

Fragile Minds: Exploring the Link Between Social Media and Young Adult Mental Health

Ben Cohen
Whiting School of Engineering
Johns Hopkins University
Baltimore, MD, USA
bcohen49@jhu.edu

Ian McCulloh
Johns Hopkins University
The Brain Rise Foundation
Orlando, FL USA
0000-0003-2916-3914

Abstract— The well documented mental health crisis among preteens and teenagers worldwide is often believed to be intertwined with the increasing ubiquity of social media services, a belief borne out by numerous findings in the literature. However, the literature has not kept pace with recent developments in the social-media sphere, such as the rise of TikTok and the decision by Instagram to pivot to video. This paper aims to help alleviate this deficiency, examining whether a correlation exists between college students’ social media usage and mental health concerns. Using a random sample of 254 undergraduate college students at a mid-Atlantic university, we find (as evidenced by Spearman’s rank correlation coefficients) that while there is a correlation between “fear of missing out (FoMO)” and social media use, the correlation is not strong, suggesting that social media use alone cannot explain observed mental health outcomes. We support previous literature regarding correlations between personality and social media use and extend it with additional measures of use to include FoMO and loneliness. We find that loneliness is weekly and inversely correlated with Instagram and Snapchat use and personality traits moderate use. We speculate that the shift in social media from peer-to-peer text to short video may be driving divergence from previous findings in the literature, lessening risk, but suggesting that additional research is needed to confirm our conclusions.

Keywords—social media, mental health, TikTok, Instagram, YouTube, loneliness, personality.

I. INTRODUCTION

Social media has taken on an increasingly large role in our everyday lives in recent years, with individuals of all ages turning to applications such as Facebook, Snapchat, and TikTok to stay connected to friends, share their own experiences (both positive and negative), and even keep up with the news. One study found that the share of U.S. adults 18 and over who

reported using social media increased from 5% in 2005 to approximately 80% in 2019 [1]. College students are no exception to this trend; over 55 percent of entering freshmen in 2019, the most recent year for which data are available, reported spending six hours or more a week on social media, with 10 percent reporting usage in excess of 20 hours a week [2].

However, there has recently been growing concern regarding the impact of social media use as well. An advisory recently released by the U.S. Surgeon General includes numerous references to social media and its role in what the report deems an “epidemic of loneliness and isolation” [3]. One study cited in the advisory found that U.S. residents who reported over two hours of daily social media use were roughly twice as likely to report “increased perceptions of social isolation” than those who reported less than 30 minutes of social media use per day [4]. Here, again, college campuses are no exception; the Healthy Minds Study, which collects data from 373 U.S. campuses, found that over 60 percent of American college students met the criteria for one or more mental health problems during the 2020–21 school year [5].

In this paper, we explore the impact of social media usage on college students’ mental health. Specifically, we test the hypothesis that high social media use is correlated with low self-esteem, low social support, depression, and generally poor mental wellness. The importance of this research cannot be overstated: the statistics given earlier in this section speak for themselves as far as the mental health crisis among college students, and determining whether social media services should be ascribed blame or held harmless is a necessary step in understanding and addressing the crisis.

The remainder of this paper is organized as follows. Section II provides additional background information on social media use among college students as well as previous explorations of this topic in the literature. Section III describes our data collection and the tests we ran on the collected data, the results of which are described in section IV. We conclude in section V.

II. BACKGROUND

The poor state of mental health among young adults worldwide has been well documented. Data from the Centers for Disease Control and Prevention (CDC) shows that suicides among U.S. females ages 15–24 increased 87 percent between

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for components of this work owned by others than ACM must be honored. Abstracting with credit is permitted. To copy otherwise, or republish to post on servers or to redistribute to lists, requires prior specific permission and/or a fee. Request permissions from permissions@acm.org.

ASONAM '23, November 6–9, 2023, Kusadasi, Turkey
© 2023 Association for Computing Machinery.
ACM ISBN 979-8-4007-0409-3/23/11... \$15.00
<https://doi.org/10.1145/3625007.3627490>

2000 and 2020 [6]; for males in the same age range, suicide rates experienced a statistically significant increase from 2020 to 2021, and the current rate of 23.8 per 100,000 is the highest this century [7]. In addition, a recent study found that “while the total number of pediatric and young adult [emergency department] visits has remained relatively stable from 2011 to 2020, the proportion of visits for mental health reasons has approximately doubled, including a 5-fold increase in the proportion of visits for suicide-related symptoms” [8]. The uptick in mental health emergencies has led the American Academy of Pediatrics (AAP), American Academy of Child and Adolescent Psychiatry (AACAP), and Children’s Hospital Association (CHA) to jointly declare a “national state of emergency in children’s mental health” [9].

Much of the blame for this degradation in teenage mental health has been laid at the feet of social media. For example, a 2019 study of 12,886 individuals in England ages 13–16 found that those who used social media services more than three times daily self-reported worse mental health and well-being than those who used social media services less frequently as measured by the 12 item general health questionnaire (adjusted odds ratio of 1.31 for girls and 1.67 for boys) [10]. Similarly, a 2016 study of 467 Scottish teenagers found that overall social media use, nighttime-specific social media use, and emotional investment, and what the authors described as “emotional investment in social media, which includes feeling upset or disconnected when unable to access social media accounts” were all correlated with increased levels of anxiety ($r = 0.27$) and depression ($r = 0.21$) and decreased sleep quality ($r = 0.24$) [11]. Citing the AAP–AACAP–CHA “emergency” declaration, Seattle Public Schools filed suit against the companies that operate Facebook, Instagram, Snapchat, TikTok, and YouTube in January 2023. The suit references the “choices [the companies] made to design and operate their platforms in ways that exploit the psychology and neurophysiology of their users into spending more and more time on their platforms,” which it argues “are both particularly effective and harmful to the youth audience [the companies] have intentionally cultivated, creating a mental health crisis among America’s youth” [12].

While the literature has previously explored this topic, two significant changes have occurred in the social-media sphere since the studies were conducted. The first, and arguably most significant, is the rise of TikTok, which became available in the U.S. in August 2018 after merging with its sister app, Musical.ly [13]. Sixty-seven percent of American teens ages 13–17 reported using TikTok in a 2022 study, with 16 percent saying they used it “almost constantly,” making it the second-most popular social media app among teenagers (95 percent of whom reported using YouTube) [14]. In addition, the product head of Instagram announced in June 2021 that the app “is no longer just a square photo-sharing app” and would place a greater emphasis on video [15]. (Incidentally, the 2022 study found that Instagram is the third-most popular social media app among American teens, with 62 percent reporting using it [14].) We feel it is essential to study the impact of social media use in light of these two highly consequential events, creating an opening for our work.

III. METHOD

Research consisted of two phases: data collection and analysis. To collect data, anonymous surveys were emailed to a randomly selected group of 4,000 undergraduate students at a medium-sized ($n = 11,000$) four-year college in the mid-Atlantic. (Notably, some respondents indicated their schools were located in other regions of the country, suggesting that some survey recipients in turn sent the survey to their acquaintances.) A total of 332 students responded to the survey. Of these, we excluded 78 respondents who either reported an age older than 24 or did not report an age, leaving a total of 254 responses for analysis. The approximately 10-minute survey Questions used in the survey and corresponding Likert scale conversions was administered via Qualtrics. In the survey, we asked participants to respond to questions based on a series of scales; Table I lists the scales used with reference, the number of questions asked for each, and the originally published Cronbach’s alpha for internal consistency and validation. Cronbach’s alpha is a common measure in survey design to test the internal consistency of a multi-item scale. It measures the shared covariance of the items that comprise the scale to the overall variance. Alpha scores will range between 0 and 1, where a score of 0.7 or higher is considered acceptable and internally consistent. By using previously validated scales and comparing their Cronbach’s alpha scores with observed values in our study, we can empirically validate our findings.

In addition, participants were asked to provide their age, gender identity, number of semesters of college study completed prior to the current semester, and location of their college (based on U.S. Census Bureau regions). They were also asked the approximate frequency of their use of 10 social media apps or platforms. Table II shows participants’ self-reported demographics, and Table III shows the self-reported frequency of respondents’ social-media use.

For the analysis phase, responses were first converted to a four point scale or a five-point Likert scale beginning at 0. We calculated Chronbach’s alpha to measure the internal consistency of each question scale. For social media use, we

TABLE I. QUESTIONS USED IN SURVEY AND CORRESPONDING LIKERT SCALE CONVERSIONS

Scale	Questions	Likert	α
Social Media Use Questionnaire [16]	9	0–4	0.9
Need to Belong Scale [17]	10	0–4	0.82
UCLA Loneliness Scale [18]	20	0–3	0.91
“FoMO” Scale [19]	10	0–4	0.9
Adjective-Based Personality Test [20]	10	0–4	0.79

TABLE II. SURVEY PARTICIPANTS’ SELF-REPORTED DEMOGRAPHIC DATA

Age	Gender identity	College location
$\mu = 20.70$	Male = 95	Middle Atlantic = 204
	Female = 137	New England = 16
	Non-binary = 18	East North Central = 14
	Other = 4	Pacific = 7
		East South Central = 6
		South Atlantic = 6
		West North Central = 1

TABLE III. SURVEY PARTICIPANTS' SELF-REPORTED FREQUENCY OF SOCIAL MEDIA USAGE

	Facebook	Messenger	Instagram	LinkedIn	Pinterest	Reddit	Snapchat	TikTok	Twitter	YouTube
Less than once per week	$n = 218$	$n = 192$	$n = 60$	$n = 210$	$n = 188$	$n = 156$	$n = 127$	$n = 144$	$n = 156$	$n = 21$
Once per week	$n = 11$	$n = 14$	$n = 15$	$n = 21$	$n = 21$	$n = 33$	$n = 16$	$n = 9$	$n = 16$	$n = 24$
2-3 times per week	$n = 10$	$n = 7$	$n = 18$	$n = 10$	$n = 27$	$n = 28$	$n = 17$	$n = 9$	$n = 25$	$n = 29$
Daily	$n = 8$	$n = 21$	$n = 56$	$n = 7$	$n = 10$	$n = 14$	$n = 27$	$n = 14$	$n = 16$	$n = 54$
2-3 times per day	$n = 4$	$n = 4$	$n = 35$	$n = 2$	$n = 1$	$n = 8$	$n = 21$	$n = 12$	$n = 16$	$n = 33$
More than 3 times/day	$n = 2$	$n = 15$	$n = 69$	$n = 3$	$n = 6$	$n = 14$	$n = 45$	$n = 65$	$n = 24$	$n = 92$

converted each participant's self-reported use of each of the 10 apps to a 0–5 scale and then calculated the average value. We also maintained individual use scores for each platform. Next, the Spearman's rank correlation coefficient was calculated to assess the correlation between attributes and social media use. The results were used to test the null hypothesis that high social media use is strongly correlated ($\rho \geq 0.75$) with low self-esteem, low social support, and generally poor mental wellness, as measured by high measures of loneliness, "FoMO," and a need to belong, and the alternative hypothesis that high social media use is not strongly correlated ($\rho < 0.75$) with these individual attributes. Findings were moderated based on personality types as measured by the Adjective-Based Personality Test [20] which assesses a respondent's level of openness, conscientiousness, extraversion, agreeableness, and neuroticism (OCEAN). All analysis was conducted using the open-source R programming language and utilized publicly available R packages.

IV. RESULTS

All scales are internally consistent. The need for social media scale has a Cronbach's alpha of 0.83 (compared to 0.9 in the literature [16]). Dropping any item reduces alpha. The "need to belong" scale has Cronbach's alpha of 0.79 (compared to 0.82 in the literature [17]). Removing items 3-4 and 6-7 increases alpha to 0.83. Factor analysis reveals the reverse coding designed into the original scale, lending further credibility to the scale's validity. The loneliness scale has a Cronbach's alpha of 0.93 (compared to 0.91 in the literature [18]). Factor analysis reveals reverse coding for the nine items designed in the original scale. Finally, the FoMO scale has a Cronbach's alpha of 0.82 (compared to 0.9 in the literature [19]). The items in each scale are averaged to create the four composite scales. All scales have alpha values consistent with the originally published scales.

Figure 1 shows the Spearman's rank correlation coefficients among the scales and social media usage. The rows and columns correspond to the scales "need for use", "loneliness", "need for belonging", "FoMO", "personality", "actual use", respectively. The distribution of these scales across respondents are represented along the diagonal in Figure 1. The lower left shows a scatter plot and fitted line plots indicating the relationships among the scales. The upper right shows the observed correlations with "*" indicating statistical significance. All results were calculated using the R statistical programming language. We note that actual social media use is correlated most strongly with the "need for use" (with coefficient of $r = 0.46$). The second-strongest correlation coefficient ($r = 0.43$) occurs with "FoMO"; both are significant at $p < 0.01$.

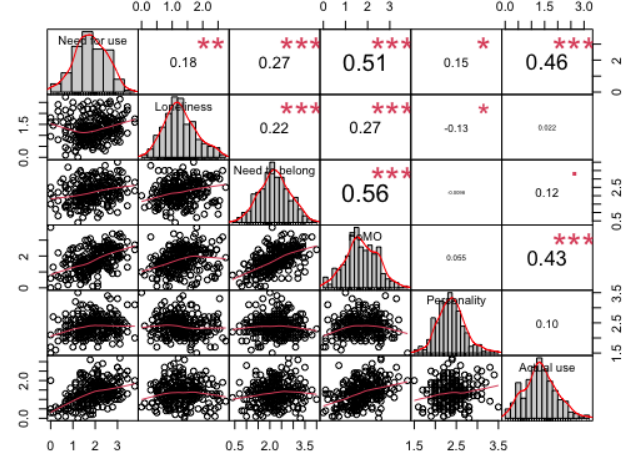


Fig. 1. Spearman's rank correlation coefficients for mental health indicators, personality traits, and social media use among survey respondents.

Based on these findings, it appears that social media use is correlated with a fear of missing out and a need for use more generally. In the case of the latter, it presumably goes without saying that an individual with a strong desire or need to use social media will make copious use of social media. In addition, the former is not an intuitively surprising result. Readers are almost certainly familiar with events frequently being advertised on Facebook; more generally, social media provides a means of keeping abreast of developments within one's group of friends and family—both life events such as weddings and child births and more mundane happenings such as parties. We note, however, that the correlation ($r = 0.43$) is not strong; indeed, the value of the coefficient falls well below the value posited in our hypothesis to indicate a strong correlation.

We note, however, that these results are based on overall usage of all social media services reported by participants. Our survey included sites such as LinkedIn—which may be less significant and of less utility to undergraduate college students than to the working professionals to whom the site is targeted—and Pinterest, which is more appropriately used for sharing ideas than for keeping up with one's peers. We observe in Table III that the largest number of participants reported using YouTube, Instagram, and TikTok more than three times daily; we thus reran the analysis for these services individually rather than all social media platforms.

Findings remain consistent. Reported use is correlated with "need for use" ($r = 0.45$) and with "FoMO" ($r = 0.39$). Instagram was correlated most strongly with "need for use" ($r = 0.38$) and "FoMO" ($r = 0.36$). TikTok was correlated most

strongly with “need for use” ($r = 0.34$) and “FoMO” ($r = 0.28$). None of these were as strongly correlated as we hypothesized, based on prior research.

Note that there are significant levels of correlation between scales, which may increase the variance inflation and confound these results. “FoMO” is correlated with “need to belong” ($r = 0.56$) and “need for use” ($r = 0.51$). The “need to belong” and “need for use,” however, are only correlated with a coefficient of $r = 0.27$. “FoMO” is also correlated with loneliness with coefficient of $r = 0.27$.

We also find correlations between personality traits and behavior scales. The strongest correlation is a negative coefficient of $r = -0.37$ between extraversion and loneliness. It is not surprising that extraverts would be less likely to be lonely. The next strongest correlations are also negative coefficients between agreeableness and “need for use” ($r = -0.32$), “need to belong” ($r = -0.32$), loneliness ($r = -0.30$), and FoMO ($r = -0.30$). Neuroticism is positively correlated with “need to belong” ($r = 0.27$), FoMO ($r = 0.25$), and loneliness ($r = 0.21$).

Some personality traits are weakly correlated with specific platform use. Neurotic people tend to use TikTok ($r = 0.20$) and SnapChat ($r = 0.18$). Conscientious people tend to avoid YouTube ($r = -0.19$), Twitter ($r = -0.20$), and Reddit ($r = -0.17$). Openness, agreeableness, and extraversion have no significant correlation with platform choice.

Given the high levels of correlations between factors, multiple regression was used to measure the marginal impact of different factors on social media behavior for TikTok, Instagram, SnapChat, and Twitter. We tested all factor combinations for each platform and report the best-fit findings with best Akaike information criterion (AIC).

Factors affecting TikTok usage are “need for use” ($p < 0.001$) and neuroticism ($p = 0.0052$). Factors affecting Instagram are “need for use” ($p < 0.001$), “FoMO” ($p < 0.001$), lack of loneliness ($p = 0.0317$), and lack of a “need to belong” ($p = 0.0488$). Factors affecting SnapChat are “FoMO” ($p < 0.001$), neuroticism ($p = 0.0295$), and lack of loneliness ($p = 0.0002$). The factors affecting Twitter are “need to belong” ($p = 0.0369$) and a lack of Conscientiousness ($p = 0.0133$).

We also find that there is high overlap in usage between TikTok, Instagram, and SnapChat. Twitter users also tend to use TikTok, but less likely to prefer Instagram or SnapChat. YouTube users tend to also use Reddit, but avoid SnapChat. It was difficult to draw conclusions about Facebook, Messenger, LinkedIn, or Pinterest due to lack of reported use.

V. CONCLUSION

Our initial hypothesis was that high social media use may be strongly correlated ($\rho \geq 0.75$) with low self-esteem, low social support, and generally poor mental wellness, as measured by high measures of loneliness, “FoMO,” and a need to belong. While our findings did not reveal strong correlation, we did observe significant moderate correlation, which diverges notably from much of the existing literature on cyber bullying [10], [11], [19].

Note that while the phenomenon of bullying on social media has been well documented [21], it is difficult to directly bully an individual user on a platform such as YouTube. (While both Instagram and TikTok allow users to send direct messages, this is not a primary focus of the platform.) This stands in contrast to an app such as Snapchat—in which the majority of a given user’s interaction with the platform involves sending and receiving pictures, videos, and/or textual messages directly to and from other users. We also note that Instagram and TikTok do not endow their users with a “profile” page on which other users can post textual and multimedia comments for all to see (in contrast to, say, a Facebook user’s Timeline); however, the ability to comment on a user’s posted media largely provides this same functionality, with the only restriction being that comments must be textual.

It is perhaps additionally appropriate to restate an observation from Section II: much of the previous literature was published before TikTok became the platform of choice for many teenagers and before Instagram pivoted to video. We observed in section IV that YouTube use is poorly correlated with all of the factors we measured. It is thus entirely possible that the shift away from images and text and towards videos—particularly those that tend to be silly and in many cases inoffensive [22]—has in fact lessened the negative impact of social media use on teens’ mental health.

We do not purport to come to this conclusion merely on the basis of our own study; we are interested, however, to see if the findings of future research on this topic are similar. Indeed, we would be remiss to not mention the limitations of our study. We begin with the relatively low sample size ($n = 254$); while large enough to draw meaningful conclusions, the number of respondents is smaller than some other studies whose findings may report inconsistent findings. For example, one longitudinal study ($n = 6,595$) that took place from September 2013 to October 2016—found a correlation between social media use by teenagers for over three hours daily and heightened risk for mental health problems [23]. It is highly possible that changes in young adult behavior and interaction with social media between 2016 and the wide-spread adoption of short-video content is alleviating some of the mental health concerns. It is also possible that there is an inherent response bias, with individuals who do feel that their mental health has been harmed by using social media less likely to respond to our survey invitation. Our finding suggest the need for a future controlled study consisting of two or more treatment groups of young adults who interact with social media differently over time and observe differences in mental health behavior. This type of controlled study, however, is very difficult to achieve.

We also wish to note that some of the existing literature did not directly examine the link between social media use and mental health. For example, Mason, Zaharakis, and Benotsch [24] studied what they termed “social network risk,” examining the link between students’ social media usage and substance use—alcohol, marijuana, and tobacco—and the link between substance use and mental health. We certainly do not mean to imply that this research is inconsequential—indeed, we believe it is enormously important—but rather to simply note that not all studies that have demonstrated a link between social media

use and adverse mental-health outcomes have examined the direct link between the two.

Future researchers may wish to continue examining the link between usage of video-based social media sites and apps (i.e., Instagram, TikTok, and YouTube) and mental health; the recency of our study and uniqueness of our finding vis-à-vis the existing literature suggest that this topic warrants further investigation. Researchers may also wish to explore behaviors that may indicate an individual is struggling with mental health—such as substance abuse—building on the work begun by [24].

There are several important conclusions we can take away from our present study. We have replicated and validated the use of several psychometric scales to measure social media users, specifically: Social Media Use [16], Need to Belong [17], Loneliness [18], and FoMO [19]. We find correlations between social media use and all the psychometric scales. These correlations are not as strong as they have been found in prior studies, lending evidence to suggest the shift in social media behavior among young adults is positive and reducing the risk of mental health concerns. This is also the only paper we are aware of that controls for big-five personality traits when investigating the relationships between mental health and social media use. Other studies focused on the relationship between personality and use do not consider psychometric factors.

As the mental health crisis among teenagers continues to rage, this research takes on ever greater importance. The crisis cannot be appropriately addressed until its causes have been adequately determined, and an understanding of the role of social media—whether central or not—is a key step in developing such a determination. We hope our findings of change among young adults in terms of social media use (video v. text interaction) and reduced indicators of mental health risk will generate further research on this important topic.

REFERENCES

- [1] E. Ortiz-Ospina. “The rise of social media.” (Sep. 2019), [Online]. Available: <https://ourworldindata.org/rise-of-social-media>.
- [2] E. B. Stolzenberg, M. C. Aragon, E. Romo, *et al.*, *The American freshman: National norms fall 2019*, Online, Los Angeles, CA, USA, Jun. 2020.
- [3] V. Murthy, Our Epidemic of Loneliness and Isolation: The U.S. Surgeon General’s Advisory on the Healing Effects of Social Connection and Community, Online, Washington, DC, USA, May 2023.
- [4] B. A. Primack, A. Shensa, J. E. Sidani, *et al.*, “Social media use and perceived social isolation among young adults in the U.S.,” *Amer. J. Preventive Med.*, vol. 53, no. 1, pp. 1–8, 2017. DOI: 10.1016/j.amepre.2017.01.010.
- [5] S. K. Lipson, S. Zhou, S. Abelson, *et al.*, “Trends in college student mental health and help-seeking by race/ethnicity: Findings from the national healthy minds study, 2013–2021,” *J. Affective Disorders*, vol. 306, pp. 138–147, 2022. DOI: 10.1016/j.jad.2022.03.038.
- [6] M. F. Garnett, S. C. Curtin, and D. M. Stone, *Suicide mortality in the United States, 2000–2020*, Online, <https://www.cdc.gov/nchs/products/databriefs/db433.htm>, Mar. 2022.
- [7] M. F. Garnett and S. C. Curtin, *Suicide mortality in the United States, 2001–2021*, Online, <https://www.cdc.gov/nchs/products/databriefs/db464.htm>, Apr. 2023.
- [8] T. J. Bommersbach, A. J. McKean, M. Olfson, and T. G. Rhee, “National Trends in Mental Health–Related Emergency Department Visits Among Youth, 2011–2020,” *J. Amer. Med. Assoc.*, vol. 329, no. 17, pp. 1469–1477, 2023. DOI: 10.1001/jama.2023.4809.
- [9] “AAP-AACAP-CHA declaration of a national emergency in child and adolescent mental health.” (Oct. 2021), [Online]. Available: <https://www.aap.org/en/advocacy/child-and-adolescent-healthy-mental-development/aap-aacap-cha-declaration-of-a-national-emergency-in-child-and-adolescent-mental-health/>.
- [10] R. M. Viner, A. Gireesh, N. Stiglic, *et al.*, “Roles of cyberbullying, sleep, and physical activity in mediating the effects of social media use on mental health and wellbeing among young people in England: A secondary analysis of longitudinal data,” *The Lancet Child and Adolescent Health*, vol. 3, pp. 685–696, 2019. DOI: 10.1016/S2352-4642(19)30186-5.
- [11] H. C. Woods and H. Scott, “#Sleepyteens: Social media use in adolescence is associated with poor sleep quality, anxiety, depression and low self-esteem,” *J. Adolescence*, vol. 51, pp. 41–49, 2016. DOI: 10.1016/j.adolescence.2016.05.008.
- [12] “Social media complaint filed by Seattle Public Schools.” (Jan. 2023), [Online]. Available: <https://www.seattleschools.org/news/social-media-case/>.
- [13] J. Russell. “Short video service Musical.ly is merging into sister app TikTok.” (Aug. 2018), [Online]. Available: <https://techcrunch.com/2018/08/02/musically-tiktok/>.
- [14] E. A. Vogels, R. Gelles-Watnick, and N. Massarat, *Teens, social media and technology 2022*, Online, Aug. 2022.
- [15] A. Silberling. “Instagram may not be a photo-sharing app anymore, but glass is.” (Sep. 2021), [Online]. Available: <https://techcrunch.com/2021/09/03/instagram-may-not-be-a-photo-sharing-app-anymore-but-glass-is/>.
- [16] N. Xanidis and C. M. Brignell, “The association between the use of social network sites, sleep quality and cognitive function during the day,” *Comput. in Human Behav.*, vol. 55, pp. 121–126, 2016. DOI: 10.1016/j.chb.2015.09.004.
- [17] M. R. Leary, K. M. Kelly, C. A. Cottrell, and L. S. Schreindorfer, “Construct validity of the need to belong scale: Mapping the nomological network,” *J. Personality Assessment*, vol. 95, no. 6, pp. 610–624, 2013. DOI: 10.1080/00223891.2013.819511.
- [18] D. W. Russell, “UCLA Loneliness Scale (version 3): Reliability, validity, and factor structure,” *J. Personality Assessment*, vol. 66, no. 1, pp. 20–40, 1996. DOI: 10.1207/s15327752jpa6601_2.
- [19] E. Wegmann, U. Oberst, B. Stodt, and M. Brand, “Online-specific fear of missing out and internet-use expectancies contribute to symptoms of internet-communication disorder,” *Addictive Behav. Rep.*, vol. 5, pp. 33–42, 2017. DOI: 10.1016/j.abrep.2017.04.001.
- [20] H. Bacanlı, T. İlhan, and S. Aslan, “Development of a personality scale based on five factor theory: Adjective-based personality test (ABPT),” *Türk Egitim Bilimleri Der-gisi*, vol. 7, no. 2, pp. 261–279, 2009.
- [21] M. Anderson, “A majority of teens have experienced some form of cyberbullying,” Pew Res. Center, Tech. Rep., Sep. 2018.
- [22] J. Herrman. “How TikTok is rewriting the world.” (Mar. 2019), [Online]. Available: <https://www.nytimes.com/2019/03/10/style/what-is-tiktok.html>.
- [23] K. E. Riehm, K. A. Feder, K. N. Tormohlen, *et al.*, “Associations between time spent using social media and internalizing and externalizing problems among US youth,” *JAMA Psychiatry*, vol. 76, no. 12, pp. 1266–1273, 2019. DOI: 10.1001/jamapsychiatry.2019.2325.
- [24] M. J. Mason, N. Zaharakis, and E. G. Benotsch, “Social networks, substance use, and mental health in college students,” *J. Amer. College Health*, vol. 62, no. 7, pp. 470–477, 2014. DOI: 10.1080/07448481.2014.923428.