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Examining the relationship between screen time and achievement motivation in an adolescent population

Jaiyoun Choi[1], Dr. Jason I. Chen[2,3]

[1] Westview High School, Portland, Oregon

[2] HSR&D Center to Improve Veteran Involvement in Care, VA Portland Health Care System, Portland, Oregon

[3] Department of Psychiatry, Oregon Health & Science University, Portland, Oregon

SUMMARY

During these times of unprecedented technological advancement, digital screens and devices have become synonymous with 21st-century life. However, such prevalence comes at a price. Research has shown a multitude of mental and physical health problems linked to excessive screen time. Although the effects of screen time have been extensively studied, one area at the core of mental health among adolescents has had limited examination: motivation, which is the drive to reach personal goals or to improve oneself. The purpose of this project was to identify the association between screen habits and achievement orientation, specifically in the prolific screen-using population of adolescents, by surveying students attending a large, suburban high school in Oregon. The survey contained three sections: one involving the Ray-Lynn Achievement Orientation scale to measure motivation; another asking participants about screen habits (time spent, devices used, and activities completed); and a third asking demographics questions. In total, 217 responses were collected. Using linear multiple regression, both average screen time—excluding work/school-related tasks—and entertainment-oriented screen time were found to be associated with lower achievement orientation. Average smartphone, television, and social media time were found to be smaller predictors of lower achievement motivation. Additionally, the results showed that all significant screen habits had negative associations with achievement motivation for adolescents. Sexual orientation was found to be a significant covariate in the models. Sources of error include the small sample size and the lack of equal grade-level representation. Further research could include experimentally manipulating participants' screen time to evaluate a causal relationship.

INTRODUCTION

Achievement motivation is an important aspect of mental health worth exploring because it drives individuals to reach their goals, improve themselves, or overcome some sort of obstacle (1). The American Psychological Association (APA) defines achievement motivation as the desire for accomplishment and success (2). In addition, motivation has shown further health benefits, such as associations with lower depressive symptoms. According to the Suicide Prevention Research Center (SPRC), motivation can also provide a sense of purpose, which has been identified as a key protective factor against suicidal ideation (3).

By contrast, screen time has been associated with an increased risk of many negative health conditions (4-6). In one investigation, Stiglic et. al established moderate-to-strong evidence for a correlation between screen time and lower mental and physical health, including greater obesity, higher depressive symptoms, unhealthy diet, and poorer quality of life (4). Another group of researchers found that heavy internet users (more than 2 hours/day) are more likely to report higher depressive scores and increased risk of somatic health problems (e.g., pain or shortness of breath) (5). Moreover, distinct types of screen times have yielded further negative associations as well. For instance, the use of social media applications such as Facebook is correlated with depressive symptoms, with studies pointing toward social comparisons as a mediator (6). Excessive gaming has garnered much attention where it now has been labeled a "condition for further study" within the Diagnostic and Statistical Manual of Mental Disorders-5 (DSM-5) (7).

With average nonproductive screen times for teens reaching over 7 hours and those of "tweens" (ages 8 to 12) at greater than 4 hours daily, technology usage covers a large majority of an adolescent's day, rivaling their time asleep or spent at school (8). Furthermore, studying screen time's effects specifically on adolescents remains critical due to the impact adolescent health can have on future life and the trajectories it can set. Adolescence is often referred to as a crucial transition point between childhood and adulthood, and research shows that 70% of premature deaths involving non-communicable diseases have been linked to behaviors beginning in adolescence (9). However, it remains unclear whether a large amount of screen usage impacts psychological factors such as motivation in teens. Therefore, this study aims to determine the relationship between screen time and achievement motivation in adolescents.

Despite the plethora of investigations on device usage, there has been little to no analysis of its relation to achievement motivation. This juxtaposition of facts only prompts further interest in the hypothesized link. The majority of the literature simply focuses on a select few aspects of physical and mental health, including topics such as obesity or depression. Rarely do they select a factor not seen as a disease. It is also relevant to note that many of the pre-existing detrimental effects of screen time already uncovered, such as weight gain, may be connected to a lack of motivation. Consequently, the research to compare screen time and achievement motivation within this population is crucial and understudied.

Multiple perspectives can be used to understand why a connection between these two variables could exist. A change in ambition resulting from screen time can be examined through a humanistic and behavioral approach. Alderfer's Existence, Relatedness, and Growth (ERG) theory (1969) is a more developed and compact version of Maslow's Hierarchy of Needs. Within this framework, Alderfer labels the process of progressing up the ladder of needs as the satisfaction progression and provides a frustration regression principle (10). This principle is what makes his interpretation unique and states that failing to meet one's needs at the stage they currently reside in would ultimately lead them to fall to lower needs. Using this approach, perceived high screen time could develop a sensation of failing to do something worthwhile. Therefore, unproductive time spent on devices could lead to a net loss in motivation specifically directed toward achievement.

Furthermore, a social-cognitive perspective can be applied to hypothesize the interconnection of technology and motivation. Based on Weiner's Attribution Theory (1985), when individuals are unable to fulfill a sense of competence, they are led to credit future success to external, unstable, and uncontrollable factors that do not benefit self-esteem (11). In turn, lower self-esteem has been found to decrease motivation (12). As the behavior of constantly retreating to devices would create a feeling of wasting time, having increased screen time would potentially reflect or facilitate low self-confidence and achievement motivation. Another theory within this perspective of psychology is the Expectancy Value Model by Eccles and Wigfield, which states that the incentive value of personal success is directly connected to the ambition to succeed (1). In this context, screen time would decrease the value of success and achievement motivation by providing a pleasurable, alternative experience.

Lastly, in a more general sense, screen time could relate to lower achievement motivation because it takes up time. It could simply express how individuals with less drive spend less time with productive tasks rather than facilitate a causal relationship. However, this reasoning may not best represent the results with the COVID lockdown necessitating and inciting further device usage. Overall, this study will primarily utilize a humanistic and behavioral lens to examine the proposed relationship.

The overarching purpose of this research is to clarify the relationship between screen time and achievement motivation. Screen time has already been found to correlate with adverse effects such as increased obesity, higher depressive symptoms, and poorer quality of life (4). With the continued rise of technology's constant availability, as well as the circumstances of the COVID-19 pandemic lockdown, the time seems appropriate to further our understanding of the impact technologies can leave on daily life. Achievement motivation also seems the next logical choice in exploring the interconnectedness of technology and mental health due to the evident lack of literature as well as its shown importance. By examining the relationship of a modern concern with the key aspects of success and fulfillment, this study attempts to deepen the awareness behind adolescent mental health.

The relation between achievement motivation and screen time was examined using Pearson's correlation factors as well as multiple linear regressions. To explore the many applications available in modern technology, the hypothesis being tested includes multiple sub-hypotheses. First off, it was hypothesized that overall nonproductive screen time or non-work/school-related screen time would be associated with a decrease in achievement orientation as suggested by the research and provided theories. In addition, we hypothesized that an increase in usage of smartphones, along with higher entertainment and social media times, would have an inverse relationship with achievement motivation based on the thought that the specific devices and activities were unproductive as well as the most commonly used among adolescents. Furthermore, general mood and grade level were hypothesized to be covariates. Negative moods could decrease motivation due to the emotional connections motivation conceptually has. Separate grade levels could experience different levels of motivation due to their varying stages in careers and life in general. No moderators or mediators were hypothesized.

The results showed a clear consistent pattern in the data, with most screen behaviors showing negative correlations with achievement motivation. Specifically, non-work/school-related screen time and entertainment time were found to be moderately strong predictors of lower achievement orientation, while social media, television, and smartphone screen time had smaller associations with lower achievement motivation.

RESULTS

A total of 217 responses were collected over six weeks. Example results of one question from each section of the survey are shown in **Figures 1 and 2**. This includes one question on screen habits and another from the demographics section. The majority of participants identified as heterosexual (70.5%), white (62.2%), and in the second year of high school (50.2%) (**Table 1**). Data on gender were not collected due to an administrative error.

The average Achievement Orientation (AO) score was 46.73 with a standard deviation of 8.356. Potential scores ranged from 14-70 with 70 representing the highest level of achievement motivation or orientation. Of the scores collected, the range was between 23 and 67. The median score was 48.00.

Of the 217 respondents, a majority of participants (n = 207)

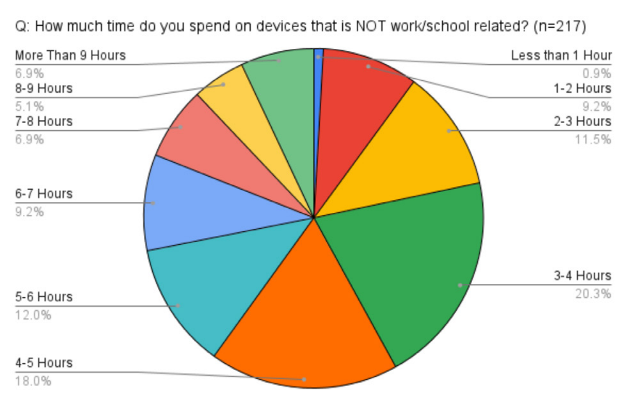

Figure 1: Example Screen Habits Question Results. The figure includes the participants' responses to the question, "How much time do you spend on devices that is NOT work/school-related?" The majority of participants reported anywhere between 2-6 hours of nonproductive screen time.

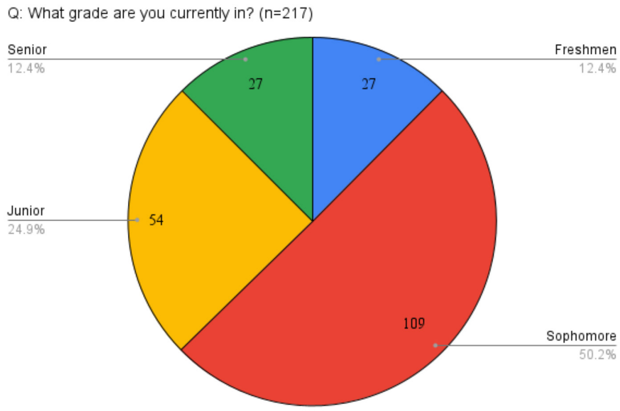

Figure 2: Example Demographic Question Results. Example results from one of the demographic questions are shown here. Participants were asked to report their current grade level. The data reveals that the grade level with the highest frequency was sophomores (second year in high school).

reported owning a smartphone. All the calculated screen time averages are displayed in **Table 2**. From these values, it is worth mentioning that the average reported screen time of participants was found to be 10.17 hours/day. The average non-productive screen time daily was 4.31 hours/day. However, the average smartphone screen time per day (participants were asked to report the average shown on their devices) was found to be 5.17 hours/day, greater than that of nonproductive screen time. In terms of relative use, 57.6% of the participants reported that smartphones were their most-used device. Entertainment was the most common main use of devices, with 47.0% of participants reporting it as their highest utilized purpose.

Multiple correlation tests were conducted with the data collected to initially describe relationships between the different screen habits and achievement motivation to identify potential sources of multicollinearity and demographics covariates to inform multiple regression models. Pearson's tests for correlations were first run between different habits and achievement orientation ($\alpha < 0.05$).

The statistically significant predictors included overall nonproductive screen time, entertainment time, social media time, smartphone time, and television time. However, television and social media time were not used in the Pearson's tests due to a lack of standard normal distribution in the raw data. Each of the remaining screen habits were plotted twice: once with the raw data and another with the averaged data points for each interval of the predictor variable (**Figures 3–5**). For all the tests run, the correlations were found to be negative, and the averaged data showed much higher correlations. The R^2 values were as follows for the tested statistically significant screen habits (raw/averaged): 0.106/0.861 for non-productive screen time; 0.108/0.848 for entertainment time; and 0.053/0.61 for smartphone time. Through the visualization of data points, the figures also show that the raw data points within each hour interval for all three predictors showed some outliers. Therefore, it is worth considering the values of the averaged graphs as they may mitigate the effects of extreme points. Model diagnostics also tested for normality in continuous variables (skew and kurtosis within ± 2) and multicollinearity (Variable Inflation Factor [VIF] > 4; Condition Index [CI] > 30) of included variables. Based on established guidance from Tabachnick et al., diagnostics did not identify issues of multicollinearity in the regression models (13).

Demographic Categories	Frequency	Percentage
Race*		
White	135	62.2
Black	8	3.7
Asian	73	33.6
Hispanic	34	15.7
Native-American/Alaskan Native	6	2.8
Pacific Islander	6	2.8
Other/Not-Specified	2	0.9
Grade Level		
Freshmen (9th Grade)	27	12.4
Sophomore (10th Grade)	109	50.2
Junior (11th Grade)	54	24.9
Senior (12th Grade)	27	12.4
Sexual Orientation		
Straight/Heterosexual	153	70.5
LGBTQ	47	21.7
Undecided/Not specified	17	7.8
Age		
13	0	0
14	21	9.7
15	83	38.2
16	69	31.8
17	33	15.2
18	11	5.1

Table 1: Demographic Distributions. Distribution of participants (n = 217) across different demographic characteristics. *Note that for race, participants were permitted to choose more than one racial identity.

In addition, data for the five screen habits found significant from the Pearson's correlation tests were also analyzed using linear multiple regressions. These models considered a covariate identified (sexual orientation) in the preliminary analyses. Screening for demographics covariates using descriptive, correlational analyses were used to determine the covariates. The linear regression models also used square

Screen Time Category	Average (Hours/Day)	Standard Error
Total	10.17	0.056
Total Nonproductive	4.31	0.155
Computer	4.03	0.168
Smartphone	5.17	0.192
Television	1.93	0.102
Entertainment	3.07	0.150
Social Media	2.56	0.133

Table 2: Average Screen Times by Category (Devices and Purpose). Table 2 shows a summarization of the data collected on screen habits. This includes the average screen time totaled in full and by nonproductive uses, the screen time by devices, and screen time by purpose. All values are shown in hours per day. Standard errors are also included for each category.

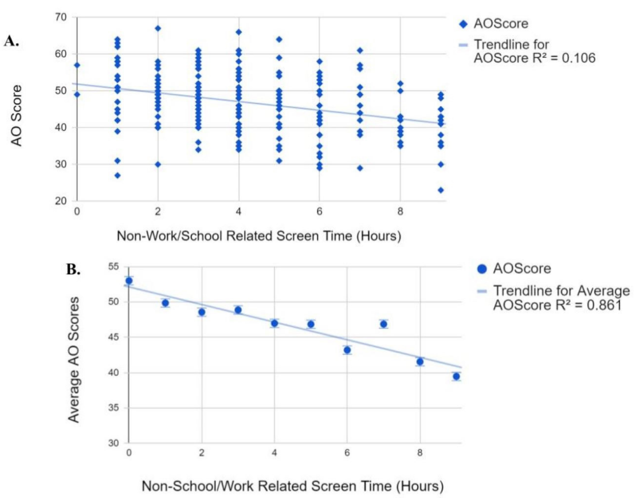

Figure 3: Level of Achievement Motivation and Averaged Achievement Motivation by Hours of Non-Work/School Related Screen Time. Figure 3 displays the relationship of A. the raw (n = 217) AO Scores with nonproductive screen time in hours and B. the averaged AO scores with nonproductive screen time. $R^2 = 0.106$ with the raw data and $R^2 = 0.861$ with the averaged data. The error bars for the averaged data were based on the standard error of the AO scores (0.5879). The *p*-value for this predictor variable was found to be less than 0.001.

root distributions for both television and social media time to normalize the data. The values were as followed (R^2 value/beta coefficient): 0.12/-1.04 for nonproductive time; 0.13/-1.11 for entertainment screen time; 0.06/-0.49 for social media time; 0.06/-0.39 for smartphone time; and 0.07/-0.85 for television time (**Table 3**). These values show that all the variables tested showed negative correlations of varying strength and magnitude. The small variance in these adjusted R^2 values in comparison to the values found before was due to the sexual orientation covariate, signifying that sexual orientation did indeed have its own independent effect on the data. Otherwise, the R^2 values showed consistency when compared to the previous Pearson's correlation tests.

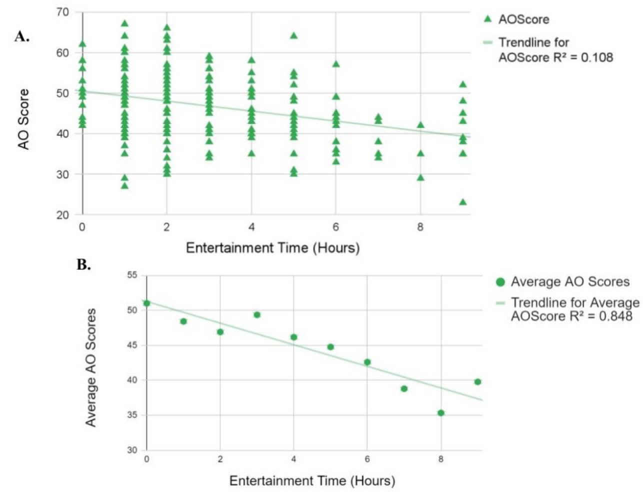

Figure 4: Level of Achievement Motivation and Averaged Achievement Motivation by Hours of Entertainment Screen Time. Figure 4 shows the two graphs for both raw (n = 217) and averaged AO scores (A and B respectively) plotted against entertainment time. Error bars were once again based on the standard error of the AO scores (0.5879). $R^2 = 0.108$ with the raw values and $R^2 = 0.848$ when averaged. The $p < 0.001$ for entertainment time as well.

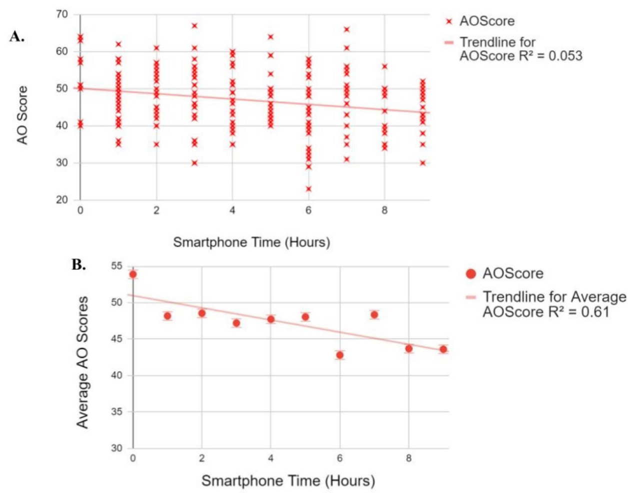

Figure 5: Level of Achievement Motivation and Averaged Achievement Motivation by Hours of Smartphone Screen Time. Figure 5 includes the two graphs for A. raw (n = 217) and B. averaged AO scores in relation to smartphone screen time. $R^2 = 0.053$ with the raw values and $R^2 = 0.61$ when averaged. The same standard error for the AO scores were used for the error bars in the averaged data (0.5879). $p = 0.001$ for this correlation.

DISCUSSION

As hypothesized, the findings show that nonproductive screen time and other screen habits all had negative associations with achievement motivation. Both the strength of the relationships as well as the beta coefficients varied depending on the activity and device. Nonproductive, entertainment, social media, and smartphone screen time were all found to be negatively associated with achievement motivation. However, television viewing time was also inversely related to achievement motivation, which was not consistent with our original hypotheses. All of these predictors were most likely

Statistically Significant Predictors ($p < 0.05$)	Average Nonproductive Screen Time ($p = 0.000$)	Average Smartphone Time ($p = 0.001$)	Average Television Time ($p = 0.000$)	Average Entertainment Time ($p = 0.000$)	Average Social Media Time ($p = 0.001$)
Adjusted R^2 Value	0.12	0.06	0.07	0.13	0.06
Unstandardized Beta Coefficients	-1.04	-0.39	-0.85	-1.11	-0.49

Table 3: Adjusted R-Squared Values and Beta Coefficients of Predictors (n = 217)*. Table 3 shows the results from the IBM SPSS linear regression analysis including the *p*-values, R^2 values, and beta coefficients. The R^2 values are quite similar to those found in the Pearson's correlations. The beta coefficients show the degree of effect - or slope of the line of best fit - of each predictor variable on achievement motivation.
*Derived from IBM SPSS Program

found to correlate due to the general unproductive nature of the device or activity. For example, nonproductive time and entertainment time are by definition unproductive. In addition, social media, smartphones, and television have many more nonproductive options. This would correlate with a decrease in the desire to succeed, which would explain the inverse relationship. Other behaviors, such as time spent on computers, were most likely not associated because of a principle productive function—such as completing homework—expressing one's interest in following their aspirations. Data from the Common Sense Census also supports this notion, where students reported that computers were more accessible for productive tasks than other devices such as smartphones (8). In explaining the strength of both the correlations and beta coefficients, the magnitude of time spent with each device or activity may have an impact as well. When asked what their most-used device was, the majority of participants (57.6%) said smartphones were their most-used device. The most common prominent usage of devices was entertainment (for 47% of participants) and social media next (20.3%). So, it seems that the more presence a certain category of screen time has, the stronger the correlation with achievement motivation. The only statistically significant classification that was not as prominent was television screen time. However, this could have to do with the lack of portability with television compared to the constant availability of smartphones.

The sub-hypothesis on the covariates was not supported. Instead of grade level and general mood, sexual orientation was found to be a covariate. Research does reflect that sexual minority adolescents tend to spend more time in nonactive leisure such as screen-based leisure than heterosexual adolescents, suggesting that sexual minority adolescents withdraw themselves more from crucial developmental activities (14). This could explain why sexual orientation was found to be a covariate for motivation alongside screen time.

The study had several limitations worth consideration. Although the survey was designed to account for acquiescence bias, response bias may still be present. There is a possibility that participants reported AO scale and screen time questions with a few potential underlying biases. From the data, it is visible that smartphone screen time—the only question where participants were asked to check their devices for a more accurate report—exceeded total nonproductive screen time values. This could reflect a self-serving or recall bias based on the information from smartphone screen time or may signify some productive use of phones. It is also possible that phones may be recording usage time when users may not be actively using these devices. Either way, many discrepancies came with such self-reported data. The inconsistencies could also point to a lack of accuracy in the questions provided. The choices may have been too broad (full hour intervals), which may have caused the averages to be reflected in such a way. Moreover, if the average screen times by device were totaled, the resulting value is larger by 0.96 hours than the average total screen time. This could indicate a degree of guilt associated with high screen times or simply a lack of awareness of one's screen habits. Regardless, such results warrant further investigation. The student population utilized would only properly reflect that of the surrounding county and area, and so may not represent all adolescents in other locations with accuracy. For example, the collected race distribution did match that of the individual school but was different in terms of national distributions in high schools. Another limitation is that the grade distribution differed from that of the school population. Although grade level and age were not associated with our variables of interest, the sample was skewed toward a majority sophomore and junior population. If the sections of the survey were scrambled and a larger area set was used, then many of these errors could have been accounted for.

With our survey being administered online, the study was subject to the many potential challenges involved in online-based research. This would include problems like inattention to questions or sample bias due to internet access constraints. One glaring issue is that many normal activities such as school or socialization have moved to a more online basis due to the COVID-19 pandemic, increasing the need for devices. This may have muddled the definition of "nonproductive" screen time and potentially alter the relationship between screen time and motivation. On the other hand, the lockdown may have allowed for the collection of very unique data, as such an environment would be impossible to replicate outside of such a circumstantial setting. By exploring the relationship over this period of time, we could also understand more about the potential drawbacks of a way of life centered on online interactions.

This study provided an initial step toward understanding the relationship between 21st-century technology and personal drive through the identification of correlative relationships. Although no causal relationships can be established, this is a clear first step into understanding this relationship and how technology affects the human population. More could be done in the future to examine aspects not tested during this study. For example, more research could be done to investigate how gender differentiates the effects of screen time on motivation or look at how other activities like texting could impact motivation. Future research could identify if data outside the time of the COVID pandemic differed from the data collected for this study during quarantine. As stated before, subsequent research could also use a more controlled environment to determine a causal relationship by experimentally manipulating the predictor variable. Elimination or limitation of specific types of screen time could also be considered if deemed ethical.

Overall, this research could help pave a new path to understanding more about the interplay between screen time and adolescent mental health. Hopefully, the results will shine light on this topic and expose the need to research more about how modern behaviors can alter motivation and other underlying psychological constructs. Motivation could also be developed into a measure worth examining in a healthcare setting for any excessive screen users. However, the main hope is that the conclusions from this project will help future generation teenagers understand the implications behind excessive screen usage. With devices continuing to develop over time, it is important to set the understanding of how technology can affect us and spread reasoning as to why it should be moderated. By exploring achievement motivation, this study has determined more about traits that are beyond the normal physical and mental health attributes commonly researched with screen time but still important in the developmental period of adolescents.

MATERIALS AND METHODS

The participants consisted of high school students from a large, suburban public high school located in Oregon. All participants that provided consent were included in the final analysis. The survey was administered to the school's student population through the school's weekly announcements with prior approval from the administration and a scientific review committee. The survey was created on a Google Form for better accessibility to the students. The survey took, on average, approximately 5-15 minutes to complete. Responses were accepted over a six-week period between December of 2020 and January of 2021.

The survey began by obtaining informed consent. After doing so, the participants were directed to a set of questions from the Ray-Lynn AO short form. In 1979, J.J. Ray developed a short version of the Ray-Lynn AO scale (15). This includes a total of 14 questions that help create a numerical value expressing the participants' level of achievement motivation. This measure was chosen due to its shorter length and ability to account for some acquiescence bias, which refers to the tendency for respondents to simply select the choice with a positive connotation of agreement (in this case, agree or strongly agree) (16). Adjustments to the original questions included wording for accessibility and the available choices from the traditional three choices (yes, ?, and no) to a five-part Likert Scale of agreement (Strongly Disagree, Disagree, Don't Know, Agree, Strongly Agree). This way, the participants were able to be more concise with their responses for more reliable data. The questions were as follows:

1. Being comfortable is more important to me than getting ahead. **R**
2. I am satisfied to be no better than most other people at activities (school, sports, etc.). **R**
3. I like to make improvements to the way the organizations I belong to function.
4. I take trouble to cultivate/acquire people who may be useful to me in my career.
5. I get restless and annoyed when I feel I am wasting time.
6. I always worked hard in order to be amongst the best in my own line (school, organization, sport, etc.).
7. I prefer to work with a congenial (pleasant, easy to work with) but incompetent partner rather than with a difficult but highly competent one. **R**
8. I tend to plan ahead for my future or career.
9. "Getting on in life" is important to me.
10. I am an ambitious person.
11. I am inclined to read the successes of others rather than to do the work of making myself a success. **R**
12. I would describe myself as lazy. **R**
13. Often, days will go by without me having done a thing. **R**
14. I am inclined to take life as it comes without much planning. **R**

During analysis, participants were given a score based on their responses. One to five points were provided based on their response to each question; one being strongly disagreed and five being strongly agreed. Statements labeled **R** were reverse-scored.

In the next section, participants were asked to report about their screen time and device usage. The questions asked were as follows (answer choices in bold):

- What is the total average time you use devices within a day? **(in hours)**
- How much time do you spend on devices that is NOT work/school-related? **(in hours)**
- Do you have a smartphone? **(yes or no)**
- On average, how much time do you spend on your smartphone daily?* **(in hours)**
- On average, how much time do you spend on computers or PCs? **(in hours)**
- On average, how much time using television? **(in hours)**
- What sort of devices do you use on a daily basis? **(Smartphone, Laptop/Computer, Tablet/Ipad, Television, None, Other)**
- What device do you use the most? **(Smartphone, Laptop/Computer, Tablet/Ipad, Television, None, Other)**
- What do you do when using devices? **(Entertainment, Social Media, Work/School Related Tasks, Texting/Messaging, Other)**
- How much time do you spend on entertainment on devices (Video games, watching videos/shows, etc.)? **(in hours)**
- How much time do you spend on social media? **(in hours)**
- What do you do the most when using a device? **(Entertainment, Social Media, Work/School Related Tasks,**

Texting/Messaging, Other)
**For this question, participants were also asked to report the time provided by their device if possible: "(If your smartphone collects this data, please record the time it provides)"*

Any terms that could be misinterpreted (such as the umbrella term "Entertainment") were defined within the survey. For reference, non-work/school-related time was synonymous with nonproductive time, entertainment time included purposes such as gaming or watching videos or shows, and social media included the use of any social media application such as Facebook, Instagram, or Snapchat. All information was self-reported to the best of the participant's knowledge other than smartphone time, in which participants were asked to report the displayed average on their device if possible.

The third and final part of the survey entailed questions on demographic characteristics. These inquiries were administered last to prevent any sense of stereotyping. This last section asked about the individuals' age, ethnicity, sexual orientation, and grade level currently at school. Questions were also asked about their general mood and other activities that they partake in. This information was used to examine the presence of other possible moderating variables. When completed, participants were directed to a debriefing page (this page was also used for participants who chose to not participate). Participants were thanked for their participation and were provided with multiple mental health resources at the end of the survey.

The survey was conducted within a local high school and was administered online to eliminate risks associated with the spread of COVID-19. Google Forms were utilized as a platform for the survey. The school's administration was also involved in both the approval and dissemination of the survey. Once data was collected, we conducted descriptive analyses prior to hypothesis testing. The IBM SPSS program was used to evaluate the association between different categories of screen time (e.g., for entertainment versus social media use). Then, all normal, statistically significant predictors were graphed and r-squared values were derived. Pearson's correlations were also conducted to analyze the correlative relationships between the amount of time spent with different categories of screen time, demographics variables, and AO scores (n = 217) to identify potential resources of multicollinearity and demographics covariates. All tests utilized an alpha level of 0.05. Lastly, we conducted individual multiple linear regressions using the categories of screen times as predictors and AO scores as the dependent variables while adjusting for sexual orientation as a significant covariate found from descriptive analyses.

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