DECISION SCIENCES INSTITUTE
The Relationship between Technostress Creators and Online Education among Students

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ABSTRACT

In this study, we examine technology related creators of stress in students taking online classes. We hypothesized that students enrolled in only online courses experience higher technostress than students enrolled in face-to-face only courses. The study involved a convenience sample of students at three regional state universities. The result of the analysis suggests that students enrolled in online only courses do experience higher technostress creators than their face-to-face peers, and that enrollment in online only courses explained 8.1 percent to the variance in the techno creator score.

Keywords: Online education, Technostress, Human-Computer Interaction

INTRODUCTION

Higher education has adopted online education as a component of its mission to provide access to higher education for all. Part of this adoption is driven by perceived student demand to have 24/7 access to course materials so that the student can complete their degree while also addressing other life issues such as work and family. Much of this adoption is the result of the introduction of technology based-learning management systems (LMS). Faculty members are encouraged to use LMS for online instruction and/or supplement the class with additional electronic content and in many cases, offer courses 100% online. For courses that are 100% online students may be expected, for each credit hour, to spend at least 3 hours online. Thus for a 3 credit course, a student could be expected to spend as many as 9 hours per week using some form of technology to successfully complete the course, and more depending on how the instructor grades the course. Prior studies suggest that the use of technology under certain circumstances can induce stress which is also referred to as "technostress."

Stress, broadly defined, is a situation "in which environmental demands, internal demands, or both, tax or exceed the adaptive resources of an individual, social system, or tissue system" (Keller et al, 2012). It is pervasive in today's society, with nearly a third of Americans rating their average stress levels as extreme. Research has shown that stressed people are subject to greater health risks and concomitantly, increased health care costs, as well as productivity losses greater than people with normal stress levels. Highly stressed individuals are at greater risk for multiple health conditions including cardiovascular disease, cancer, diabetes, depression and anxiety, fatigue, obesity, and musculoskeletal pain. (Wolever et al, 2012) Consequences of prolonged stress include adverse psychological and physical health effects, as well as an increased risk of premature mortality (Keller et al, 2012). People who suffer from technostress may also suffer from anxiety which include symptoms like irritability, headaches, nightmares, insomnia, technological rejection, and technological resistance (Tarafdar et al, 2007). The

effects of stress on well-being are so well recognized that U.S. Public Health officials have called for a reduction of stress since the 1970s (USPHS, 1979). Thus, if technostress increases stress in online students and a student enrolls in a fully online undergraduate program which could take many years to complete, then it is important that we understand what contributes to the creation of stress in the online learning environment and identify methods to mitigate it. And, as technology is being used a tool for efficient delivery of education, its use will become meaningless without student's continued interest in online education. In fact, a 2014 annual report by the Babson Survey Research Group "Grade Level: Tracking Online Education in the United States" reported online education grew at the slowest rate in more than a decade in Fall 2013. Part of the decline may be to a saturation of the market, or it could be because students are feeling a lack of satisfaction in online education, and part of it may be due experiences of higher levels of stress.

Much of the prior research in technostress has examined the work environment or the general environment, and focuses either on the general population or employees. No current study has examined and measured technostress in students, specifically in the online environment despite its rapid growth. In 2012, the percentage of institutions offering online courses and full programs were 72.9 percent for private for-profit colleges, 48.4 percent of private non-profit, and 70.6 percent of public college (Chin et al, 1997). Despite the slowdown in online education growth, the number of students taking online courses does continue to climb. According to "Grade Level: Tracking Online Education in the United States", an annual report by the Babson Survey Research Group about 5.3 million students took at least one online course in fall 2013, which is approximately 2% of the United States population.

LITERATURE REVIEW

Wang, et al (1995) defines technostress as a ''reflection of one's discomposure, fear, tenseness and anxiety when one is learning and using computer technology directly or indirectly that ultimately ends in psychological and emotional repulsion and prevents one from further learning or using computer technology.'' Technostress is a focus of IS research because researchers and employers are beginning to recognize that stress caused by the use or overuse of technology can lead to lower productivity by employees.

Lazarus' (1966) introduction of the transaction theory of stress from organizational psychology has formed the basis for much of the research and theoretical conceptualization of technostress. He suggests that it is a phenomenon that encapsulates relationships between strain and stress creators. Key aspects of the technostress phenomenon create stress because of information and communications technology use includes but is not limited to techno-overload, techno-complexity, techno-insecurity, techno-uncertainty and techno-invasion. (Ayyagari et al., 2011).

Walz (2012) examined the relationship between technology and stress to learn the stress related issues, to what extent "technostress" affect our personal lives and the consequences of too much technology use. Her results corroborated that the phenomenon known as "technostress" exists. Brod (1984), reported that employees at all levels of the organization experience some level of stress related to the use of information and computer technologies (ICT) at work. Other studies have shown that the type of techno-stress experienced vary and include data smog, multitasking madness, computer hassles, burnout, techno-addiction, and techno-strain (Salanova, et. al 2007; and Brillhart 2004).

Ragu-Nathan et al (2008) describes the different technostress creators as follows:

> "Techno-overload describes situations where information and communication technologies (ICTs) force users to work faster and longer. Techno-invasion describes the invasive effect of ICTs in situations where employees can be reached anytime and feel the need to be constantly connected, thus blurring work-related and personal contexts. Techno-complexity describes situations where the complexity associated with ICTs leads users to feel inadequate with regard to their computer skills and forces them to spend time and effort in learning and understanding ICTs. Techno-insecurity is associated with situations where users feel threatened about losing their jobs, either because of automation from ICTs or to other people who have a better understanding of ICTs. Techno-uncertainty refers to contexts where continuing ICT changes and upgrades unsettle users and create uncertainty so that they must constantly learn and educate themselves about new ICTs."

There have been studies that have examined technostress more specifically for particular groups, such as among librarians, because of rapid introduction of successive computer-based library cataloguing, retrieval and database systems such as LexisNexis (Van Fleet & Wallace, 2001). It showed that the pace of change of library and reference IS were key causes of technostress (Bartlett, 1995; Ennis et al, 2005). The strains were computer use-related anxiety, feelings of isolation and frustration, indifference to needs of library users and negative attitudes towards computer-based information sources (Kupersmith, 1992). Wang et al (2008) reported results from IS use in Chinese organizations found that levels of technostress creators are positively related to power centralization and an organization culture that encourages innovation. It also showed that higher dependence on IS for completion of routine work tasks and lower levels of computer self-efficacy were associated with higher levels of technostress creators (Shu et al ., 2011). Booker et al (2014) explored technostress in students and modified the existing survey to accommodate the learning environment to measure techno-stress in online students. Booker et al also found gender and age contributed to overall technostress in their study.

This study, however, focuses only on techno-creators. This particular focus is to determine if there are differences in experience with techno-creators for online only students as compared to face-to-face students, and to try to understand the external factors that influence the creation of stress for students enrolled in online only courses.

RESEARCH METHODOLOGY

The purpose of this study is to examine if taking online only classes increases technostress in students, specifically the subscale of technostress-creators, and if so, to determine how much of an increase, if that increase is significant, and factors that contribute to that differential. The hypothesis for the study was:

H1: There is no significant difference in techno-stress reported by students enrolled in face-to-face only courses and students enrolled in only online courses.

The instrument used was the subscale from the technostress measure created by Ragu-Nathan et al. (2008), and redesigned specifically for online students by Booker et al (2014). The items developed by Booker et al are shown in Table 1. Techno-stress structure for online students. Only the items for technostress creators are used in this study.

Technostress creators
Techno-overload
TSC_3—I am forced by this technology to work with very tight time schedules.
TSC_4—I am forced to change my study habits to adapt to new technologies.
TSC_5—I have a higher workload because of increased technology complexity.
TCS_6-I have a higher workload because of the online learning environment.
TSC_7-- I have to spend a lot of time everyday reading an overwhelming amount of e-mail messages.
TSC_8-- I have to spend a lot of time everyday reading an overwhelming amount of discussion board messages.
Techno-invasion
TSC_10—I have to sacrifice my vacation and weekend time to keep current on changes to the courses and learning environment.
TSC_11—I feel my personal life is being invaded by this learning environment.
TSC_13—I spend less time with my family due to this technology.∗
Techno-complexity
TSC_14—I do not find enough time to study and upgrade my technology skills to meet the needs of the program.
TSC_15—I find new students to this program know more about computer technology than I do.
TSC_16—I often find the learning tools too complex for me to understand and use effectively.
TSC_17—I do not know enough about this technology to complete my courses satisfactorily.
Techno-insecurity
TSC_20—I do not share my knowledge with my peers for fear of being accused of cheating.∗
TSC-21-I find younger students in this program know more about computer technology than I do.
TSC-23-I find younger students more easily adapt to changes in the learning environment.
TSC_24—I feel constant threat to my ability to complete the program due to new technologies.
Techno-uncertainty
TSC—26 I have to work harder because of delays from hardware, software and network problems.
TSC_27—There are always new developments in the technologies we use in our program.
TSC_28—There are constant changes in computer software in our program.
Technostress inhibitors
Literacy facilitation

TSI_1—Our program encourages knowledge sharing to help deal with new technology.∗
TSI_3—Our program provides end-user training before the introduction of new technology.
TSI_4—Our program fosters a good relationship between IT department and students.
TSI_5—Our program provides clear documentation to students on using new technologies.
TSI_6-Our program provides training to new students.
Technical support provision
TSI_7—Our end-user help desk is well staffed by knowledgeable individuals.
TSI_9—Our end-user help desk is responsive to end-user requests.
TSI_10—Our end-user help desk does a good job of answering questions about technology.∗
Involvement facilitation
TSI_12—Our students are consulted before introduction of new technology.
TSI_13—Our students are involved in technology change and/or implementation.
TSI_14—Our students are encouraged to try out new technologies.

Table 1. Techno-stress structure for online students

All statements were answered using a five-point Likert scale: from 1 ("strongly disagree") to 5 ("strongly agree") with a sixth option of "Not Applicable" or "I do not know" which was coded as 0. The responses were totaled for each usable response to provide a **Total Score**. The responses were divided into two groups – Online Only and Face-to-Face only. The means of the two groups were analyzed using Pearson's t-tests to determine if a significant difference exists between the online only and face-to-face only students. A regression analysis was performed to using Total Score as the dependent variable, and the following independent variables:

- Institution 1 (inst1) – the first of the three regional comprehensive universities to participate in the study; binary variable coded as 1 if the student attended the first of the three universities, 0 if not.
- Institution 2 (inst2) – the second of the three regional comprehensive universities to participate in the study; binary variable coded as 1 if the student attended the second of the three universities, 0 if not.
- White (white) – students who self-identified as white (NOTE: This could include Hispanics, Africans, and other immigrants who self-identify as white as well as international students who self-identify as white); binary variable coded as 1 if the student self-identified as white, 0 if not.
- Gender (gender) – students were allowed to select two options: I self-identify as Male and I do not self-identify as male; binary variable coded as 0 if the student self-identified as Male and 1 if not.
- First Language English (fle) – students whose primary language spoken at home is American English; binary variable coded as 1 if the student selected American English as the primary language spoken, 0 if not.
- Aged 23-30 (23-30) – students who are between the ages of 23 and 30;
- Aged 18-22 (18-22) – students who are between the ages of 18 and 22
- Enrolled Online only (online) – if student reported only taking classes online
- Average Hours worked per week (ahwpw) – number of hours student reported working, on average, per week
- Relationship status (rs) – 1 if the student had a live-in partner, 0 if not

- Family status (fs) – 0 if the student had at least one child, 0 if not
- Average hours per week spent recreationally online (ahpwsro) – number of hours student reported spending, on average, per week not related to completing school work or paid employment
- Junior (jr) – Junior level status of enrollment
- Senior (sr) – Senior level status of enrollment
- Freshman (fr) – Freshman level status of enrollment

The variables Institution 3, Aged over 30 and sophomore were used as control variables.

Data Collection
The data was collected from a convenience sample of students attending three regional comprehensive universities. Students were sent an email describing the nature and purpose of the study asking if they would be interested in participating and if so, to complete a Qualtrics survey. Students were informed that participation was voluntary and that their responses would be confidential to the researchers. A confirmation number was given to students for those instructors who incentivized their students to complete the survey by offering bonus points towards their final grade. All surveys were collected during the last two weeks of Fall 2015 semester. Students were asked demographic questions such as age, gender, ethnicity, primary language, number of hours per week student worked, number of courses enrolled, the number of online courses and the number of hybrid courses, and the number of courses that used any type of technology as part of the class. Students were also asked how much time they spent online for recreational purposes and how many hours per week the student worked. From a population of 37,528 we received 893 responses of which 571 were usable. This resulted in a usable response rate of 1.5%. Gender and Ethnicity demographics are given in Table 2.

Gender/Ethnicity	I Identify as Male	I Do Not Identify as Male	Total
I Identify as White	206	208	414
I Do Not Identify as White	78	79	157
Total	**284**	**287**	571

Table 2. Gender and Ethnicity

Of the sample, 457 spoke English as the first language, 282 were from the first institution, 158 from the second and 131 from the third. 150 of the respondents were seniors, 284 juniors, 73 sophomores and 64 were freshmen. 95 were aged 18-22, 416 were between 23 and 30, and the others were over 30. 227 of the students were enrolled in only face-to-face courses and 344 were enrolled in online only courses.

The descriptive statistics for the overall Total Score and for both groups of students are shown in Table 3. Descriptive Statistics. The average Total Score for the Face-to-Face students was lower than that of the Online students as expected. However, the overall average was closer to the Face-to-Face average than the Online average. The higher variance for the Face-to-Face group also suggest a wider range of responses. This is validated by the range which is 100 for the Face-to-Face students and 59 for the Online students.

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	Overall	Face-to-Face	Online
Average	48.24	33.54	70.52
Variance	893.4933	776.51	247.32
Maximum	100	100	100
Minimum	0	0	41
Range	100	100	59

Table 3. Descriptive Statistics

T-test Analysis

The t-test between groups was performed on Total Score. The result of the t-test is shown in Table 4. T-test results. As shown in the table, the scores showed a significant difference ($p<0.05$), suggesting there is a significant difference between the technostress creation of Online students and Face-to-Face students.

	Total Score
F	138.11
Sig.	0.00
t	-18.17
df	569.00
Mean Difference	-36.98

Table 4. T-test Results

The t-test result provided support to perform further analysis to understand how much the online only contribute to the difference as well as external variables that might contribute to higher technology related stress. Thus, a regression was conducted using Total Score as the dependent variable and the aforementioned independent variables.

Regression Analysis

A regression analysis was run to ascertain the variable contributions to the overall techno-creator score. The regression statistics are shown in Table 5: Regression Statistics Summary Data. The regression model had an R-square of .46 which indicates that the model explains some but not the majority of the factors that may influence a student's stress related to technology. However, the variables that are used do explain 46% of the score.

Regression Statistics	
Multiple R	0.68
R Square	0.46
Adjusted R Square	0.44
Standard Error	22.30
Observations	571

Table 5. Regression Statistics Summary Data

The variable contributions are shown in Table 7. Regression Model. The significant variables are bolded.

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	43.74	5.43	8.05	0.00	33.07	54.41	33.07	54.41
Inst1	-1.06	2.39	-0.44	0.66	-5.76	3.63	-5.76	3.63
Inst2	-2.25	2.66	-0.85	0.40	-7.47	2.97	-7.47	2.97
White	1.19	2.11	0.56	0.57	-2.96	5.34	-2.96	5.34
Gender	3.69	1.89	1.96	0.051	-0.02	7.39	-0.02	7.39
First Language English	**-15.23**	**3.45**	**-4.42**	**0.00**	-22.00	-8.46	-22.00	-8.46
18-22	-4.47	2.49	-1.80	0.07	-9.36	0.41	-9.36	0.41
23-30	5.53	4.28	1.29	0.20	-2.87	13.94	-2.87	13.94
online only	**29.08**	**2.14**	**13.56**	**0.00**	24.87	33.30	24.87	33.30
hours worked	2.01	2.00	1.00	0.32	-1.93	5.94	-1.93	5.94
average hour rec	-0.77	2.66	-0.29	0.77	-5.99	4.46	-5.99	4.46
relationship status	**5.92**	**2.03**	**2.92**	**0.00**	1.94	9.90	1.94	9.90
family status	**5.75**	**2.25**	**2.56**	**0.01**	1.34	10.17	1.34	10.17
Senior	0.43	2.96	0.14	0.89	-5.39	6.24	-5.39	6.24
Junior	3.03	3.21	0.95	0.35	-3.27	9.34	-3.27	9.34
Sophomore	0.11	3.87	0.03	0.98	-7.49	7.70	-7.49	7.70

Table 6. Regression Model

The variables **First Language English, Online Only, Relationship Status and Family Status** all had p-values of less than 0.05. Gender has a p-value of .051. If rounded it would also be significant which is consistent with the Booker et al (2014) results. But because the value is slightly over .05 we did not include it as a significant result for this particular dataset. This is partially due to the coding of Gender as self-identifying as Male or Not Male which is different from coding as Male/Female. Online Only contributes, on average, 29 points towards the techno-creator score. Committed relationships and children increase the score by 6 points each. However, speaking English as the primary language reduces the score by 15 points. English as first language is enough to mitigate the relationship and family status variables but not the online only variable.

DISCUSSION AND CONCLUSION

The purpose of this study was to determine of students in online only courses report higher techno-stress creation than students in face-to-face only. The study was conducted using a convenience sample of students at regional comprehensive institutions. Recall the hypothesis:

H1: There is no significant difference in techno-stress reported by students enrolled in face-to-face only courses and students enrolled in only online courses.

Based on the results of the t-test and the regression model, we reject the hypothesis that there is no significant difference in self-reported technostress creation between students taking online

only courses and students taking face-to-face only courses. We can also assume that for this population, age was not a factor in the higher level of techno-stress as was not the academic year in school. Gender could be considered marginally significant with a p-value = 0.051 but it was not highly correlated nor highly significant as a coefficient. First Language English and household variables were highly significant. The results suggest that we can improve online courses and potentially retention as well as reduce stress if we can offer courses in multiple languages. The two factors of relationship status and family status are two factors that cause students to be "place-based" and partially gave rise to the need for online education as a method of improving access to higher education. That these two factors are significant at a p-value of less than 0.05 is important in noting that while the online education environment is providing access, it may also be increasing negative health conditions for the populations that the online system is designed to serve.

The next step for this study is to examine the factors within techno-creation to determine if one or more factors influence the techno-creation score more than others. Additional analysis should be made regarding the number of courses taken online, the course design, and whether or not a faculty are officially trained in and use standards such as Quality Matters and the Online Consortium Pillars. Finally, further analysis should be conducted regarding gender, qualitative versus quantitative, and differences in major programs.

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