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Technology use, self-directed learning, student engagement and academic performance: Examining the interrelations

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ABSTRACT

The widespread technology use among current college and university students has made higher educational institutions worldwide acknowledge the need of incorporating it in teaching and learning for explicit reasons. But does access and usage of technology enhance academic performance and foster student engagement in reality? Researches in the last over two decades have conjectured both the positive and negative outcomes of the students' continuous interface with technology. Student engagement and self-directed learning (SDL) are the two other themes that have independently attracted considerable interest of researchers, ascribable to the explicit and implicit assertions that both are related to the academic success. Additionally, the relationship of technology use with these two academic behaviors have also been investigated although not very extensively. The current study aimed to inspect a path model with technology use, student engagement, self-directed learning and academic performance among undergraduate students. 761 students responded to an online survey comprising three scales: Media and Technology Usage and Attitude Scale (MTUAS), Self-Rating Scale of Self-Directed Learning (SRSSDL), and student version of Utrecht's Work Engagement Scale (UWES-S). The results showed that use of technology has a direct positive relationship with students' engagement and self-directed learning, however, no significant direct effect was found between technology use and academic performance. The findings point towards the complex interchange of relationships of the students' technology use with student engagement, self-directed learning and academic performance. The implications and future research directions are discussed.

1. Introduction

The present day college and university students comprise of a generation who are brought up in a digitally rich environment and engrossed in a world permeated with various types of Information and Communication Technologies (ICTs). However, the actual usage of these technologies for the academic purposes, by this technologically-revolutionized era-generation variously termed as "Millennials" or Gen Y (Howe & Strauss, 1991), "the net generation" (N-Gen; Tapscott, 1998), "digital learners" (Brown, 2000), digital natives (Prensky, 2001), "learners of the digital era" (Rapetti & Cantoni, 2010) etc., are continually debated. Does the persistent

absorption and engagement with technology facilitate or hamper their learning experiences and academic performance? Given the fact that technology affordances are in concurrence with learning environments, i.e., from retrieving and sharing information to instant access and interaction with faculty and peers, it seems plausible that students may be using various technologies to facilitate and augment their learning experiences and effectively meeting academic challenges. However, the opinions vary: on the one end of the spectrum are those holding the belief that digital technology does augment and actually have already 'transformed' the teaching and learning in higher education (e.g., Beetham & Sharpe, 2013); on the other end are those who perceive these technologies as 'disruptive', and thereby a challenge for the universities to cope with, as Losh (2014) observes, "Not all modes of digital engagement are suited to education". Nonetheless, it is apparent that the ubiquitous and ever evolving digital technology has infiltrated in the ecosystem of the higher education, and explicably got the attention of researchers' focusing on numerous

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related issues, particularly the effectiveness and efficacy of technology vis-à-vis learning and teaching processes and outcomes.

The effect of technology with regard to students' academic achievement is persistently marked in growing literature of the last over two decades, albeit demonstrating inconsistent results ranging from both positive and negative to zero effects and relationships. We are presenting a selective literature representing the varied results. Supporting the positive outcomes, Fonseca, Martí, Redondo, Navarro, and Sánchez (2014) indicated that through the use of technology, students were able to achieve a greater level of direct engagement with the proposed content, which in turn improved overall achievement. They indicated that technology was highly correlated with student motivation, and also found a significant correlation between technology use and academic achievement. In another study Cheng, Lin, and She (2015) found that the students' long term knowledge retention in a technology enhanced classroom (*Virtual Age*) subsequently influenced learning outcomes; and students who use technology outperform in engagement and achievement (e.g., Fonseca et al. 2014; Gulek & Demirtas, 2005). Using a longitudinal design, Gulek and Demirtas (2005) provided substantial evidence that using technology enhances student learning and educational outcomes. The findings of the study revealed that compared to non-technology users, students using technology showed significantly higher achievement (overall GPA) and had high scores on criterion referenced standardized tests.

Similarly, Trimmel and Bachmann (2004) found that students who used technology in classrooms reported higher participation rates, more interest in learning, and a greater motivation to perform well as compared to the students who did not use technology. Drain, Grier, and Sun (2012) concluded from the results of their study on high school students that "intelligent use" of electronic devices improves academic performance measured via GPA & standardized test scores; results specifically showed that students who reported spending more time using their electronic devices for academic purposes did better in school than those who claimed they used their devices for other purposes.

In a review of earlier studies of computer and internet use/gaming and its effects on cognitive skills besides some other factors like social skills, relationships, sense of reality and violent behavior among children and adolescents, Subrahmanyam, Greenfield, Kraut, and Gross (2001) found the evidence of some immediate cognitive skills improvement like spatial, iconic, and attentional skills among users of some computer games. However, the researchers recommended more empirical evidence to validate the assumption that long term computer and Internet use (both game and nongame) can lead to long term improvements in cognitive skills and thereby on academic achievement. In another study, Hu and Kuh (2001) used data from 71 four-year colleges and universities in the United States (N = 18,344) and found that using Internet for course material had positive effects on the students' intellectual development and career preparation, as well as personal development. Similarly, in a study conducted on university students of Pakistan, Suhail and Bargees (2006) found positive effects of Internet use in terms of improved grades and reading, writing and information-processing skills among three quarters of the participants.

Conversely, a number of studies have reported either negative relationship or no significant relationship between technology use and academic performance. Fuchs and Wössmann (2004) surveyed students in 31 countries using a very thorough, detailed survey in order to eliminate other probable causes of the downward inclination of academic performance, stated in their results that the "sheer ubiquity of information technology is getting in the way of learning" (as cited in Ferguson, 2005). Findings from a recent study by Sana, Weston, and Cepeda (2013) suggest that technology use in classrooms has a negative effect on achievement, as measured by performance on a comprehension test. The studies examining the relationship of specific types of technology usage with students' academic performance have also demonstrated mixed results. For example, Jacobsen and Forste (2011) found a negative correlation between calling, texting, and GPA among university students in the United States. Instant messaging (IM) which today's college students prefer to use over email (Carnevale, 2006; Horrigan & Rainie, 2005; Junco, 2005) has been studied in relation to academic performance, and results indicate the detrimental effect of IM on school work (Junco & Cotten, 2011); and level of IM use related to academic impairment (Huang & Leung, 2009). Similarly, Lepp, Barkley, and Karpinski (2014, 2015) found that cell phone use/texting was negatively related to GPA and positively related to anxiety. Previously, Fox, Rosen, and Crawford (2009) have also reported that the time spent on instant messaging during classroom time is negatively correlated with the GPA. Along the similar lines, a number of studies have identified the negative relationship between the frequency of cell phone use and academic performance (e.g., Harman & Sato, 2011) academic difficulty (Hong, Chiu, & Hong, 2012) "intensive" cell phone use and school failure (Sanchez-Martinez & Otero, 2009). Some earlier studies have also reported the negative effect of the internet usage and college students' academic progress e.g., Malaney (2004–2005) indicated that some students reported that their grades had suffered in consequence of spending too much time on internet. Corroborating these findings, Kubey, Lavin, and Barrows (2001) and Kuh and Hu (2001) found that heavily indulging in online recreation is closely linked to impaired academic performance.

However, Pasek, More, and Hargittai (2009) didn't report any negative relationship between Facebook use and grades, whereas in the same year Karpinski and Duberstein (2009) had reported a negative correlation between grades and Facebook usage, though the sampling strategy and analytical design of the study was reportedly limited (Pasek et al. 2009). Hunley et al. (2005) found no significant correlation between computer use and grade point average among adolescents. Furthermore, students' grade point averages (GPA) were not found to be closely correlated with specific activities, such as searching for information, E-mailing, and playing games (link).

Given the fact that current college and university students comprise of a generation of Millennials and even Post-Millennials whose constant interface, competence and confidence with the digital technologies have supposedly led them to develop different learning styles and behavioral characteristics and probably an inherent technological capability of multitasking termed 'parallel processing functions' by Prensky (2003), although the proposition is challenged by some critics, and secondly, owing to the affordances these technologies provide, it is intuitively assumed that the usage of these technologies should be influencing their academic performance and outcomes. However, as is evident through the literature the results are confounding and inconsistent. A number of arguments ranging from the contextual and affective to cognitive factors, are presented to elucidate the incongruity of results e.g., some researchers have argued that it is not the quantity of time that students spend online which affects the outcomes rather what they actually do online does matter more vis-à-vis the outcomes (Chen & Tzeng, 2010) and the use of such technologies by students does not necessarily entail that they use them for their academic activities (Bennett, Maton, & Kervin, 2008; Romero, Guitert, Bullen, & Morgan, 2011). Along similar lines, Paretta and Cattelano (2013) stated that in-depth observations of students' technology-based practices suggest them to be sometimes of little academic relevance. Observing 730 individual behaviors of students in the