.003	.594	.132
	N	389	389	388
Number of Technology Devices Owned (2 or Less, 3, 4, or 5)	Pearson Correlation	.047	-.036	.047
	Sig. (2-tailed)	.356	.480	.353
	N	389	389	388

Note: ** indicates that correlation is significant at the 0.01 level.

DISCUSSION

This was an exploratory survey of college students' perceptions of the negative impacts of technology upon their lives. This study is important because, while positive influences of technology have been both assumed and investigated, possible negative impacts have remained largely unexplored. This study was part of a previously unexplored larger study on use of technology in college students (Zhang, Russo, & Fallon, 2014). However, the negative aspects of technology use in that study were not previously analyzed. The results of this study may also be generalized to students and instructors at varying levels, from Kindergarten to post secondary. It is, however, particularly critical for college students and instructors alike to understand potential negative impacts of technology in order to create a positive learning environment in the classroom and online.

This was an exploratory survey of college students' feelings about technology, specifically if the participants experienced negative feelings about technology use in the college classroom. The research questions explored in this study were deciphered into six more narrowed-down questions: Are there any significant differences in the mean scores of relationship improvement, the stress levels of college students' usage of technology, and the stress levels caused by unavailability of technology for one day among those who went online or used e-mails at different frequency levels? Are there any significant differences in the mean scores of relationship improvement, the stress levels of college students' usage of technology, and the stress levels caused by unavailability of technology for one day among those who owned different number of technology devices.

LIMITATIONS

In order to fully understand the implication so of this study, it is important to review its limitations. The results of this study are limited in several ways. The first limitation is that all participants were volunteers and self reported their perceptions about technology use and impacts. Next, the participants were all college students and were primarily female. The results of this study might be different for younger students in Kindergarten-Grade 12 schools and for primarily male students. Several researchers have found significant differences in technology proficiency and usage based on gender (Baker, Lusk, & Neuhauser, 2012). Lastly, all the participants came from a single course at a northeastern university. A more diverse population from different schools, majors, countries, or regions might yield differing results (Zhang, Fallon, & Russo, 2014; Fallon, Russo, & Zhang, 2014).

CONCLUSIONS

College students today are digital natives and prolific users of technology. They have greater access to a variety of technology devices and applications than any previous generation. Much of the previous research on technology use had been focused on potential benefits and the positive impacts of technology on the user (Song et al., 2013). This current generation of college students is a fluent user of technology due to increased access to technology (Quan-Haase, 2008). Some anecdotal reports have hinted that not all users of technology are positively impacted. Yet little research has actually investigated if this frequent use of technology can lead to negative impacts such as anxiety, stress, or feelings of addiction.

Some researchers have suggested that perhaps technology activities can be addictive. One study (Harwood, Dooley, Scott, & Joiner, 2014) suggest that the Internet may allow an individual to develop a ‘‘virtual self’’ which allows them to escape their daily lives for a more enjoyable virtual life. However, such outcomes do not distinguish between technology use and level of involvement with technology. They (Harwood et al., 2014) concluded that it is vital to understand the costs of becoming involved with a technology that allows for use anytime. The results of our study suggest that researchers should focus more on self-reported feeling or perceptions of the user as a more accurate indicator of the impact of technology.

RECOMMENDATIONS

The results of this study suggest several recommendations for the instructors of college students whether the course is online, in person, or hybrid. The first recommendation is that instructors should conduct an in-depth review of their students' comfort levels (Zhang, Russo, & Fallon, 2014), analysis of learner skill levels in technology (Song et al., 2013), and their involvement with online activities (Harwood et al., 2014). Such an analysis of the learners within the classroom environment can inform the instructor in the best ways to construct the course in order to best meet the needs of all learners.

Many instructors are of a different age and have had different experiences with technology than their students. So, the second recommendation is that college instructors investigate the beliefs and actual practices of their students around technology use in their everyday life, asking them to be honest in sharing their concerns and feelings. Understanding those beliefs can help the instructor to bridge the potential gap between the personal beliefs of the instructor and the perceptions of the college students.

FUTURE RESEARCH

It is critical that future research is conducted to further explore the issues raised in this study. Researchers have assumed that the level of digital literacy is positively impacted when literacy is increased. However, the results of this study suggest that all learners may not perceive the benefits of technology use in the same way. Only when we untangle these issues will we fully understand the relationships among technology use, involvement, learning styles, and the relationships between digital literacy and personal beliefs and perceptions. Such research should also include an investigation into whether issues of diversity among students negatively impacts technology use. It is possible that issues of diversity in other sub-cultures lead to widely varying beliefs and perceptions about technology use and values of technology in users. Continued research in this area can only lead to positive classroom learning environments and enhanced social and academic experiences for all students.

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