WIP: Development of a Framework to Support Technology-Life Balance in Undergraduate Engineering Students

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Abstract

Technology-life balance, also referred to as digital wellness or digital health, can be defined as the pursuit of an intentional and healthy relationship with technology and digital media. Due to the COVID-19 pandemic and the surge of digital technology usage in the 21st century, technology-life balance has become a much-needed field of research. The extreme extent to which many individuals use and consume technology and digital media can have serious physiological and psychological health effects. Postsecondary engineering students are regular digital technology users in various forms, from study and notetaking tools to entertainment systems, making them highly susceptible to the negative effects of technology overuse. The main purpose of this research is to support health and wellness in undergraduate engineering students by a) promoting effective technological literacy skills and b) improving self-efficacy in understanding technology-life balance. The resulting best practices from this work, which have been condensed into an easily accessible framework, are intended to support students in maintaining digital wellbeing throughout their lifetime. The proposed framework will allow individuals to access research-informed strategies to improve and maintain technology-life balance in an increasingly technological and digital media-focused environment.

Keywords: technology-life balance, physiological and psychological health, technology use, undergraduate engineering

Motivation

In the rapidly evolving landscape of the 21st century, the integration of digital technology into our daily lives has reached unprecedented levels, with further acceleration generated by the COVID-19 pandemic [1]. The resulting surge in technology usage popularized a critical field of research: technology-life balance. Technology-life balance, also referred to as digital wellness or digital health, can be defined as the pursuit of an intentional and healthy relationship with technology and digital media. This emerging discipline seeks to explore and cultivate a positive relationship between digital technology and daily life, which in turn has the potential to benefit individuals' health and well-being.

While technology-life balance has been traditionally focused on promoting work-life balance in individuals whose careers involve extensive digital technology usage [2]-[5], the ability to balance digital technology and daily life is an essential skill needed to navigate the complexities of modern society. Current research on the topic has investigated the impact of digital technology on society, public life, and individual behaviors and experiences; notably physiological and psychological health [2], [3], [6]-[21].

However, there is a lack of comprehensive information and education on digital technology usage and technology-life balance, which raises concerns given that the average Canadian spends

20+ hours per week using the internet [22]. Furthermore, over the past decade, there has been a large increase in the use of digital tools within engineering education. As educational technology and tools become increasingly integrated within engineering classrooms [23], educators and students consume an unpresented amount of digital media, in turn subjecting themselves to dangerously high levels of screen time. As part of this research study, a recent survey of first-year engineering students showed that an average of 7.45 hours per week were spent using technology for a single introductory programming course. Considering that the average full-time engineering student is enrolled in a minimum of 5 courses per semester, students may be spending upwards of 40 hours per week on technology solely for educational purposes; the equivalent of a full-time job. This does not include technology use for communication, entertainment, employment, or daily living (bus schedules, etc.). Although the use of technology within classrooms has a multitude of benefits, such as increased class engagement, access to information, sense of community, and accessibility of course resources [23]-[27], it also has the potential to pose a threat towards the mental and physical health of both students and educators. Internet addiction disorder [6]-[8], [10], sleep problems [11]-[15], digital eye strain [16], [17], musculoskeletal issues [18], obesity [19], mental health challenges [20], [21], and social isolation [9] are just some of the potential harms that many educators and students may face due to excessive technology use. This research aims to mitigate the potential harm that technology poses to educators and students without losing intended benefits.

The primary focus of this research is to support health and wellness through a) promoting effective technological literacy skills and b) improving self-efficacy in understanding technology-life balance. The resulting best practices from this work-in-progress are intended to support postsecondary engineering students in maintaining technology-life balance throughout their lifetime while building their capacity for lifelong learning and technological adaptation.

Approach

To gain insight into the existing research on technology-life balance, an informal scoping literature review was conducted. The following search terms were chosen: digital wellness, digital health, technology-life balance, digital well-being, and technology use. This selection of terms ensured a thorough exploration of synonymous concepts while encompassing the wide range of the research domain.

Simultaneously, to delve into the challenges faced by both students and educators, two instruments were created. First, a research-informed mixed methods survey was developed with quantitative Likert scale and qualitative short answer questions to assess student perceptions of specific elements of engineering curricula (classes, curriculum content, etc.) as well as their experience in engineering as a whole (stress, wellbeing, workload, etc.). The survey was administered to all 2nd year and above software engineering students at the University of Calgary's Schulich School of Engineering. The software engineering cohorts were chosen as a target population due to the regular use of technology within their discipline. Secondly, an interview protocol was developed to assess faculty and staff perceptions of student wellbeing and the engineering experience. The interview protocol was administered to three faculty/staff

members with detailed knowledge and experience working with first year and software engineering students.

The results of the survey indicated that 53% of software engineering students feel like they seldom have time for themselves, and 66% of students indicated that they often feel nervous and stressed. Multiple students also noted having mental or physical health challenges that impacted their engineering education including: "having a baby," being "very physically ill," "burnout," "feeling stupid and inadequate," "poor mental health," etc. Other challenges mentioned by students included: a "loss in the family," poor "time management skills", the "transition online with COVID-19," a "lack of connection/community," a "lack of accountability for both professors and students," the "rising cost of school," and "limited [...] mental health resources". The interview data reiterated many common stressors such as the high workload, the lack of free time, the influence of socioeconomic factors, and sensations of isolation. Many of these factors play a large role in why, when, and how students use digital technology [28], [29].

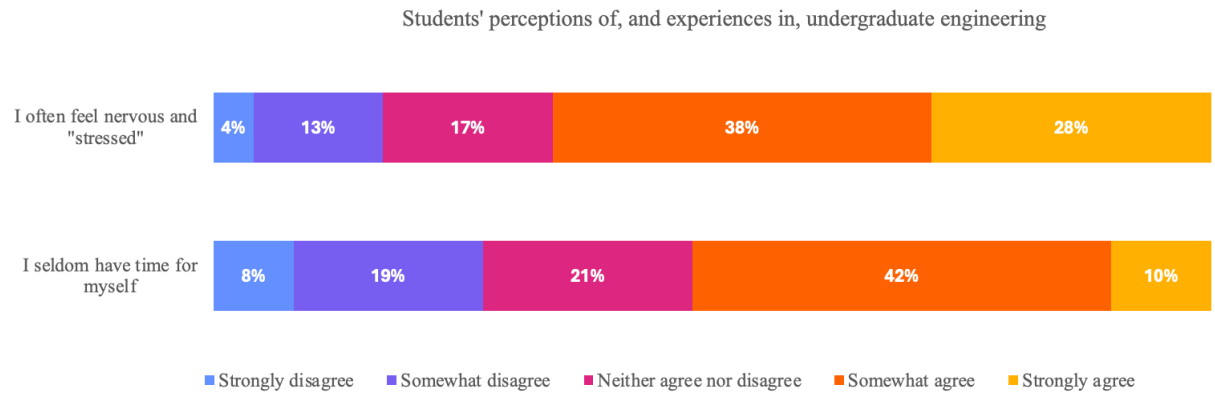

Fig. 1. Software engineering students' perceptions of, and experiences in, undergraduate engineering aggregated survey results.

Integrating the findings from the literature review and our previous research, a framework was created detailing the core aspects of technology-life balance. Our intended goal was to develop an educational framework to support first-year engineering students as they enter their engineering studies and begin to build lifelong skills.

Framework Development

The preliminary framework was informed by critical analysis of both the literature review and survey data. The scoping literature review underscored a significant gap in readily understandable and accessible information concerning technology-life balance. Furthermore, the survey and interview findings highlighted a challenge within engineering education, which is that most students struggle to maintain equilibrium between academic demands and personal commitments. These challenges may be further exacerbated by the technological demands of the modern engineering classroom. While we recognize that this is a multifaceted issue, the lack of

accessible information on technology and technology-life balance emerges as a significant obstacle according to both students and educators [30], [31]. Previous research has consistently demonstrated that when presented with information on a topic, students are able to identify issues in peers and themselves and are able to alleviate these issues when given the proper resources [32]. Our framework was developed to promote effective technological literacy skills and improve undergraduate engineering students' understanding of technology-life balance.

The framework created consists of a module-based resource, complete with informative and easily digestible information on technology and technology-life balance. It contains five major sections: 1) digitalization and technology in our modern world; 2) defining technology-life balance; 3) positive and negative effects of technology use; 4) ways to practice and promote technology-life balance; and 5) a reflective assignment. Each section was chosen based on its applicability to first-year engineering students and designed to contain examples from popular culture to appeal to students' interests, such as the mobile application TikTok.

The first module, Digitalization and Technology in Our Modern World, focuses primarily on providing students with the appropriate background information and context to situate themselves within the modules. Furthermore, it promotes the exploration of student positionality within a highly digital environment. A group activity in which students are asked to share what they already know about digitalization, digital technology usage, and technology-life balance, is used to further engage students with the module content.

The second module, Defining Technology-Life Balance, provides students with a standardized definition of the concept. It expands on the broad nature of technology-life balance and its applicability to various aspects of a student's life. The primary goal of the second module is to define and conceptualize the concepts that will be discussed in the following modules.

The third module, Positive and Negative Effects of Technology Use, expands on the many consequences of using digital technology. From an array of physical health problems to an increased sense of community and social connection, the module focuses on highlighting both the positive and negative repercussions of digital technology use. This module emphasizes the importance of practicing technology-life balance.

The fourth module, Practicing and Promoting Technology-Life Balance, equips students with the relevant tools to rethink and reconstruct their relationship(s) with digital technology. It provides students with examples of ways to improve their technology-life balance and encourages an open group discussion surrounding the topic. Students are also encouraged to ask questions to develop a deeper understanding of the module content thus far.

The fifth and final module, Personal Reflection, is an individual reflection assignment geared towards encouraging long-term retention of the information provided. The assignment prompts students to create four obtainable goals related to improving their technology-life balance. Moreover, it asks students to reflect on the positive and negative impacts their goals may have, the challenges they may face when attempting to accomplish their goals, and the ways in which they can motivate themselves to succeed.

A pilot implementation is currently underway to assess the outcomes and efficacy of the module content. The preliminary format of the framework consists of a facilitated session complete with downloadable module content. It is being administered to nearly 1000 first-year engineering students as part of the first-year engineering attribute seminars, which are a mandatory program component in which students are taught valuable information about important engineering graduate attributes, along with skills such as goal setting, supporting mental wellness, building resiliency, and much more. An early draft of the material was incorporated into first-year content alongside information about academic burnout. The early draft is now being expanded to incorporate the latest modules. Initial feedback from the teaching team indicated that students require more tangible examples that connect their engineering goals and their daily lives, and that students would benefit from receiving this material early in the semester. Further refinement of the modules is on-going and updated content will be used to educate the incoming cohort of students. We anticipate that by providing easy to understand educational information about digital technology usage and technology-life balance, students will show an increase in positive, balanced interactions with technology while developing their life-long learning skills as engineers.

Conclusions and Future Work

The primary objective of the framework is to serve as an educational tool for students and educators, facilitating their understanding of the intricate relationship between technology and daily life. The framework will allow individuals to access research-informed strategies to improve and maintain technology-life balance in an increasingly technological and digital media-focused environment. By providing students and educators with access to the framework and the corresponding materials, we hope to see an increase in the technology-life balance of engineering students while in turn improving their physical and mental wellbeing.

Our next steps involve the expansion of the developed framework into a format that can be easily disseminated, ensuring its accessibility to a wider audience within and beyond the university community. This includes our plans to integrate the enhanced framework into a larger digital literacy pilot program that is optionally offered to all first-year engineering students at the Schulich School of Engineering. This strategic integration seeks to create a holistic educational approach to technology usage that addresses not only technical skills but also cultivates a nuanced understanding of technology-life balance among first year engineering students. We anticipate that by expanding the breadth of the framework, we will see an increase in technology-life balance in a large majority of the undergraduate engineering population, with potential expansion to graduate students and beyond.

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