

Investigating Associations among Resilience, Psychological Flourishing, Stress, and Screen Time in Online University Students

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Abstract

We have experienced an increase in online university programs within the last decade. With this, the amount of time that students spend on their computers have increased drastically. The current study investigates the associations among resilience, psychological flourishing, stress, and screen time in students enrolled in an online university program. Participants responded to survey questions that measured these variables. Correlational and regression analyses, including a mediation model were performed on the data. Results show that the amount of time spent in front of a screen was positively correlated with emotional reactivity. As well, aspects of resiliency significantly predicted psychological flourishing and stress. Finally, emotional reactivity was a significant mediator of the relationship between psychological flourishing and stress. Implication and recommendation are discussed.

1. Introduction

There are many personal, social and economic benefits to attending post-secondary education, and these have been well-documented in the literature. In particular, online programs are appealing to many students who are working, have a family, or are unable to relocate to a new location. Although there are known benefits to education, students also face challenges, including stress and mental health issues, and these have become increasingly more prevalent in the general population but also in the post-secondary student population due to the covid-19 global pandemic [1]. While much research has been conducted on post-secondary students' mental health and wellbeing in more traditional face to face programs prior to the pandemic, there has been limited focus on students in online learning programs. Furthermore, much research on screen time has focused on TV-viewing and smart phone use in children and adults, but little has focused more specifically on post-secondary students' use of screen time and its association with stress and mental wellbeing. Considering the significant amount of time that online students spend on their computers, and the known risks associated with screen time, it is important for research to focus more specifically on this student population. This study focused specifically on post-secondary students in online

programs, and has expanded our understanding of these students' experiences and the potential associations and relationships between screen time, resilience, and mental health and wellbeing, including both positive (flourishing) and negative (stress) aspects of mental health.

2. Literature Review

The benefits and importance of a post-secondary education are widely recognized, with the 2016 Statistics Canada Census of Population showing that the median annual employment income was associated with level of education, subsequently resulting in an increase in enrolment in post-secondary education programs [2]. To increase accessibility to education and in response to technology becoming more prevalent in our lives, online educational programs have become more common and prominent [3], with the number of Canadian institutions offering online learning between 2011 and 2016 increasing by about 2% per annum growth rate [4]. Therefore, online learning has grown in popularity in Canada, and in more recent years, as a result of the Covid-19 global pandemic, more and more students sought out and/or were forced to engage in online learning in order to continue to pursue their education [5].

Online learning has evolved, and generally consists of a combination of asynchronous and synchronous learning activities [6]. For example, many online learning programs involve discussion forums and other interactive learning activities, along with required course readings and media presentations. The synchronous and interactive components often occur through Zoom or similar platforms. Given the nature of online learning, at times learners may feel isolated or alone, and therefore, opportunities for cooperative learning and peer interactions, along with feeling supported by instructors and/or institutions has been identified as being important for online learners [7, 8].

One of the main differences between online and traditional learning is the environment in which instruction and learning occurs. For students enrolled in an online learning program, learning generally occurs in their home, workplace or other public spaces and within a more limited social context [6, 9]. Research has suggested that online learning

requires increased attention and focus, as learners may be easily distracted or drawn to other activities within the home or online (i.e., social media; [10]) as well as they may have difficulties balancing and managing academic and family responsibilities [9, 11], which can impact their engagement and possibly lead to dropout [12].

One of the features that often draws students to online learning is the flexibility and control they have over their learning [13], and therefore, online learners are often described as being independent, autonomous, and self-disciplined [14, 15, 16]. Some of the factors that have been shown to be connected to engagement in online learning are technological self-efficacy, ease of online platform, satisfaction with learning, knowledge attainment, intrinsic motivation, and practical/vocational utility [8, 17, 18], suggesting that when an online learner can see the personal and/or professional value in the learning and the program, they are likely to be more satisfied and engaged, and more likely to follow through with completion of the program.

There has been a lot of research comparing performance in online learning to traditional in-person learning, with the majority of results showing comparable performance between online and traditional in-person learners [19, 20]. The benefits to online learning have been well-documented [21, 22]; however, one of the challenges associated with online learning is increased screen time. Screen time can refer to time spent on devices (such as phones and tablets), computers, gaming systems, and viewing television, as well as it can include those activities that are required for work and education purposes and those for more leisure enjoyment. In 2020, the Canadian Society for Exercise Physiology released some guidelines around the recommended amount of physical activity, sedentary behaviours, and sleep for adults aged 18 to 64 years old. According to their guidelines, the recommended number of hours of sedentary behaviour is ≤ 8 hours per day [23]. More specifically, they recommend ≤ 3 hours of recreational screen time per day [23]. In a study completed by Weatherson et al. [24], they found that a small percentage ($<5\%$) of post-secondary students in Canada adhered to the recommended screen time guidelines, suggesting that a high number of post-secondary students are engaging in sedentary behaviours and screen time at a higher rate than recommended. Furthermore, physical activity has been shown to be positively associated with positive mental health and negatively associated with screen time [25].

3. Stress, Mental Health and Resilience

One of the ongoing challenges with post-secondary learning is that students have been found to be at increased risk for stress and mental health

issues [26, 27]. In Canada, about 1/3 of post-secondary students report mental health issues [28]. Challenges with stress and mental health have been found to be associated with poor academic performance, including dropping out of post-secondary education [29]. Further impacting mental health and stress in students in online educational programs is the impact of screen time on mental health. Although some research has shown that social media and technology use for the purpose of social support can have a positive impact on wellbeing [30], other research has shown that screen time is associated with negative psychological health outcomes [31, 32], including stress, depression and anxiety [33, 34], with some research indicating that adults who engage in screen time activities for more than 4 hours per day are at increased risk for mental health issues [33]. More specifically in relation to post-secondary students, a study by Yinjian and colleagues [35] found that increased screen time was associated with higher levels of stress, especially in female College students. While a notable amount of research has focused on stress and mental health issues in students, much of the research has predominantly been on students in undergraduate programs and in traditional in-person programs. Therefore, more research examining online students' mental health and wellbeing is needed.

Another notable gap in the research is the limited focus on positive aspects of mental health and wellbeing in post-secondary students. While most of the research has focused on mental health outcomes such as stress, depression and anxiety, few studies have focused on positive wellbeing, resilience, or psychological flourishing [36]. Psychological flourishing is defined as being in good social, psychological and emotional health [37]. Within the limited body of research focusing on psychological flourishing, it has been shown that psychological flourishing has a positive influence on wellbeing [38]. One study focusing on College students in the United States found that stress was negatively associated with flourishing [39]. They also found a significant relationship between resilience and stress and psychological wellbeing [39]. Furthermore, students with higher levels of academic engagement tend to also have higher levels of flourishing [40].

As psychological flourishing focuses more on positive affect and wellbeing [38], it is important to study flourishing in connection with screen time, academic stress, and resilience in Canadian online students because positive mental health and wellbeing, including flourishing, have been shown to be connected with more positive outcomes, including academic performance, and with resilience [37, 38, 39]. Although resilience can be defined in different ways, a common component of most definitions is the ability to adjust to adversity, challenges or stressors, and therefore, it is connected to our

adaptational systems [41]. Many factors, such as social supports, emotional regulation and problem-solving, have frequently been associated with resilience [41], which can also be connected to stress and mental wellbeing. Research examining the relationship between resilience and mental health and wellbeing has found that resilience is a mediating factor in the relationship between stress and depression [42]. In another study, resilience was found to be a moderating factor in the relationship between stress and media use [39]. Ego resilience, which involves adapting the ability to control and regulate impulses, has also been explored in the research, with results suggesting that it is associated with mental health [30, 43]. Cole and colleagues [43] also found that ego resilience was a moderating factor in the relationship between stress and mental health. Furthermore, Therefore, based on the research on resilience and its connection to wellbeing and mental health, resilience may be viewed as a protective factor for students in online programs.

4. Purpose of the Study

Given the risks of screen time on stress and mental health and the amount of time online students spend on their computers and devices, it is important to understand the impact of screen time on stress, psychological flourishing, and resilience for students in online programs. Therefore, this study will seek to better understand the association between screen time, stress, psychological flourishing, and resilience in online students. Secondly, since resilience is connected to stress and wellbeing, this study will also seek to investigate what role resilience plays in online students' levels of stress and psychological flourishing.

4.1. Research Questions and Hypotheses

Our research study sought to answer the following questions:

i. What is the relationship between screen time, psychological flourishing, stress, and resilience in online students? It was hypothesized that screen time would be negatively associated with psychological flourishing and positively associated with stress. For resilience, it was hypothesized that screen time would be negatively associated with the sense of mastery and sense of relatedness components of resilience, and positively associated with the emotional reactivity component of resilience. It was also hypothesized that stress would be positively correlated with emotional reactivity and negatively correlated with sense of mastery, sense of relatedness, and psychological flourishing. Lastly, it was hypothesized that psychological flourishing would be positively correlated with sense of mastery

and sense of relatedness, and negatively correlated with emotional reactivity.

ii. What is the predictive association between resilience and stress and psychological flourishing? It was hypothesized that: (1) higher levels of sense of mastery and sense of relatedness would predict higher levels of psychological flourishing and lower levels of stress; and (2) higher levels emotional reactivity would predict higher levels of stress and lower levels of psychological flourishing.

iii. Does resilience mediate the relationship between stress and psychological flourishing in online students? It was hypothesized that resilience would act as a significant mediator in the relationship between stress and psychological flourishing.

5. Method

Survey method of research was used to conduct this study on post-secondary students enrolled in an online program in Canada. An online questionnaire was used as the data collection instrument. The research questions were analyzed using quantitative data analysis procedures.

5.1. Participants

One hundred thirty-one online students were recruited from a University in Canada. Of these, 94 students made up the final sample in the study. Participants were excluded if they had a significant amount of missing data or if they were significant outliers (see data analysis section below). All of the participants were enrolled in an online post-secondary program. Of the 94 participants, the majority were female (87.40%), working full-time (49.50%), enrolled in a Master's graduate program (88.40%), and in the first year of their program (69.50%). Participants ranged in age from 21 to 65 years old, with a mean age of 36.55 years ($SD = 10.83$).

5.2. Materials

Participants completed demographic and background information questions relating to gender, age, program of study and current year of study. Participants were also asked to report their daily percentage of screen time. This study was primarily interested in looking at screen time in total, but it was also divided up into educational/work screen time and leisure screen time. The different categories of screen time were not mutually exclusive, so total percentages of daily screen time can be over 100%.

Psychological Flourishing: Diener and colleagues' [38] Flourishing Scale was used to measure psychological flourishing, which focuses on positive feelings connected to relationships, optimism, purpose, self-esteem, and wellbeing. Participants rank the eight items on a 7-point Likert scale, ranging from 1 (Strongly Disagree) to 7 (Strongly Agree). Total scores can range from 8 to 56, with higher scores indicating higher levels of psychological flourishing [38]. The Flourishing Scale has been shown to have acceptable levels of internal consistency, test re-test reliability, and convergent validity, with a coefficient alpha of .87 and a test-retest correlation of .71 [44]. A more recent study in 2015 [45] also reported a coefficient alpha of .89 for the Flourishing Scale.

Stress: Academic stress can be measured in many ways, from reporting frequency to severity to reporting perception of control and impact [46]. Feldt's [46] College Student Stress Scale was used to evaluate stress in students completing post-secondary education. The College Student Stress Scale evaluates perceived stress, perceptions of goal attainment, control of events and feelings, and subjective appraisal of common stressors [46]. Participants rate how frequently they are distressed or anxious in several different areas of life (i.e., financial matters, family matters, relationships, housing, academics and goal attainment) on a 5-point scale ranging from 1 (Never) to 5 (Very Often). The scale consists of 11 items and total scores can range from 11 to 55, with higher scores indicating a higher level of stress [46]. This scale has been shown to have acceptable levels of reliability (coefficient alpha of .87; [46], and test re-test reliability (ranging from .62 to .86; [46]). The College Student Stress Scale has also correlated to the perceived Stress Scale, supporting its convergent validity ($r = .76$; [46]).

Resilience: Prince-Embury and colleagues' Resilience Scale for Young Adults (RSYA; [47]) was used to evaluate resilience. The RSYA is a 50-item scale, and participants rank the items on a 5-point Likert scale, ranging from 0 (Never) to 4 (Almost Always). The RSYA is divided into three sub-areas of resilience: sense of mastery, sense of relatedness, and emotional reactivity. Sense of mastery focuses on the characteristics of optimism, adaptability, and self-efficacy [47]. Total scores on sense of mastery range from 0 to 60, with high scores indicating a higher level of resilience. Sense of relatedness focuses on trust in others, comfort with others, access to social supports, and level of tolerance [47]. Total scores on sense of relatedness range from 0 to 80, with higher scores indicating a higher level of resilience. Emotional reactivity measures sensitivity, recovery from an emotional reaction, and the degree of

impairment in relation to one's emotional reactions [47]. Total scores on emotional reactivity range from 0 to 60, with higher scores indicating lower levels of resilience. The RSYA at both the factor and subscale level has been shown to have internal consistencies ranging from .75 to .92 as well as demonstrating construct validity through confirmatory factor analysis and appropriate relations to other variables as shown through convergent and divergent correlational analysis [47].

5.3. Procedure

Participants were recruited through online advertisement postings on the University home page and the University's mass communication systems with students. Interested students were provided a link to the online research participation system and survey (Qualtrics), where an overview of the study was provided, and electronic consent was provided. After providing consent, participants completed the survey, which included the background and screen time questions as well as the standardized questionnaires (Flourishing Scale, College Student Stress Scale and RSYA). The survey took approximately 20-30 minutes to complete. Following completion of the survey, participants were given contact information for the researchers and for the University's student services/wellness supports. Participants were entered into a draw for \$50 gift cards to show appreciation for their time and contributions to the study. The study was approved by the University's research and ethics board.

6. Data Analysis

Data were prepared for analysis in several steps. The first step was to check the data for outliers, which was defined as any value that was beyond 3 times the interquartile range [48]. Missing data was checked for each variable used in the study as well as for each participant and variable with more than 10% missing data were removed from the study [48]. The appropriateness of the variable distributions was ascertained by creating histograms and checking the skew and kurtosis values for each variable used in the analysis.

Descriptive statistics, correlational, and regression analyses were completed using Statistical Software for the Social Sciences (SPSS) version 28. Correlational analyses were used to examine the relationship between screen time, stress, psychological flourishing, and resilience. Regression analyses were used to examine the predictive association between resilience, stress, and psychological flourishing.

Mediation analyses were conducted using R statistical software package version 4.2.1 to examine the role that resilience plays in the relationship

between stress and psychological flourishing. The indirect effects bootstrapping method first proposed by Preacher and Hayes [49] was used to evaluate the statistical significance of the mediation analyses. One thousand replications were used to generate the 95% confidence intervals, with the absence of zero from the 95% confidence intervals being indicative of statistical significance.

7. Results

There were no outliers present in the data. Thirty-six participants were removed from the study due to large amounts of missing data (>50%). Distributions were deemed to be appropriately normal to conduct the proposed analyses.

Table 1 provides a summary of the descriptive analyses. It is worth noting that for the RSYA, the mean scores are comparable to other research studies (i.e., [50]) that have used this scale with adults and students in more traditional programs. The mean stress score was also consistent with a previous validation study of the stress scale, which found that students had a mean of 29.30 and SD of 7.84 on the scale [46].

Table 2 summarizes the results from the correlational analyses examining the relationship between screen time, psychological flourishing, stress, and resilience. Notable relationships shown in the table include total screen time being positively correlated with emotional reactivity ($r = .31, p < .05$), indicating that as screen time increases, so does one's levels of emotional reactivity.

More specifically, social media and leisure web-browsing were positively correlated with emotional reactivity. Sense of relatedness, sense of mastery, stress and psychological flourishing were not significantly correlated with screen time.

The results also showed that psychological flourishing and stress were negatively correlated with one another, meaning that as psychological flourishing increases, levels of stress decrease ($r = -.58, p < .001$). Stress was also negatively correlated with sense of mastery ($r = -.41, p < .001$) and sense of relatedness ($r = -.23, p < .05$), and positively correlated with emotional reactivity ($r = .48, p < .001$). Psychological flourishing was positively correlated with sense of mastery ($r = .58, p < .001$) and sense of relatedness ($r = .60, p < .001$), and negatively correlated with emotional reactivity ($r = -.29, p < .05$).

The results from the linear regression examining the association between resilience and psychological flourishing was significant. The Durbin-Watson test of independence was 1.92, tolerance values testing for multicollinearity ranged between .7 and .8, and the residual plot for linearity and heteroscedasticity was acceptable demonstrating that the assumptions of multiple linear regression were met. The results

showed that some of the components of resilience were predictive of psychological flourishing ($F(3, 90) = 23.44, p < .001$). More specifically, sense of mastery ($\beta = .34, p < .05$) and sense of relatedness ($\beta = .39, p < .001$) significantly and positively predicted psychological flourishing. Emotional reactivity was not a significant predictor of psychological flourishing.

The results from the linear regression examining the association between resilience and stress was significant. The Durbin-Watson test of independence was 1.85, tolerance values testing for multicollinearity ranged between .7 and .8, and the residual plot for linearity and heteroscedasticity was acceptable demonstrating that the assumptions of multiple linear regression were met. The results showed that some of the components of resilience were predictive of stress ($F(3, 90) = 11.40, p < .001$). More specifically, sense of mastery ($\beta = -.25, p < .05$) significantly and negatively predicted stress, and emotional reactivity ($\beta = .37, p < .001$) significantly and positively predicted stress. Sense of relatedness was not a significant predictor of stress.

The results from the mediation analysis examining whether emotional reactivity mediates the relationship between psychological flourishing and stress was significant (See Figure 1). Results showed that prior to accounting for the mediator into the model, there was a significant direct effect of psychological flourishing on stress, ($\beta = -.73, p < .05$). Once the mediator was accounted for in the model, the direct effect of psychological flourishing on stress was reduced ($\beta = -.61, p < .05$). The mediating effect of emotional reactivity was significant based on the bootstrapped 95% confidence intervals values not including the value of zero (95% CI = $-.22, -.02$), ($\beta = -.13, p < .05$), suggesting that higher psychological flourishing was associated with lower stress through its association with lower levels of emotional reactivity.

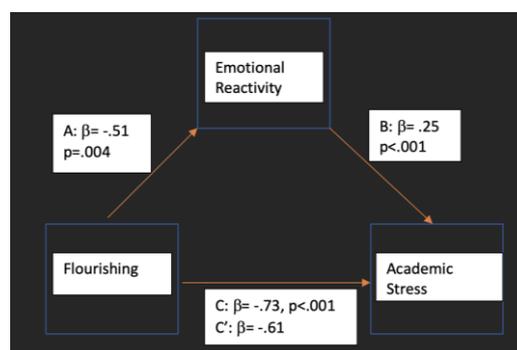


Figure 1. Mediation Analysis

Mediation models were also examined using sense of mastery and sense of relatedness, but they were not found to be significant.

Table 1. Descriptive Statistics

	Mean	Std. Deviation
Resilience: Sense of Mastery	50.90	11.84
Resilience: Sense of Relatedness	65.67	14.78
Resilience: Emotional Reactivity	18.85	10.81
Psychological Flourishing	47.15	6.22
Stress	30.54	7.90
Screen Time Percentage (Day): School	38.70	24.54
Screen Time Percentage (Day): Work	31.78	26.28
Screen Time Percentage (Day): Social Media	14.56	18.95
Screen Time Percentage (Day): Leisure/Web Browsing	12.02	15.99
Screen Time Percentage (Day): Gaming	2.64	6.80
Screen Time Percentage (Day): Total	99.71	56.84

Table 2. Correlation Among Variables

	1	2	3	4	5	6
1. Resilience: Sense of Mastery	1.00					
2. Resilience: Sense of Relatedness	.60**	1.00				
3. Resilience: Emotional Reactivity	-.46**	-.30**	1.00			
4. Psychological Flourishing	.58**	.60**	-.29**	1.00		
5. Stress	-.41**	-.23*	.48**	-.58**	1.00	
6. Screen Time Percentage (Day): Total	-.10	0.01	.31**	0.03	0.13	1.00

Note: * $p < .05$, ** $p < .001$

8. Discussion

The first set of hypotheses examining the relationships between screen time, resilience, psychological flourishing, and stress were partially supported. Screen time, especially social media and leisure web browsing were significantly related to emotional reactivity, but they were not significantly associated with other aspects of resilience, psychological flourishing or stress. This significant relationship between screen time and emotional reactivity suggests that as individuals increase their screen time, they may be more likely to experience emotional dysregulation. The more specific connection between social media use and leisure web browsing may be connected to the previous research suggesting that online learners may be more distracted or drawn towards other online activities [10]. When individual's experience a break in concentration or deviated focus, their efficacy is impacted [51]. As much research has established a connection between attention and executive functioning, particularly in relation to focus and shifting attention [51], one may hypothesize that executive functioning is playing a role. As this was outside the scope of this paper, future research should consider the role of executive functioning.

Another interesting factor to consider when examining the relationship between screen time and emotional reactivity is that the connection may be

explained by screen time being a sedentary behaviour, and as students spend increased amounts of time engaging in sedentary behaviours, they spend less time participating in physical activities [24]. Physical exercise has been found to be an effective tool for helping individuals remain regulated and for improving mental health [24], and therefore, given the more sedentary lifestyle of many students, they may have fewer regulation activities available to them.

Finally, another interesting factor to consider in the relationship between screen time and emotional reactivity is sleep. There is a significant amount of research that has identified the importance of sleep to mental health and wellbeing (i.e., [52]) and the negative association that screen time has on sleep [53]. Therefore, it is possible that sleep may be a mediating factor in the relationship between screen time and emotional reactivity. However, this relationship was beyond the scope of the present study and should be investigated in future research.

Stress was found to be associated with resilience and flourishing, suggesting that as online students' stress increases, their level of resilience and positive feelings of wellbeing/psychological flourishing tend to decrease. Psychological flourishing was also found to be related to resilience, in that individuals with higher levels of positive feelings and wellbeing are more likely to also have higher levels of resilience. These findings are consistent with

previous research that has also found associations between stress, mental health, flourishing, and resilience [1, 39].

The hypotheses examining the predictive relationship between resilience and psychological flourishing was also partially supported, in that sense of mastery and sense of relatedness were able to predict one's level of psychological flourishing. More specifically, individuals with higher levels of sense of mastery and sense of relatedness were more likely to have higher levels of psychological flourishing. However, emotional reactivity was not predictive of psychological flourishing. On the other hand, emotional reactivity was predictive of stress, meaning that students who are more emotionally reactive are also more likely to have higher levels of stress. Sense of mastery and relatedness were not found to be predictors of stress. As emotional reactivity can be connected to regulation, these results may suggest that self-regulation plays a role in this relationship. Previous research has found that self-regulation personality factors were predictive of stress [54, 55]. Therefore, future research should consider the role that executive functions may play.

The final hypothesis examining whether resilience plays a mediating role between stress and psychological flourishing was partially supported, as only emotional reactivity was found to mediate the relationship. Sense of mastery and sense of relatedness were not significant mediators. This is similar to previous research that found that resilience mediated the relationship between stress and mental health issues such as depression [42]. While the results of the mediation suggested that emotional reactivity plays a role in the relationship between stress and psychological flourishing, there are likely other factors such as executive functioning and sleep that may also be mediating this relationship.

While there is much research to suggest that students are at-risk for stress and mental health challenges [26, 27], and the results of this study further support those findings, one also needs to consider that this study was conducted during a global pandemic. Research has shown that individuals have experienced increased levels of distress during the pandemic [1], and this may also be connected to the high levels of screen time reported by participants as many participants reported significantly higher amounts of screen time use compared to the recommended standards. As a result of the pandemic, many individuals were forced to use technology for work and to stay connected during the pandemic, as well as research has also suggested that individuals used media as a coping mechanism during the pandemic [39]. Therefore, the pandemic may be a contributing factor to the increased screen time and its associated impacts on student wellbeing.

Another important distinction between this study and other research conducted on learners during the pandemic is that this study focused on students who were enrolled in an online program and not on students who were forced to shift from a traditional learning environment to an online platform. Therefore, while the findings of the current study were similar to those of other students during the pandemic, one needs to consider the different situational and contextual factors between those students who chose to learn online versus those who were forced online. Online learners have often been described as being more autonomous and independent, and autonomy has been shown to be related to flourishing [56]. Therefore, this difference in traits and qualities of online learners may provide additional context to the results of this study.

As little research has focused on students in online programs, this study provided one step towards filling a gap in the research. A notable strength in the study was that there was not a vast amount of missing data, and even when participants with missing data were removed, the sample size was still appropriate for the analyses conducted. Furthermore, all the variables were normally distributed, allowing for parametric analyses to be completed. One limitation of the study was the use of a convenience sample, which impacts the generalizability of the results. In addition, the majority of participants were female, which may have also impacted the results. Previous research has shown that college female students with higher amounts of screen time use reported higher levels of stress [35], as well as there are gender differences in learning characteristics and in relation to the impact of stress on mental well-being [26], so gender may also be a contributing factor to the findings. Future research may be interested in further examining gender differences amongst online students.

9. Practical Implications

With limited research focusing specifically on online learners, this study has increased understanding of students' experiences of engaging in online learning platforms. It is important to recognize the unique needs of online students. The results of this study may be of interest to instructors and university administrators and personnel, but also to those in the student service and wellness centers at the universities as the study has practical applications for how to better support online students and their needs. Post-secondary institutions are encouraged to provide programming through their university wellness centers in order to foster and help students build personal resilience. By building resilience, students would be more prepared to face the challenges of post-secondary education.

Prioritizing self-care in students is also important as many online students are balancing home, work, and school responsibilities, and therefore, may be at increased risk for mental health issues and burnout [26, 27]. As many of the results of the study are connected to emotional reactivity, students should be encouraged to develop more effective coping, self-regulation, and self-care strategies. For example, students should be encouraged to take breaks away from screen time, and during those breaks engage in more physical activities, as physical activity has been shown to be connected to lower levels of stress and mental health issues [24]. Research has shown that mental health issues, distress, and burnout can impact engagement and academic performance [26, 54, 55], so universities should be proactive in offering supports to students. Research has shown that early and proactive interventions are more successful than reactive interventions [54, 55]. Therefore, university wellness centres should provide psychoeducation to students on the possible warning signs of burnout as well as provide support for students for coping with stress, mental health issues, and burnout.

10. Conclusions

The results from this study have helped increase understanding of online learners and have relevant practical implications as noted above, but they also have the potential to inform future research initiatives. While this study was focused on screen time, psychological flourishing, stress, and resilience, the results suggest that there may be other important factors to consider within these relationships. For example, future research should look at the possible role that executive functions and sleep may play in the relationships between screen time, stress, and resilience. It may also be important to include other mental health factors in future research studies as research has shown that students are at increased risk for other mental health issues such as depression and anxiety [26, 27]. Furthermore, while some research has been done comparing academic outcomes of students in online versus traditional in-person programs, research has not focused on comparing the students across learning environments in relation to resilience, psychological flourishing, stress, and mental health. Therefore, future researchers may complete a comparative study looking at the similarities and differences of students in different learning programs to better understand the potential role that common trait of online learners (i.e., autonomy) may play.

11. References

[1] Laurene, K., Kodukula, G., Lechner, W., Grega, C., Lumpkin, E., and Kenne, D. (2022). Assessment of

psychological distress as a function of positive psychological variables during the COVID-19 pandemic: A university longitudinal study. *Journal of American College Health*. DOI: 10.1080/07448481.2022.2032086.

[2] Statistics Canada. (2016). Education, learning and training: Research paper series. Labour market outcomes of postsecondary graduates, class of 2015. https://www150.statcan.gc.ca/n1/pub/81-595-m/81-595-m_2020002-eng.htm (Access Date: 10 July 2022).

[3] Xiao, J. (2018). On the margins or at the center? Distance education in higher education. *Distance Education*, 39, 259–274. DOI: 10.1080/01587919.2018.1429213.

[4] Bates, T. (2018). The 2017 national survey of online learning in Canadian post-secondary education: Methodology and results. *International Journal of Educational Technology in Higher Education*, 15(29), 1–17. DOI: 10.1186/s41239-018-0112-3.

[5] Mukhtar, K., Javed, K., Arooj, M., and Sethi, A. (2020). Advantages, limitations, and recommendations for online learning during COVID-19 pandemic era. *Pakistan Journal of Medical Sciences*, 36(COVID19-S4), S27-S31. DOI: 10.12669/pjms.36.COVID19-S4.2785.

[6] Ng, C.F. (2021). The physical learning environment of online distance learners in higher education- A conceptual model. *Frontiers in Psychology*, 12, Article 635117. DOI: 10.3389/fpsyg.2021.635117.

[7] Burns, M. (2013). Staying or leaving? Designing for persistence in an online educator training programme in Indonesia. *Open Learning: The Journal of Open, Distance, and e-Learning*, 28(12), 141-152. DOI: 10.1080/02680513.2013.851023.

[8] Lee, J., Sanders, T., Antczak, D., Parker, R., Noetel, M., Parker, P., and Lonsdale, C. (2021). Influences on user engagement in online professional learning: A narrative synthesis and meta-analysis. *Review of Educational Research*, 91(4), 518-576. DOI: 10.3102/0034654321997918.

[9] Alphonse, A., Orellana, A., and Kanzki-Veloso, E. (2019). How online students describe their physical learning environment. *Quarterly Review of Distance Education*, 20(2), 29-54.

[10] Solvbert, A. M., and Rismark, M. (2012). Learning spaces in mobile learning environments. *Active Learning in Higher Education*, 13, 23–33. DOI: 10.1177/146978741429189.

[11] Selwyn, N. (2011). 'Finding an appropriate fit for me': Examining the (in) flexibilities of international distance learning. *International Journal of Lifelong Education*, 20, 367–383. DOI:10.1080/02601370.2011.570873.

[12] Annansingh, F., and Bright, A. (2010). Exploring barriers to effective e-learning: Case study of DNPA. *Interactive Technology and Smart Education*, 7(1), 55–65. DOI: 10.1108/17415651011031653.

- [13] Nie, M., Armellini, A., Witthaus, G., and Barklamb, K. (2011). How do e-book readers enhance learning opportunities for distance work-based learners? *Research in Learning Technology*, 19, 19–38. DOI: 10.1080/09687769.2010.548506.
- [14] Barnes, K., Marateo, R., and Ferris, S.P. (2007). Teaching and learning with the net generation. *Innovate: Journal of Online Education*, 3(4), Article 1. <https://nsuworks.nova.edu/innovate/vol3/iss4/1>.
- [15] Lee, M. C. (2010). Explaining and predicting users' continuance intention toward e-learning: An extension of the expectation–confirmation model. *Computers and Education*, 54(2), 506–516. DOI: 10.1016/j.compedu.2009.09.002.
- [16] Montgomerie, K., Edwards, M., and Thorn, K. (2016). Factors influencing online learning in an organisational context. *International Journal of Management and Enterprise Development*, 35(10), 1313-1322. DOI: 10.1108/JMD-05-2016-0067.
- [17] Hong, J. C., Tai, K. H., Hwang, M. Y., Kuo, Y. C., and Chen, J. S. (2017). Internet cognitive failure relevant to users' satisfaction with content and interface design to reflect continuance intention to use a government e-learning system. *Computers in Human Behavior*, 66, 353–362. DOI: 10.1016/j.chb.2016.08.044.
- [18] Shaha, S. H., and Ellsworth, H. (2013). Predictors of success for professional development: Linking student achievement to school and educator successes through on demand, online professional learning. *Journal of Instructional Psychology*, 40(1), 19–25.
- [19] Hoffman, H.J. and Elmi, A.F. (2021). Do students learn more from erroneous code? Exploring student performance and satisfaction in an error-free versus error-full SAS programming environment. *Journal of Statistics and Data Science Education*, 29(3), 228-240. DOI: 10.1080/26939169.2021.1967229.
- [20] Holmes, C.M., and Reid, C. (2017). A comparison study of on-campus and online learning outcomes for a research methods course. *Journal of Counselor Preparation and Supervision*, 9(2). DOI:10.7729/92.1182.
- [21] Bargh, J. A., and McKenna, K. Y. A. (2004). The Internet and social life. *Annual Review of Psychology*, 55, 573–590. DOI: 10.1146/annurev.psych.55.090902.141922.
- [22] Bessière, K., Pressman, S., Kiesler, S., and Kraut, R. (2010). Effects of internet use on health and depression: A longitudinal study. *Journal of Medical Internet Research*, 12(1), e6. DOI: 10.2196/jmir.1149
- [23] Ross, R., and Tremblay, M. (2020). Introduction to the Canadian 24-hour movement guidelines for adults aged 18-64 years and adults aged 65 years or older: An integration of physical activity, sedentary behaviour, and sleep. *Applied Physiology, Nutrition, and Metabolism*, 45(10). DOI: 10.1139/apnm-2020-0843.
- [24] Weatherson, K. A., Joopally, H., Wunderlich, K., Kwan, M. Y., Tomasone, J. R., and Faulkner, G. (2021). Post-secondary students' adherence to the Canadian 24-Hour Movement Guidelines for Adults: Results from the first deployment of the Canadian Campus Wellbeing Survey (CCWS). *Health Promotion and Chronic Disease Prevention in Canada*, 41(6), 173-181. DOI: 10.24095/hpcdp.41.6.01.
- [25] Qin, F., Song, Y., Nassiss, G. P., Zhao, L., Dong, Y., Zhao, C., Feng, Y., and Zhao, J. (2020). Physical activity, screen time, and emotional well-being during the 2019 Novel Coronavirus Outbreak in China. *International Journal of Environmental Research and Public Health*, 17(14), 5170. DOI: 10.3390/ijerph17145170.
- [26] Barbayannis, G., Bandari, M., Zheng, X., Baquerizo, H., Pecor, K. W., and Ming, X. (2022). Academic stress and mental well-being in college students: Correlations, affected groups, and COVID-19. *Frontiers in Psychology*, 13(886344), 1-10. <https://www.frontiersin.org/articles/10.3389/fpsyg.2022.886344> (Access Date: 12 July 2022).
- [27] Linden, B., and Stuart, H. (2020). Post-secondary stress and mental well-being: A scoping review of the academic literature. *Canadian Journal of Community Mental Health*, 39(1), 1–32. DOI: 10.7870/cjcmh-2020-002.
- [28] American College of Health Association. (2019). American College Health Association- National college health assessment II: Canadian consortium executive summary Spring 2019. Silver Spring.
- [29] Eisenberg, D., Golberstein, E., and Hunt, J. B. (2009). Mental health and academic success in college. *The BE Journal of Economic Analysis and Policy*, 9(1). DOI: 10.2202/1935-1682.2191.
- [30] Lane, J. A. (2020). Attachment, ego resilience, emerging adulthood, social resources, and well-being among traditional-aged college students. *The Professional Counselor*, 10(2), 157–169. DOI: 10.15241/jal.10.2.157.
- [31] Akulwar-Tujane, I., Parmar, K.K., Naik, P.H., and Shah, A.V. (2020). Rethinking screen time during COVID-19: Impact on psychological well-being in physiotherapy students. *International Journal of Clinical and Experimental Medicine Research*, 4(4), 201-216. <http://www.hillpublisher.com/journals/ijcemr/> (Access Date: 12 July 2022).
- [32] Twenge, J. M. (2019). More time on technology, less happiness? Associations between digital-media use and psychological well-being. *Current Directions in Psychological Science*, 28, 372-379. DOI: 10.1177/0963721419838244.
- [33] Madhava, K.C., Sherchand, S., and Sherchan, S. (2017). Association between screen time and depression among US adults. *Preventive Medicine Reports*, 8, 67-71. DOI: 10.1016/j.pmedr.2017.08.005.
- [34] Wu, X., Tao, S., Zhang, Y., Zhang, S. and Tao, F. (2015). Low physical activity and high screen time can increase the risks of mental health problems and poor sleep

- quality among Chinese college students. *PLoS ONE*, 10, e0119607. DOI: 10.1371/journal.pone.0119607.
- [35] Yinjian, G., Xin, S., Luan, D., Zou, Z., Bai, X., Liu, M., and Gao, Q. (2020). Independent and combined associations between screen time and physical activity and perceived stress among college students. *Addictive behaviors*, 103, 106224.
- [36] Wang, T.L., and Vella-Brodick, D.A. (2018). Examining screen time, screen use experiences, and well-being in adults. *Social Networking*, 7, 32-44. DOI: 10.4236/sn.2018.71003.
- [37] Keyes, C. (2002). The mental health continuum: From languishing to flourishing in life. *Journal of Health and Behaviour Research*, 43, 207–222. DOI: 10.2307/3090197.
- [38] Diener, E., Wirtz, D., Tov, W., Kim-Prieto, C., Choi, D., Oishi, S., and Biswas-Diener, R. (2009). New measures of well-being: Flourishing and positive and negative feelings. *Social Indicators Research*, 39, 247-266. DOI: 10.1007/978-90-481-2354-4_12.
- [39] Eden, A., Johnson, B.K., Reinecke, L., and Grady, S.M. (2020). Media for coping during COVID-19 social distancing: Stress, anxiety, and psychological well-being. *Frontiers in Psychology*. DOI: 10.3389/fpsyg.2020.577639.
- [40] Montano, R. L. (2021). Academic engagement predicts flourishing among students in online learning setup: The mediating role of psychological needs. *Journal of Psychological and Educational Research*, 29(1), 177–196.
- [41] Masten, A. S. (2015). *Ordinary Magic: Resilience in development*. Guilford Press.
- [42] Versteeg, M., and Kappe, R. (2021). Resilience and higher education support as protective factors for student academic stress and depression during Covid-19 in the Netherlands. *Frontiers in Public Health*, 9, 737223. DOI: 10.3389/fpubh.2021.737223.
- [43] Cole, N.N., Nonterah, C.W., Utsey, S.O., Hook, J.N., Hubbard, R.R., Opore-Henaku, A., and Fischer, N.L. (2015). Predictor and moderator effects of ego resilience and mindfulness on the relationship between academic stress and psychological well-being in a sample of Ghanaian college students. *Journal of Black Psychology*, 41(4), 340-357. DOI: 10.1177/0095798414537939.
- [44] Diener, E., Wirtz, D., Tov, W., Kim-Prieto, C., Choi, D., Oishi, S., and Biswas-Diener, R. (2010). New well-being measures: Short scales to assess flourishing and positive and negative feelings. *Social Indicators Research*, 97(2), 143–156. <http://www.jstor.org/stable/40649361> (Access Date: 10 July 2022).
- [45] Howell, A. J., and Buro, K. (2015). Measuring and predicting student well-being: Further evidence in support of the Flourishing Scale and the Scale of Positive and Negative Experiences. *Social Indicators Research*, 121(3), 903–915. DOI: 10.1007/s11205-014-0663-1.
- [46] Feldt, R. (2008). Development of a brief measure of college stress: The College Student Stress Scale. *Psychological Reports*, 102, 855-860. DOI: 10.2466/PRO.102.1.855-860.
- [47] Prince-Embury, S., Saklofske, D. H., and Nordstokke, D. W. (2017). The Resiliency Scale for Young Adults. *Journal of Psychoeducational Assessment*, 35(3), 276-290. DOI: 10.1177/0734282916641866.
- [48] Tabachnick, B. and Fidell, L. (2019). *Using multivariate statistics* (7th ed.). Pearson.
- [49] Preacher, K. J., and Hayes, A. F. (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behavior Research Methods, Instruments and Computers*, 36(4), 717–731. DOI: 10.3758/BF03206553.
- [50] McGuinness, C., and Nordstokke, D. (2021). Mindful self-care and resilience in first-year undergraduate students. *Journal of American College Health*. Advance online publication. DOI: 10.1080/07448481.2021.1978463.
- [51] Rubinstein, J. S., Meyer, D. E., and Evans, J. E. (2001). Executive control of cognitive processes in task switching. *Journal of Experimental Psychology: Human Perception and Performance*, 27(4), 763–797. DOI: 10.1037/0096-1523.27.4.763.
- [52] Zhai, K., Gao, X., and Wang, G. (2018). The role of sleep quality in the psychological well-being of final year undergraduate students in China. *International Journal of Environmental Research and Public Health*, 15(12), 2881. DOI: 10.3390/ijerph15122881.
- [53] Christensen, M. A., Bettencourt, L., Kaye, L., Moturu, S. T., Nguyen, K. T., Olgin, J. E., Pletcher, M. J., and Marcus, G. M. (2016). Direct measurements of smartphone screen-time: Relationships with demographics and sleep. *PLOS ONE*, 11(11), e0165331. DOI: 10.1371/journal.pone.0165331.
- [54] de la Fuente, J., Pachón-Basallo, M., Santos, F. H., Peralta-Sánchez, F. J., González-Torres, M. C., Artuch-Garde, R., Paoloni, P. V., and Gaetha, M. L. (2021). How has the COVID-19 crisis affected the academic stress of university students? The role of teachers and students. *Frontiers in Psychology*, 12, 626340. DOI: 10.3389/fpsyg.2021.626340.
- [55] de la Fuente, J., Santos, F., Garzon-Umerenkova, A., Fadda, S., Solinas, G., and Pignata, S. (2021). Cross-sectional study of resilience, positivity and coping strategies as predictors of engagement-burnout in undergraduate students: Implications for prevention and treatment in mental well-being. *Front. Psychiatry*, 12, 596453. DOI: 10.3389/fpsyg.2021.596453.
- [56] Purarjomandlangrudi, A., and Chen, D. (2020). Exploring the influence of learners' personal traits and perceived course characteristics on online interaction and engagement. *Educational Technology Research and Development*, 68(5), 2635–2657. DOI: 10.1007/s11423-020-09792-3.