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Problematic internet use and academic achievement among teacher-trainees in Israeli colleges

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Abstract

Digital technology has penetrated all aspects of modern culture, and it has been purported revolutionize education. However, a growing concern alludes to subtle adverse effects it may have on learning outcomes. The current work studied the association between problematic Internet use (PIU) and academic achievements among pre-service teacher trainee students (N=138) from two educational colleges in Israel. A significant interaction effect for PIU and gender was observed on students' grades, while holding four demographic variables as covariate. These results indicate an underlying behavioral phenomenon with unique relevance in an educational context.

Keywords: internet use; academic achievement; learning difficulties; behavior

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1. Introduction

The 21st century has hailed in a new era of digital technology in the lives of people of all ages. Penetration of high-speed Internet access has increased almost exponentially during the last two decades driving a cultural change where billions of people conduct day-to-day activities in cyberspace (Odlyzko, 2003). In many countries, digital technology has redefined many aspects of life: work and career, social interaction, rest and relaxation. This trend has been driven by the falling costs of cellular wireless services and hardware (Diamandis & Kotler, 2012). In developed nations, diffusion of these technologies has saturated. Adoption rates of 97% in Taiwan, for example (Chen, Hsiao, Chern, & Chen, 2014) and, in the US, more than 70% of the population spent 5.2 hours online (U.S. Census Bureau, 2013). Israel is also one of the global leaders in these trends with 4.5 million users, constituting 77% of households, who have high-speed internet access. Cellphone penetration in Israel has reached 99.8% of adults, while 57% of those own smartphones with 25% of those connected to cellular networks (Organization for Economic Cooperation and Development, 2011). Even so, today nearly all schools have adopted high-speed internet access. In other words, people now spend almost all of their time interacting with digital technology (Newell, Pilotta, & Thomas, 2008).

There are many perceived benefits that are associated with ubiquitous Internet access. Instantaneous search of online databases of information, social and entertainment media are powerful and alluring tools accessible only through the Internet. The always-online "Digital Natives", especially, are immersed in an information rich environment. The content found online is also engaging the academic world - students, teachers and lecturers and scientists - even accounting for substantial institutional barriers (Schneckenberg, 2010). There are pervading pedagogical and economical imperatives to implement such technologies in order to teach these students and imbue them with so-called 21st century skills, now consolidated into the "4 C's" - Communication, Collaboration, Creativity and Critical Thinking (Voogt, Erstad, Dede, & Mishra, 2013). Proponents of constructivist learning techniques have embraced these technologies for student-based self-learning and cooperative acquisition of knowledge (Huffman, Goldberg, & Michlin, 2003). Indeed, recent studies have tracked the connection between Internet use for academic purposes (research, reading, learning) and academic achievement, both qualitatively and quantitatively (Zhu, Chen, Chen, & Chern, 2011; Cheung & Huang, 2006; Kumar & Sampath, 2013). This hints at the positive effects of these online activities among students (Chen et al., 2014).

However, a growing body of knowledge has accumulated relating to problems associated with excessive Internet use, such as depression, generalized and social anxieties, attention disorders, pathological personality traits and obsessive behaviors (Weinstein & Lejoyeux, 2010; Koc, 2011; Huang, Wang, Qian, Zhong, & Tao, 2007; Kuss, Griffiths, & Binder, 2013). Researchers and practitioners have cautioned as to the possible psychological risks and addictive potential of excessive internet exposure among students (Young, 1996, 1998). Adolescents are at higher risk of developing such symptoms, with 4-10% of students suffering from a definitive compulsion brought on by internet use (Chou, Condron, & Belland, 2005; Czincz & Hechanova, 2009). Excessive and compulsive Internet use and gambling pathology may share similar etiologies, especially in the paucity of substance abuse (Brezing, Derevensky, & Potenza, 2010).

Successful pharmacological treatment of this condition targeting the reward system has been shown to be beneficial and attests to the underlying pathophysiology shared with other addictions (Yuan, Qin, Liu, & Tian, 2011). Also, a number of neuroimaging studies have systematically demonstrated molecular (decreased dopaminergic activity), neuroadaptive (structural changes in the brain) and cognitive (behaviors constricted to similar areas in the brain) correlates showing a striking resemblance to behavioral and substance addiction (Kuss and Griffins, 2012). Even so, and in the context of heated debated whether to include Internet Addiction in the

DSM-V, a set of criteria for elucidating these symptoms has yet to be compiled and adopted by the scientific community (Oxford Handbook of Media Psychology). The disputation revolves around the question: Does Internet Addiction represents a manifestation of an underlying pathology, or does it constitute a distinct disease (Pies, 2009; Widyanto & Griffiths, 2006). In any case, this has been onerous for detection, diagnosis and treatment of a potentially devastating syndrome.

To date, a not insignificant amount of empirical evidence shows the detrimental effects of this phenomenon among adults and adolescents. Chen and Peng (2008) showed in a large sample of 49,609 students in 156 universities that intensive internet use may be a risk factor in the development of a number of psychiatric disorders, as well as, impairing social functioning. They compared two categories of internet use. “Heavy users” were at higher risk of developing depressive symptoms, elicited higher morbidity and were more introverted, as compared with “light users”. Even though the nature of this phenomenon is still not fully elucidated, these findings are consistent with a series of studies, spanning inter- and intercultural differences, relating immoderate internet usage and addictive psychiatric symptoms, such as depression, somatization, neuroticism, compulsive behavior and anxieties (Young, 1996, 1998; Koc, 2011; Huang et al., 2007; Kuss, Griffiths, & Binder, 2013).

The American Pediatrics Association has advised strict curtailing of exposure of children and adolescents to interaction with screen-based technologies (AAP, 2013). And it seems that digital technology interfaces with our central nervous system in radically different ways than previous technologies (Carr, 2010), learning or otherwise. Although there is, yet, no reliable and valid diagnostic category for this phenomenon, undoubtedly, research is imperative into this behavioral phenomenon, and it seems that effects of constant use of technology have yet to be sufficiently elucidated.

A connection between internet use as the existential proxy of pervasive digital technologies (the rest are platforms for information access) and academic achievement has already been demonstrated by a number of researchers. Adverse educational outcomes have been shown to be related with problematic internet use among adolescent and mature students. Stavropoulos, Alexandraki, and Motti-Stefanidi (2013), for example, found significant differences in academic achievement between internet-addiction and non-internet addiction groups among pupils in Greek schools. Whereas boys were found to be at higher risk of adopting internet addictive behavior (i.e., scoring higher on the Internet Addiction Test (IAT scale) within the study, the negative effect of an addictive internet use on academic performance was observed only for the female students. They also reported a cultural context of the phenomenon, as adolescent students from urban areas exhibit a greater risk with respect to internet addictive behavior as compared to students from rural areas. Other recent related studies tracking mature students are generally consistent with these findings, showing a link between various problematic internet uses and poor academic functioning, perceptions and achievements (Kirschner & Karpinski, 2010; Kormas, Critselis, Janikian, Kafetzis, & Tsitsika, 2011; Odaci, 2011; Derbyshire et al., 2013). Some of them strongly support the relevance of the aforesaid demographic variables in affecting internet problematic behavior and regulating its relationship with academic achievement.

Here we focus on the connection between problematic internet use and academic achievement among teacher-trainee students, in recognition of their significant future educational role in shaping children's internet behavior. As far as we know, most of the studies in this field have not exclusively considered this unique group. Accordingly, three main questions were addressed as part of the current study:

- Are there gender differences in problematic internet use (PIU) among teacher-trainees students?
- How is PIU associated with academic achievement among teacher-trainee students?
- Do students' gender and PIU effects interact with regard to academic achievements?

2. Method

2.1 Procedure and Participants

Data were collected from 138 pre-service teacher students from two teacher-trainee academic colleges in Northern Israel - 43 male and 95 female, with overall mean age of 26.03 (SD=6.37). Most of the responders were single (n=90, 65.2%) with the remainder either married or married with at least one child (n=48, 34.8%). The sample included respondents of different academic levels: pre-academic studies (n=42, 30.7%), undergraduates (n=82, 59.9%) and graduate students (n=13, 9.5%). The cohort was an ethnically heterogeneous (95 Jews, 25 Muslims and 17 Druze) representing a population with a high variance among them. One respondent did not report his academic status and one respondent did not report his ethnicity. As part of data collection, participants were asked to complete an online questionnaire which was administered anonymously. This allowed them the freedom of choosing whether to take part in the study and guaranteeing the privacy of their information. The purpose of the study and specific instructions were explained to the respondents as part of the instructions on the forms.

2.2 Measures

Problematic Internet Use (PIU) - Due to the ambiguity of this set of symptoms a number of terms have been coined: “Internet Addiction”, “Internet Dependency”, ”Pathological Internet Use” and “Problematic Internet Usage” (Davis, 2001). Since the terminology for the phenomenon tested here is still debated, based on Moreno et al. (Moreno, Jelenchick, Cox, Young, & Christakis, 2011), we adopt the latter term for the rest of this report. Similar to many studies, we measured Problematic Internet Use using Young’s Internet Addiction Test (IAT: Young, 1998), based on a 5-point Likert scale (from ‘rarely’ to ‘always’). The scale consists of 20 self-reporting items, generally measuring the magnitude of one’s compulsive internet use and its impact on his/her life (e.g., “How often do you block out disturbing thoughts about your life with soothing thoughts of the Internet?”). The scale’s total score ranges between 20 to 100, with a cut-off point score of 50 regarded as the lower bound indicator for problematic internet behavior (Yoo et al., 2004).

According to this definition, we observed a problematic internet use group (IAT≥50, n=29), and an Internet non-problematic use group (IAT<50, n=108). The original test was validated via a group differences criterion (Young, 1998). It has also been tested for a variety of populations in wide geographic distributions (Frangos, Frangos, & Sotiroplulos, 2012). The Hebrew-translated version used for the current study yielded a high internal-consistency reliability indication (α=0.95). The scores of this scale obtained for the groups of the study are reported in Table 1. For the purposes of the present study we also utilized a separated item that quantifies the extent to which the participant uses the internet (“please assess the amount of hours you use the internet for leisure purposes”). This item was treated as a different variable and was not calculated as part of the IAT score.

Academic Achievements - In order to assess the participants' grades in the academic colleges of education, they were asked to report their overall average grade during the recent academic semester (e.g., "Please evaluate your final average grade in the last semester"). The respondents were given on four levels ordinal scale, ranging from 'between 50-60' to 'between 90-100'. The scores for this scale are reported in Table 1.

3. Results

3.1 Preliminary analyses

First, we examined the effects of the relevant demographic variables (gender, ethnicity, marital status, academic status) on academic achievement and internet addiction scale (IAT) total scores, using multivariate analysis of variance (MANOVA). Means and standard errors for these variables are presented in Table 1. The

results showed a significant main effect for ethnicity on PIU scores ($F(2,87)=3.86$, $p<.05$). With respect to the PIU variable, it also obtained a main effect for students' gender, whereby males scored significantly higher on this scale compare to females ($F(1,87)=3.23$, $p<.05$). In addition, student's marital status had significant main effect ($F(2,87)=3.81$, $p<.005$) and interaction effect with student's gender ($F(2,87)=4.96$, $p<.001$) on academic achievements. This interaction effect indicates that the average grades of married female students in the sample are significantly higher than that of married male students.

Further, we tested the zero-order correlations between the quantitative variables measured in the study, and found negative association between the students' age and their academic achievement ($r=-.38$, $p<.001$) and their PIU scores ($r=-.27$, $p<.005$). In the general sample a significant negative correlation was also revealed between problematic internet usage (PIU) and academic achievements ($r=-.38$, $p<.001$) and a positive correlation between PIU and amount of internet use ($r=.44$, $p<.001$). This moderate correlation alongside the fact that the amount of internet use was not significantly correlated with the students' academic achievements ($r=-.13$, $p>.05$), Strengthen the assumption that the internet addiction scale (IAT) encompasses a domain of problematic internet use which is above and beyond merely excessive amount of internet use.

Table 1

Means of IAT & academic grades by gender ethnicity marital status & academic status

Fixed Effect		IAT Mean	S.E.	Average Grade	S.E.
Gender	Male	48.90	2.61	85.24	1.31
	Female	35.86	2.04	88.29	1.03
Ethnicity	Jews	34.12	2.04	87.68	1.02
	Druze	47.85	3.91	89.00	1.96
	Muslims	51.84	3.34	83.40	1.68
Marital Status	Single	44.78	2.15	86.64	1.08
	Married	41.70	2.96	85.82	1.49
	Married +	32.61	3.96	90.00	1.99
Academic status	Pre-academic	44.31	2.85	91.48	1.43
	Undergraduates	44.48	2.14	85.10	1.07
	Graduates	31.19	3.98	86.94	2.00

3.2 Internet problematic use (PIU) and academic achievement

First, the sample was divided into two groups of internet problematic use using the score of 50 as cut-off threshold on the problematic internet use scale (see Method section). Subsequently, in order to examine the current hypothesis, an analysis of covariance (ANCOVA) was conducted to delineate the differences in academic achievement by problematic internet use group (PIU: yes/no) and student's gender (2x2), with four demographic variables held as covariates (marital status, academic status, age, ethnicity). This aims to measure the unique effect of internet problematic use by gender in relation to academic achievement, while controlling for the demographic variables which might explain the group differences on the dependent variable. Means, standard errors (S.E.) and the ANCOVA results are shown in Table 2.

Table 2

Internet Problematic Use and Gender on Academic Achievement Adjusted for Four Covariates

	Non-Problematic Internet Use Group n=87	Problematic Internet Use Group n=26	Total
Male	84.04	86.52	85.28
n= 34	(1.61)	(1.87)	(1.22)
Female	89.26	83.89	86.57
n= 79	(.84)	(2.19)	(1.16)
Total	86.65	85.21	-
n= 113	(.91)	(1.74)	

Note. ANCOVA for PIU group: ($F(1, 105)=0.67$, $p>0.05$); ANCOVA for gender: ($F(1,105)=0.57$, $p>0.05$); ANCOVA for interaction

between PIU group X gender: F(1,105)=5.43, p<.05; partial η2=0.047. S.E. are in parentheses

ANCOVA results don't reveal significant main effects for problematic internet use and student's gender. Nevertheless, an interaction effect between these two variables on academic achievement was obtained (F(1,105)=5.43, p<.05; η2=.047), which indicates that female students who experience problematic internet use achieve lower grades than female students who do not. These differences, however, do not appear among male students, in spite of their stronger tendency toward problematic internet use in comparison with female students.

4. Discussion

The birth of the Internet began the digital revolution. Probably, it's most important advantage is ubiquitous access to information, previously out of the reach of many. However, as with every tool there come disadvantages. The alluring properties of digital technology subtly impact every facet of our lives. This report demonstrates the negative consequences which might be associated with excessive and problematic internet use. It exclusively focuses on academic achievement as a context and, hence, limited in its magnitude.

The first research question refers to the gender differences between teacher-trainee students. Consistent with previous studies (Stavropoulos et al., 2013; Huang et al., 2009), we found males to be at greater risk to engage in problematic internet use when scoring higher on internet addiction scale. Although not related with academic achievement within this group in the current sample, males being consistently more prone to negative internet usage which should be considered as a risk factor in various cognitive and psychological contexts. For instance, with the increasing consideration of learning disabilities in education, attention deficit is an important aspect to investigate, given its disorders are substantially more common among boys (APA, 2013). This is especially crucial with the increasing adoption of digital technologies in education.

The subsequent two research questions deal with the issue of the association between problematic internet use and academic achievement. An effect for PIU in this context was observed only in interaction with gender, indicating that female students who embrace excessive and addictive internet usage behavior performed academically less well than female students who employ normal internet use. An effect for problematic internet use on educational contexts only among female students was also documented by Stavropoulos et al. (2013), but its logic is yet to be clarified and requires further attention. Given that females constitute the overwhelming majority among teacher-trainees students in Israel, this finding is generally in line with previous studies supporting the relationship between PIU and poor academic achievement among college students (Englander et al., 2010; Junco et al., 2012; Ravizza et al., 2014).

One plausible explanation for these coherent findings across studies would be that students who spend excessive time on the Internet may have difficulty completing homework assignments, studying, and getting sufficient sleep to meet their academic responsibilities (Young, 1998). Sleep deprivation itself has been shown to be negatively correlated with memory function, as well as, in the context of international testing of academic achievement (Diekelmann & Born, 2010; Mullis et al., 2012). The social and cultural changes incurred by technology-associated chrono-disruption should not be overlooked (Ekirch, 2001; Kantermann 2013) and should be an increasing concern with the contribution of technology, and the educational use of technology on disruption of optimal sleep patterns (West et al., 2011) and the effects of this on brain function (Yuan et al., 2011; Yang et al., 2014; Zhang et al., 2014), which undoubtedly impact on academic achievement.

Furthermore, by recording the association between PIU and academic achievement among teacher-trainee students, the current study also extends the validity of the above cited studies who documented the similar trends among general student populations. It is essential that educational policymakers and researchers consider the implications of this finding regarding this specific group when planning technology-based curriculum, due to their special role in educating children to proper and efficient internet usage.

We note the following limitations, which should be taken in consideration when regarding these conclusions. Due to the data-collection method employed in the study, information regarding academic achievement (i.e.,

grades) was based on self-evaluation of the participants and was not confirmed or verified with academic records. Hence, although the study applied an anonymous report design, these reports might be inaccurate, upward biased and/or vulnerable to social desirability effects. A similar effect should be also considered, though with a downward bias, with respect to PIU scores observed. Moreover, using a self-reporting ordinal scale in order to estimate academic achievements, rather than the actual quantitative grades of the participants, may fail to capture a part of variance of this variable which could be relevant in explaining the connections studied here. These methodological features might undermine the validity of the scores measured and, consequently, weaken the findings and conclusions relating to the link between problematic internet use and poor academic achievements. This also might be the case due to the relatively small sample size used, especially among the subgroups of the study. Even so, it is conceivable that these findings may constitute a minimal estimate due to the natural tendency to underreport PIU and overestimate academic achievement. If this is the case, then the true connection is only larger than the one found here.

However, taking together that PIU was moderately correlated with the quantity of internet usage among the sample, along with the fact that the latter variable was not significantly correlated with academic achievement suggests that the construct of problematic internet use, whether it meets the criteria of addiction or not, may constitute a behavioral phenomenon which is above and beyond an excessive amount of internet use *per se*. The current finding identifying the effect for this construct on academic achievement, while holding a set of demographic variables as covariance, may also strengthen this assumption by reflecting its unique possible consequences in the educational context.

The contribution of this study was to report preliminary findings of the effects of technology usage on student teachers in Israel. This is a unique group with the high potential of influence on children. This at a time when the expectation that schools appropriate characteristics of the "real world"; and, accordingly, educational systems are rapidly deploying Information Communication technologies (ICTs) to fulfill this objective. However, since the long-term effects of uninterrupted usage of digital technologies are as yet unproven it, therefore, perhaps may be prudent to proceed with caution. We can recommend translation of the IAT test to Hebrew and "validation" for use in Israel. This will allow an increase in the scope of the research among pre-service teachers and teachers, as well as, explore the effects on pupils in Israel. Also, the preponderance of knowledge among faculty in teacher-training facilities regarding the state-of-the-art empirical multidisciplinary research, like educational neuroscience, should be investigated, as it impacts on the future education of children. It may also be interesting to analyze the prevalence of these hypotheses in the curriculum for undergraduate training.

Of Further, the possible connection between screen exposure, as well as, addictive Internet use, and attention disorders should be elucidated. Yoo et al. (2004) showed a correlation between these two variables, with attention deficit disorders as an important risk factor for excessive internet use, while up to 14% of ADHD-diagnosed children with probable internet addiction. Conversely, exposure to screen technology, leading to hyper-stimulation of the developing brain, has been associated, with implied causation, with the development of attention problems and self-regulation (Christakis, Zimmerman, DiGiuseppe, & McCarty, 2004; Swing, Gentile, Anderson, & Walsh, 2010), reflecting a serious concern regarding the susceptibility and consequences of over-exposure of ADHD children to screen-based technology (Weiss, Baer, Allan, Saran, & Schibuk, 2011). Taking into consideration their stronger tendency toward problematic internet use, male students with ADHD may experience serious difficulties when interacting with technological learning environments for educational purposes.

The significance of our results, in the context of much scientific research, is even more relevant for the training of teachers, as they are increasingly encouraged to implement technology in the classroom. More, the digitization of learning materials, while decoupling learning from a structured framework, may increase consequences of the potential negative effects. These implications may have tangible ramifications for stakeholders (teachers and learners) and should be a guide for policy makers, at all levels, as students are increasingly exposed to these influences. Practical recommendations suggested by this research include

encouraging childcare givers to provide a framework to leverage the benefits of digital technology while concomitantly managing the more problematic aspects of this phenomenon. This then suggests the need to emphasize the dissemination of the current science generated by the interaction among disciplines and its adoption, throughout the educational profession, leading to optimized educational outcomes.

It has been argued, that use of technology should be integrated in modern education so as to mimic the 21st century high-tech multitasking work environments for students to effectively learn the skills that will be required from them (Kraushaar & Novak, 2010). This, however, has been shown to degrade cognitive control (Ophir, Nass & Wagner, 2011). Moreover, digital technology has been empirically demonstrated to impact learning and retention (Spencer, 2006; Wood et al., 2012; Sana, Weston, & Cepeda, 2013). Empirical findings coming forth shed light on the possible negative aspects which digital technology might cause and imply that Internet usage may impair its own productive potential (Englander et al., 2010). Combined with the observation that technology is used less for learning during study periods (Awwad, Ayesh, & Awwad, 2013; Ragan, Jennings, Massey, & Doolittle, 2014), it is imperative to elucidate the circumstances and levels of intensity, if they exist, which technology may adversely influence learning.

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