IT STUDENTS' AWARENESS OF THE NEGATIVE EFFECTS OF TECHNOLOGY

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ABSTRACT– The motivation for this study is that people often become victims of technology abuse and cybercrime and that they are not equipped to counteract the negative effects of technology. Many studies emphasize the benefits of using technology in our daily lives. Despite people's increased use of technology, specifically information technology (IT), there are insufficient educational efforts made regarding informing users of the dark side of technology. The dark side of technology entails all the negative side-effects of technology, such as plagiarism, information security threats, technostress, etc. In this paper, some of the main negative impacts that technology can have, are addressed. IT students' awareness regarding the negative effects of technology is assessed in this study. It was observed that some of these issues correlate with graduate attributes that need to be developed at university level. The study employed a survey where observations in a classroom and electronic questionnaires were used. The results indicated that the students lacked adequate knowledge regarding the dark side of technology. With this information in mind, a mobile app to educate users was developed, using the data extracted from the survey and the literature study. The fact that some students are not adequately educated about the dark side of technology can imply that there is a possibility that information technology users may become victims of cybercrimes, e.g. internet scams, or at the other hand become the perpetrators by misusing the technology intentionally or unknowingly. In educating the students regarding these matters and raising their awareness, graduate attributes, such as "responsible and engaged members of society" and others are addressed.

Keywords: Dark side of technology, IT use, awareness, cybercrime, university students.

INTRODUCTION

Information Technology (IT) is a core component of current society, and it has been exponentially growing over the past few decades. IT (and technology in the broader sense) has offered users a means to improve and effectively accomplish tasks, whether for work, education, or personal benefit (Porter, 2010). However, the implementation of information technology caused negative side-effects, such as cyber-related crimes which affect people of all age groups and all walks of life. These negative side-effects are referred to as the dark side of technology which can be unintentional or intentional.

With the world becoming more accustomed to IT-related problems, it has become unclear where the responsibility lies to address or reduce the impact of these problems. According to Siegle (2017), various IT mediums offer children and learners a vast number of opportunities to learn and to express themselves; however, it is up to the parents and educators to guide them in the correct manner to utilize these mediums appropriately.

Studies over time show the immense potential of IT, but are not addressing the dark side of technology adequately. The key issue, posed by Ran (2017), is that there are insufficiently effective education methods and efforts to teach the correct and safe way to use technology. The justification of the study to explore the dark side of technology and the awareness of IT students, has as basis the phenomenon that many people become prey of cybercrime and technology abuse or at the other hand become the offenders. Raising awareness of IT students - who are the workforce of the future - regarding negative effects of technology is a way to address unwanted consequences. In this way, the new generation may be better prepared to face these challenges in a proactive way.

The research questions raised in this project were: 1) How do IT students use technology in the classroom? And 2) To what extent are IT students aware of the negative effects of technology? The paper is structured as follows: In section 2, the background to the problem is given. The research methods are presented in section 3. In section 4, the survey is

discussed, while the results are presented in section 5. In the final section the paper is concluded.

BACKGROUND

The dark side of technology (focusing on information technology) has exponentially grown over the past few decades. Technology has without a doubt brought with it many potential benefits. From the innovation of the telephone, internet, mobile platforms, all the way to the creation of a rocket, technology has allowed people to achieve goals and missions which had not been possible a hundred years ago. According to the OECD (2015), in 2012, 96% of adolescents in the developed world had already access to a technological device which is an astounding increase compared to the 56.3% of the previous ten years. This also implies that the number of negative technology-related problems has also risen.

There are several types of effects on people using IT. Each type of effect may impact individuals differently, depending on who they are and what they were using the technology for. The groups may be employees, students and individuals. This paper focuses on students.

Effect of technology on students in an educational environment

Students are required to use technology extensively for academic purposes. Many universities and schools benefit from using technology in education; however, they also experience a dark side to which technology has contributed. In this section of the study, some of the issues that the dark side technology has brought to students and the educational environment are discussed.

Benefits of technology in education

Technology can be a wonderful platform for students, especially when used for academic activities. Technology brings many benefits to teaching, communicating, and learning among educators and students through e-learning and other online platforms. E-learning is the general coverage of the range of applications, learning methods, and processes used for information exchange and communication with a purpose to enable access to learning/teaching (Arkorful & Abaidoo, 2015). Educators use e-learning to share resources or as a "wholly online" tool, as used in cyberschools.

According to Nguyen et al. (2015), using technologies during class, especially the practical modules, allows students to get to see and use actual data made available by society and companies (e.g. patient data for health students). This means that students can quickly and easily obtain study-related data in vast quantities. It is also indicated that students can learn through distance-learning and therefore they are not bound by a physical location.

Negative effects of technology and the impact on students

Students are a large group of the population that interacts with technological devices on a daily basis. Students use technology to access their resources, upload their assignments, and most commonly, get help and information from the internet. Mobile phones and other handheld devices are popular mediums of technology used by students on a daily basis. This implies that technology can be used consistently and at all times. A few possible negative impacts of technology are discussed in the following sections.

   a) Plagiarism

Technology platforms may enable people to share online content such as jokes, ideas or artwork and reposting are taking place very often. The boundaries of what may be reused as own work or not, may become unclear and authorship of work "*is not held in high regard*" by students (Taras, 2017). Therefor it is observed that plagiarism is increasingly practiced and seen as acceptable. When students use other resources, specifically the internet without the proper ethical considerations, they can be guilty of plagiarism. According to Merriam-Webster (2018), plagiarism is defined as the act of stealing someone's ideas, words, or work and representing it as if it were that person's original work (to commit literary theft) and

usually these individuals do not indicate or acknowledge the original author. With the development of the internet, literally thousands and thousands of solutions to assignments have been made available and the act of plagiarizing has become much easier in comparison to previous decades. Students need to be educated to consider plagiarism as cheating, and thus, need to learn to use and reference sources correctly.

b) Smombies and technology addiction

The term smombie originated in Germany in 2015 (Chatfield, 2016) and is derived from the phrase "smartphone zombie". It refers to the people who constantly view their smartphones while walking, resulting in strolling pedestrians who do not check the road for safety. In 2015, this term was not taken as seriously as in the following year. On 6 July 2016, the game Pokémon created a sequel game called "Pokémon GO". The game uses players' real locations via GPS and has players going out into their towns to catch Pokémons which are located all around their town, country, or in the world.

According to Scanlon and Neumann (2002), Pokémon GO has caused around twelve thousand accidents which have been reported to the police in Tippecanoe Country of Indiana alone. Students were often found to have missed classes to play Pokémon GO and/or were found to be casually playing it during classes.

Smombies are also caused by the constant messages and notifications on mobile devices, specifically smartphones. Addiction can set in. By having this compulsive addiction towards technology, students commonly have their smartphones on their desks during classes, tempted to use them.

c) Cyberbullying

In addition to the traditional bullying where the bullies physically hurt their victims, there is also cyberbullying. Cyberbullying is defined as a type of violence which occurs with the use of computers or cell phones (Wang, et al., 2009). Cyberbullying occurs regardless of gender and age; however, studies have shown that it is most prevalent amongst adolescents (Wang, et al., 2009). It is further stated that more boys were involved in direct bullying, whereas more girls were involved in indirect bullying. However, when it comes to cyberbullying (also known as electronic bullying or internet bullying) gender or age differences are irrelevant.

d) Isolation, unproductiveness and technology engagement

E-learning is a term that is used to describe a range of applications, learning methods, and processes used for information and resource exchange along with communication, all with the purpose of enabling access to learning/teaching which contributes to meaningful learning (Arkorful & Abaidoo, 2015). Unfortunately, the use of e-learning environments as well as other online platforms may restrict social interaction and this may lead to a sense of remoteness. The students require therefore a high-level of self-control and discipline to complete tasks (Arkorful & Abaidoo, 2015). This in turn may lead to isolation, procrastination and unproductiveness. Siegle (2017) suggests that students should sign a pledge to state that all technology use in class is solely for the purpose of class content, to respect other students while using technology, and to train them in ethical methods of using technologies in an educational environment. This young generation is the one that grew up using technology and is most likely to possess a personal device which is used on a regular basis. The implication is, therefore, that there is and increased risk of excessive human-machine interaction that may lead to the addiction to technology (Ali, 2018).

There are many other negative impacts of technology such as technostress (Salanova et al., 2013), phishing, loss of money (Morse, 2017), fake news, use of duplicate passwords (Okyle 2015), integrity of information, privacy violations, etc. (D'Arcy et al., 2014; Holland & Bardoel, 2016). Space restricts further discussion.

Solutions and recommendations

The biggest problem with the use of technology is undoubtedly the people behind it. All technology users should attempt to learn about the negative effects that technology may cause so that they do not become victims or become the perpetrators. It is recommended that companies, organizations, and schools should implement rules or regulations and policies regarding the respectful and ethical use of technology in the workplace, academic environment, and in communication, as well as towards fellow-users (Porter, 2010). It is also suggested that IT teams should implement strong security measures to protect data physically and internally. Konradt et al. (2018) conducted a study regarding "phishing" as a method of committing cybercrime by perpetrators and the economic analysis thereof. Countermeasures should be investigated to cope with these economic losses. Awareness and education regarding cybercrime and the negative impact of technology is therefore of utmost importance.

METHODS USED

The survey conducted in this project consisted of an electronic questionnaire and observation sessions in two first-year IT student classes. Questionnaires were considered to be the most effective way to get feedback from the students – with the added benefit of collecting the data electronically and therefor no additional data entry was necessary. The sample size of the respondents for the questionnaire was 80 first-year students and the sample size of the observations was 62 first-year students. Observation was deemed to be the best way to unobtrusively determine how the students were interacting with and using the technology during class. Basic statistical tests were performed to ensure the validity of the data, along with its accuracy and reliability. The questionnaire comprised a demographics section with five questions, a technology device usage in daily-life section with five questions, a technology-use in education section with seven questions, two perception questions, three knowledge questions, three behavior questions and two previous experience of the dark side of technology questions. The questions were split into three major categories of "Perception", "Knowledge", and "Behavior". There was an additional question asking the respondents about how well they think they know the negative effects of technology in order to get an indication of the students' awareness levels. After analyzing the data, it was seen that the students lacked adequate knowledge regarding the dark side of technology. With this information in mind, a mobile app to educate users was developed, using this data extracted from the survey and the literature study. (This is not discussed further in this paper).

RESULTS AND DISCUSSION

Observation

The aim of the observation was to get insight into what the students were doing during a class session and how they used technology as part of their classroom activities. Two classes in a computer laboratory were observed. The classes consist of BSc students in IT and BCom students, both on first-year level. Table 1 presents an overview of the observation data.

Table 1:   Overview of observation data of first-year students in computer lab

Reason for being in class	# Students				
Practical	46	74%			
Not official	16	26%			
	62				
Devices use for other uses			**Applications - not official use in class**		
Smartphone	19	41%	Movies/music/YouTube	13	28%
Computer	22	48%	Games/Facebook/9Gag/WA	16	35%
Tablet	1	2%	Other Homework	13	28%
Laptop	4	9%	Taking pictures of homework	4	9%
	46			**46**	

62 students were observed in a computer lab. Observation was carried out in an unobtrusive way and tabulated in an Excel file, using a table consisting of columns as follows:

Module name, official or unofficial participant, designated use of IT device, specific device used and other reason used.

46 students were module members while 16 other students also went into the computer lab during the class sessions. 41% of devices used for other reasons than class was smartphones. Computers were used 48% of the time for other uses. The applications the students used the devices for were mostly games/Facebook/WhatsApp – 35%. 28% of uses was for downloading movies, listening to music or watching YouTube. 13 students were not officially part of the class, but were doing other homework. The students were, therefore indeed using technology devices in the classroom either for their practical class or for other reasons as indicated, including for academic work.

Questionnaire

The questionnaire was developed and distributed through Google Forms to the first-year students along with the permission of and assistance from first-year lecturers. The questionnaire focused on obtaining information regarding on how well students thought they knew the dark side of technology compared to how well they actually did. Therefore, the questions were designed to be asked in types, such as questions of perception (i.e. "Do you think you can be a victim of internet scams?"), knowledge (i.e. "What is spam?"), and behavior (i.e. "I often use my smartphone during lectures for non-academic activities). Data collected from the questionnaires were exported by Google Forms to a Microsoft Excel sheet.

Once data was collected, recoded and organized, the result sets were taken to the Statistical Consultation Services. The data were analyzed with statistical software called SPSS version 25. To ensure for significance in the statistics, all relations between the relevant questions were tested to ensure that the Cronbach Alpha was near 0.5 or higher (as the sample size was relevantly small, it was suggested that 0.5 was adequate) for reliability. For the factor of "the use of mobile devices in education" the Cronbach Alpha was 0.564. In addition, it was ensured that the inter-item correlation was between 0.15 and 0.55.

With the reliability test certain, it was possible to carry out the correlation test between the questions and their relations. The main groups which were tested for statistical significance were the device use (such as how often users use technology everyday) and for educational use (such as whether students used technology for academic-purposes). Each correlation between the groups ensured that the data were significant at a level of 0.01(**) or level 0.05(*), as well as for the correlation value to be between 0.2 and 0.5 (it was suggested that since the data set was collected from people and not machines, meaning that responses varied from person-to-person, a correlation value of 0.2 to 0.5 was adequate enough to accept as statistically significant).

After the reliability test, the T-test and ANOVA test were conducted. The T-test examined whether the correlation of the reliability test showed different results in respect of the different demographical groups, e.g. language and gender for two categories. If there were more than two categories, then the ANOVA test was done. The p-value (a calculated probability value) had to be below 0.05 to be statistically significant. However, since the sample size and the questionnaire itself were small, there were no significant statistical differences between the different genders or language groupings.

DISCUSSION

It was decided to report on simple frequencies from the questionnaire and scoring of the students concerning their perception, knowledge, and behavior on the dark side of technology issues.

The scores in Figure 1 indicate that 64% (51) of the 80 students state that they feel they know the technological dangers well. The right side of the figure presents the three categories of questions with the scores of the students for each category of questions.
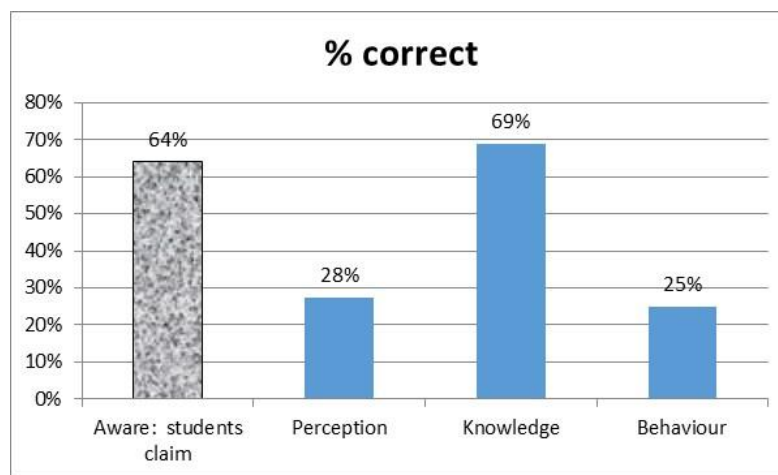
Figure 1: **Frequencies from the data**

The students' overall knowledge of the dark side of technology issues seems not to be too negative (69% of students answered the knowledge questions correctly). However, all these students were sitting in an IT class and one would have thought that they would have achieved a higher score. Only 25% of students could give correct answers in the behavior category, indicating that although it seems they know the dangers well and have a high individual perception of IT security awareness, this is not the case. For the perception category, only 28% of the students could achieve an overall positive awareness score for those questions. Therefore the students may need more guidance in this respect.

Table 2 presents examples of questions from each category of the questionnaire.

Table 2: **Examples of the categories of questions**

Awareness category	# Students having most questions in the category correct	Example
Perception	22 - 28%	*"On a scale of 1 to 5, how well do you think you know the negative side effects of technology use?"*
Knowledge	51 - 69%	*"What is a computer virus?"*
Behavior	20 - 25%	*"You have to do a homework report due in 30 minutes. You find another person's assignment on Course Hero (and it is indicated that the answers are 100% correct). What would you do to complete your homework?"*

It can be observed that the students did not do so well when assessing their awareness of the dark side of technology issues. Specific questions are shown in Table 3.

Table 3:   **Examples of responses to individual questions**

Question	# students	%
I procrastinate tasks due to technology (e.g. because you want to watch a video)	36	45%
I often use my smartphone during lectures for non-academic related stuff	25	31%
I often sleep late because of technology in my room	45	56%
I often text/message someone who is physically close to me (e.g. within your house or hostel)	27	34%
Do you think you can be a victim to internet scams? (Yes…)	34	43%

Only certain results are given in this paper. It is seen that although it was IT students participating in this project, their use of technology and awareness of issues concerning the negative effects of technology may need attention with training programs and other awareness efforts. It would appear that students mix their academic functions and online social activities which may imply that their academic performance can be negatively impacted.

CONCLUSIONS

In this paper, insights gained from a project that investigated the use of technology by IT students and their awareness of the negative effects or dark side of technology were presented. The ultimate aim was to assess and raise the students' awareness in order to prepare them for the challenges regarding cybercrime – not to become prey to cybercrime, nor to become the perpetrators thereof.

Education is vital in preventing users from becoming victim to these exploitations and in doing so prepare the students to proactively cope with these challenges in the cyber world. A follow-up study as future work could include more student groups from all year levels, thereby allowing comparisons between groups as well.

REFERENCES

Ali, S. (2018). Could you be addicted to technology? *Psychology Today*. Retrieved from https://www.psychologytoday.com/intl/blog/modern-mentality/201802/could-you-be-addicted-technology

Arkorful, V., & Abaidoo, N. (2015). The role of e-learning, advantages and disadvantages of its adoption in higher education. *International Journal of Instructional Technology and Distance Learning*, 12(1):29-42.

Chatfield, T. (2016). *The new words that expose our smartphone obsessions. BBC Future*. Retrieved from http://www.bbc.com/future/story/20161129-the-new-words-that-reveal-how-tech-has-changed-us.

D'Arcy, J., Gupta, A., Tarafdar, M., & Turel, O. (2014). Reflecting on the "Dark Side" of Information Technology Use. *Communication of the Association for Information Systems*, 35(5):109-118.

Holland, P., & Bardoel, A. (2016). The impact of technology on work in the twenty-first century: Exploring the smart and the dark side. *The International Journal of Human Resource Management*, 27(21), 2579–2581.

Konradt, C., Schilling, A., & Werners, B. (2016). Phishing: An economic analysis of cybercrime perpetrators. *Computers & Security*, (58): 39-46.

Merriam-Webster. (2018). *Plagiarism*. Retrieved from https://www.merriam-webster.com/dictionary/plagiarism

Morse, S. (2017). *The Negative Effects of Hackers*. Retrieved from https://itstillworks.com/negative-effects-hackers-2867.html

Nguyen, L., Barton, S.M., & Nguyen, L.T. (2015). iPads in higher education—Hype and hope. *British Journal of Educational Technology*, 46(1):190-203.

OECD. (2015). *New approach needed to deliver on technology's potential in schools*. Retrieved from http://www.oecd.org/education/new-approach-needed-to-deliver-on-technologys-potential-in-schools.htm

Okyle, C. (2015). *Password statistics: The bad, the worse and the ugly (Infographic)*. Retrieved from https://www.entrepreneur.com/article/246902

Porter, G. (2010). Alleviating the "dark side" of smart phone use. In: *Technology and Society* (ISTAS), IEEE International Symposium. June 7-9. Rutgers Conference Publications. pp. 435-440.

Ran, B. (2013). *The Dark Side of Technological Innovation*: IAP.

Salanova, M., Llorens, S., & Cifre, E. (2013). The dark side of technologies: Technostress among users of information and communication technologies. *International Journal of Psychology*, 48(3):422-436.

Scanlon, P.M., & Neumann, D.R. (2002). Internet plagiarism among college students. *Journal of College Student Development*, 43(3):374-385.

Siegle, D. (2017). Technology: The dark side of using technology. *Gifted Child Today*, 40(4):232-235.

Taras, V. (2017). *How social media encourages plagiarism (and six ways you can fight it)*. Retrieved from https://www.edsurge.com/news/2017-11-13-how-social-media-encourages-plagiarism-and-six-ways-you-can-fight-it

Wang, J., Iannotti, R.J., & Nansel, T.R. (2009). School bullying among adolescents in the United States: Physical, verbal, relational, and cyber. *Journal of Adolescent health*, 45(4):368-375.