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The Relationship Between Sleep Quality and Social Media Content

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Abstract

The present study investigated the relationship between social media posting behavior and sleep quality in a population of college students ($N = 30$) over 5 nights. Sleep duration and number of nightly disruptions were used to measure sleep quality using a smartphone app, SleepScore, that participants downloaded prior to the study. Every day after recording their sleep participants were presented with a "prompt word" and asked to make a post related to their respective prompt on the anonymous social media network Yik-Yak. A content analysis was then performed with the assistance of an independent coder in order to categorize the posts according to common themes and rate them on a scale of perceived negativity/positivity. I hypothesized that students who experience a poorer quality of sleep will subsequently make posts on Yik-Yak that would be perceived more negatively by the raters. While this hypothesis was not supported, a significant difference was observed in the relationship between the gender of the participant and how negative their posts are, with males writing more negative Yik-Yak posts than females. Existing literature regarding gender disparities in social media behavior is discussed.

Keywords: Yik-Yak, social media, sleep quality, affective stimuli, weekly mood

Dedication

This paper is dedicated to Mr. Rood, who first sparked my fascination with psychology during my senior year of high school. I undoubtedly would not have the same love for this field if it were not for his challenging and personable teaching style.

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I would first like to thank my advisor, Professor Devlin, who enthusiastically accepted my request for her to supervise my research project. She has supported my research ideas from the start, and pushed me to think critically about my methodology and improve it wherever I can. I am incredibly grateful for her timely and highly detailed feedback on any question I had or new version of my paper that I produced. Lastly and perhaps most importantly, Professor Devlin encouraged me to get excited about my research, which I have learned is an invaluable pre-requisite for embarking on such an extensive project as an Honor's Thesis. I truly appreciated her guidance in this process. I would also like to thank my readers, Professor Rich and Professor Schroeder, for giving me feedback on many different iterations of the paper. I am especially appreciative of Professor Rich, who gave me guidance and materials in the early stages of my thesis while I was still contemplating what topic I should be investigating.

I would like to thank Lucas Vasquez and Avery Remillard for volunteering to participate in my pilot study. They ensured that the instructions were clear and concise so that the rest of my participants could thoroughly understand their tasks. A major component to my research involved conducting a content analysis, a process that requires an independent coder to validate my perceptions of the data. On that note I want to thank one of my best friends, Arthur Baltz, who spent an afternoon with me in Shain Library sorting through over 100 social media posts. His help in this crucial task is very much appreciated.

Lastly, and most importantly, I would like to extend my gratitude to my parents. They have consistently gone above and beyond in encouraging me in all my academic pursuits and certainly influenced me to push myself in completing an Honor's Thesis. My passion for psychology has been constantly encouraged by my parents since high school, especially my dad,

whom I have spent many treasured moments with marveling at how amazing the human brain is. I owe my success in large part to this encouragement, and without my parents I certainly would have not made it as far as I have today.

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A conversation with any college student will reveal that social media plays a key, if not dominant, role in the lives of young adults. A single network alone can offer the ability to keep up with friends, meet new people, stay up to date on news, scout out new job opportunities, and consume and share popular media. With individuals spending increasingly more time on social media with a broader spectrum of activities in which to engage, I believe that it is vital for researchers to investigate the nuances of how people, students in particular, behave online. As individuals spend more and more time in the virtual world, however, they are also simultaneously retreating from a very separate world; that which we enter every night when we lie down in our beds and fall asleep. Across age demographics, Americans are sleeping far less than they have in the past (Center for Disease Control, 2016). This decline poses a plethora of public health concerns, threatening every aspect of the individual's well-being. In this study I sought to investigate the intersection between these two topics and pose the following question: does sleep quality in any way impact how people interact on social media?

Social Media: Why It Should Be Studied and How It Affects Our Health

To say that social media use had become widespread would be an understatement; as of July 2020, more than half of the global population, approximately 4.96 billion individuals, are active on some social network. When accounting for the proportion of the population who are not "eligible" to use social media (most networks are restricted to users over the age of 13), this number swells to more than 2/3 of the world population (Kemp, 2020). Americans are active participants in this global wave of social media use. A Pew Research poll indicates that 72% of Americans use some type of social media app. The nature of this engagement, however, is not uniform: users of all different ages and backgrounds interact with social media in very different

ways. For example, while over 65% of Americans between the ages of 18 and 30 have reported ever using the messaging app Snapchat, the proportion of adults over the age of 65 who have used the app sits at only 2% (Auxier & Anderson, 2021). YouTube, a social media site whose main form of engagement is video sharing, enjoys the attention of 95% of Americans from the same younger demographic yet only about half of users older than 65. Location also plays a role in what social media apps people use; users are almost twice as likely to use Instagram, Whatsapp, and Reddit if they are from an urban setting compared to a rural one (Auxier & Anderson, 2021).

Part of why these social media sites receive such heavy traffic is because of the wide range of utilities provided by a single app. In a 2021 survey of worldwide social media users, Statista lists 16 different reasons why users engage with social media, ranging from staying in touch with friends and family and reading the news to watching sports and following the daily lives of their favorite celebrities (Statista, 2021). Furthermore, the mobile nature of social media has allowed these tools to be accessible virtually whenever and wherever users would like to access them. As of 2017, 77% of Americans own a smartphone, reaching up to 95% for teenagers (Niles et al., 2019; Stockdale & Coyne, 2020).

The sheer prevalence of social media alone has warranted research into how it is affecting the inner lives and behavior of its users. Its tremendous variety, in terms of different networks as well as different uses, demands an in-depth investigation into these nuances. To be sure, the following pages will not touch on every way this surge of social media has infiltrated people's daily lives. Rather, I will focus on a few key areas of the literature that serve to demonstrate the importance in studying social media and its effects on human behavior. First, the tendency to rely on social media for the consumption and dissemination of information will be discussed.

Next, the complex relationship that networks like Facebook and Twitter have with their users' mental health will be explored. Lastly, and perhaps most relevant to the study at hand, the author will discuss the impact of social media use on users' sleeping habits.

Social Media as an Avenue for Knowledge Dissemination

For many in younger generations, it is difficult to imagine the prospect of *not* being able to access the news instantaneously, at any time they please. As social media has become ubiquitous, its functions have expanded to include providing users with news not only from traditional media outlets, but also from politicians, political parties, local and national governments, as well as prominent cultural figures like celebrities. In America, social media has actually surpassed print newspapers as the most popular way to inform citizens about current events (Lee, 2020).

The ongoing COVID-19 pandemic has taken the influence of social media use one step further as it has become one of the major sources of information flow during a time of panic, fact-searching, and often confusion among the general public. Research has demonstrated that social media use has historically increased in the times leading up to, during, and after natural disasters. Niles et al. studied trends on the platform Twitter during and around five American natural disasters. These events included hurricanes, flooding, and tornadoes that struck between 2011 and 2016 (Niles et al., 2019). The authors found that users were more likely to make Twitter posts more often than usual during such dire times. Users were also more likely to create posts that included disaster-related terms and share information regarding topics like preparation (pre-disaster) and recovery (post disaster) than prior to these events (Niles et al., 2019). Whereas Tweets regarding disasters such as Hurricane Sandy or flooding in Louisiana might be localized

to users in their respective regions, the social media onslaught that has accompanied the current pandemic has reached every American with access to the Internet.

The ability to share information is a crucial utility during a global pandemic. Social media networks have allowed an unprecedented level of dissemination of such information, both in terms of speed of access (users can instantaneously read posts made by other users) and geographical location (researchers from all over the world can share news and potential breakthroughs regardless of location) (Venegas-Vera et al., 2020). In a review of the positive and negative aspects of social media prevalence during the pandemic, Venegas-Vera et al. describe the dual nature of networking sites in their ability to help and harm the public. On one hand, clinicians and government officials can waste no time in getting crucial information into the hands of the public. In academia, researchers can quickly share sources and debate their validity, expediting the process of reaching a scientific consensus (Venegas-Vera et al., 2020). However social media can just as easily be used as a weapon to rapidly spread misinformation and low-quality information. Furthermore, even if all the information being spread is veridical, the sheer quantity of sources that the social media landscape offers could be overwhelming at best and confusing at worst (Venegas-Vera et al., 2020).

Additionally, celebrities with little to no medical training often siphon precious social attention away from verified sources like clinicians, public health officials, and researchers (Gottlieb & Dyer, 2020). The lack of empirically supported information that is spread through social media is a major concern of those in the public health field especially. Gupta et al. interviewed 128 researchers, academics, and clinicians on their attitudes toward social media as a source of pandemic-related information (as well as misinformation) (Gupta et al., 2020). The team found that about 81% of respondents viewed social media as the greatest channel of

information flow for facts regarding the pandemic. Conversely, a slightly greater percentage of the same group (87%) simultaneously viewed social networks as the greatest source of misinformation (Gupta et al., 2020). Supporting this perspective, one Pew poll found almost half of all Americans report getting some (30%) or a lot (18%) of their COVID-19 related news from social media networks (Mitchell & Liedke, 2021). The degree of influence that social media networks have on the general population demonstrates its important implications for public health. Another dimension of public health that researchers are increasingly interested in is mental well-being. The effect that social media use has on the users' mental and emotional health is another key component to understanding the technology's full impact.

Social Media and Mental Health: A Complicated Relationship

In November of 2021, an anonymous whistleblower working at Facebook released tens of thousands of documents that showed the social media giant had covered up the results of internal research regarding its relationship with the mental health of teenage users. Surveys found that 32% of teenage girls believe Instagram (owned by Facebook) made them feel worse about their bodies, and many of the desires to create a perfect image or be attractive began on the network (Wells, 2021). The scandal triggered a powerful media backlash and furthered already existing skepticism about the role of social media in the current state of mental health in the country.

Mental health has become a frequently discussed matter for those in the field of public health as rates of anxiety and depression have increased in the last decade. According to Mental Health America, a nonprofit that funds yearly assessments of the state of mental health in the country, in 2019 nearly 50 million Americans (19.86%) experienced some kind of mental illness. In 2021, 15.08% of American youth experienced a major depressive episode, a 1.24% increase

from 2020 (Mental Health America 2022 Key Findings). The global COVID-19 pandemic has in many ways exacerbated this already existing trend by leading to higher rates of loneliness and isolation (Abbot, 2021). Many researchers have noted that this increase in mental health concerns maps directly onto the growing prevalence of new technology like smartphones and social media, prompting many to ask the question: is social media to blame for this steep rise in depression, anxiety, and other mental health issues?

As early as 1998 researchers demonstrated a relationship between increased Internet use and a decline in subjective reports of mental health. In one of the pioneering studies investigating the effects of the Internet on behavior, researchers followed 169 adults across 73 households who were between their first and second years "online" after recently acquiring a computer. The researchers found that among these adults a significant increase in depression and loneliness was associated with greater amounts of Internet usage (Kraut et al., 1998). Furthermore, a small but significant association was found between Internet usage and a decrease in time spent communicating with household family members and the size of the user's social circle.

Of course general Internet usage is vastly different from the more narrow category of social media use, and Internet use in 2022 is far more complex than it was in 1998; yet Kraut's study served as a jumping-off point for more research on the relationship between the use of novel technology and well-being. More than two decades later, a number of researchers have examined correlational trends between social media usage and a deterioration in mental health (Donnelly & Kross, 2016; Lup et al., 2015; Pantic et al., 2012). Using experience sampling, Kross et al. found that Facebook use was related to moment-to-moment declines in reports of well-being among users, measured through how positively individuals felt and how satisfied they were with their lives (Kross et al., 2013). In one study researchers limited social media use

across several different platforms for 3 weeks in a population of 143 undergraduates. Use was limited to 10 minutes a day (per app) for the experimental group, and the control had no social media limitation (Hunt et al., 2018). The researchers observed a significant decline in loneliness and depressive symptoms in the experimental group, with the greatest impact among students entering the study with the highest levels of depression (Hunt et al., 2018). Tromhott similarly found that adults in an experimental group assigned to take a break from Facebook experienced greater levels of life satisfaction and more positive emotions than did the control group (Tromhott, 2016). The researcher also found that adults who tended to use Facebook passively (scrolling through pages without interacting with other users) were more likely to reap those positive effects, a finding consistent with other research (Verduyn et al., 2015). Clearly there is mounting evidence that social media can have a harmful effect on mental health, albeit in limited experimental studies (this weakness in the current literature will be discussed later). However, positive effects of social media usage have also been found in a wide range of studies.

The opportunity to engage in positive, peer-to-peer interactions and expand one's social circle has been pointed to as a potentially protective function of social media (Odgers & Jensen, 2020). For example, Gross had adolescent participants exposed to social exclusion in a laboratory setting via participation in a "multi-player" computer game in which they were "ignored" by other players (in reality there were no other human players and this experience was entirely simulated). Then the researchers had them either play a computer game alone or instant message (IM) an unfamiliar peer on social media. The communication with a peer led to a greater "bounce-back" from the experience of ostracization; the participants in this group reported greater self-esteem and perceived relational value after the experience than did the control group (Gross, 2009).

One study demonstrated that for participants using Facebook to maintain already existing friendships, using the social network was associated with greater overall psychological well-being (Ray & Lonborg, 2015) than was true for those who did not use the social network. Pereira et al. reported Facebook use (alongside usual pharmacotherapy) could be used to improve the depressive symptoms of patients with treatment-resistant major depressive disorder. In a randomized control study, patients who used Facebook for 1 hour everyday improved significantly more than did the non-Facebook control group. Interestingly, a third group who had access to Facebook and was "friends" with their psychiatrist reaped even greater benefits from using social media (Pereira et al., 2014) relative to the other two groups. Furthermore, social networks can act as avenues for important mental health-related information, especially for young individuals (Kauer et al., 2014; Rideout & Fox, 2018). All these data indicate that in certain contexts, social media can improve well-being by facilitating positive social interactions.

To explain the inconsistency between those who experience deleterious effects of social media use and those who are uplifted by it, several researchers propose a "rich-getting-richer" model of social media use (Kraut et al., 2002; Odgers & Jensen, 2020). The hypothesis suggests that individuals who enter the virtual environment with greater levels of self-esteem and high quality social connections are more likely to have positive experiences on social media than are individuals without those characteristics. Those with high self-esteem are more likely to use messaging apps more frequently and have a greater number of online friends (Odgers & Jensen, 2020). Conversely individuals who have had experiences with bullying in "real-life" are more likely to experience cyberbullying and ostracization online than are those without that experience. In a similar vein, those with mental health problems tend to engage in a more passive way online, being more likely to observe what others post rather than actively reach out to others

in what one researcher called a “lurking nature” (Odgers & Jensen, 2020). In this way, social media appears to exacerbate existing divides between those who thrive socially and those who have more trouble in the social sphere and in life in general. Interestingly, far more numerous than either clear negative or positive findings in this field is research that shows there might not be a simple, causal relationship between social media use and mental health.

In a review of six meta-analyses from 2014 and 2019 conducted by Odgers and Jensen, not one demonstrated a strong causal relationship between the amount of time spent on social media by adolescents and any indicators of mental health (depression, anxiety, self-esteem, overall well-being, etc.). Small and mixed associations were the norm across all six studies (Odgers & Jensen, 2020). What could account for such mixed findings? The results from one review from 2016 included in the meta-analysis reflect a potential answer: the effects of social media on mental health are highly dependent on the *unique, specific interactions* that individuals experience on these sites, which could lead to either negative or positive outcomes (Seabrook et al., 2016). Rather than painting social media use as harmful or helpful, Seabrook et al. argue that “engagement and interactional styles” differ between individuals and that the consequences of these interactions are equally as varied.

For example, maladaptive styles of cognition, when present during engagement on a social network, can warp the user's experience and result in negative health outcomes (Seabrook et al., 2016). One such error in thinking is the negative perception of neutral or positive social interactions, common among individuals suffering from depression (Seabrook et al., 2016). Researchers found that among individuals with higher depressive symptoms, perceptions of social support on Facebook do not align with reality. Despite being reached out to by a number of friends, depressed users perceive relatively little social support on social media sites (Park et

al., 2016). Another cognitive error that mediates social media's effects on wellbeing is the habit of rumination, or brooding (Seabrook et al., 2016). Rumination is characterized by the excessive focus of problems and negative feelings (Davila et al., 2012). Two studies conducted by Davila et al. demonstrated that the relationship between experiencing negative interactions on social networks and developing depressive symptoms was strengthened by tendencies to ruminate. The authors also demonstrated that the same is true for negative interactions online between those in romantic partnerships (Davila et al., 2012).

There are a number of weaknesses in the current literature that make it difficult for researchers to pinpoint an exact relationship between social media use and mental health outcomes. Primary among the reasons why it is empirically dubious to claim that social media directly impacts the mental health of adolescents and adults is the lack of causal evidence; strikingly few experiments have been conducted in this field of study. As is well known, correlation on its own does not infer causation, and the vast majority of research regarding mental health and social media use has taken the form of cross-sectional correlational studies (Odgers & Jensen, 2020). In fact, out of a number of widely cited literature reviews, only a handful of experimental designs are present in the entire field (Ghaemi, 2020; Odgers & Jensen, 2020). For this reason academics and clinicians have remained cautious about making any such claims.

In this way, the ability for researchers to make causal claims about the effects of social media on mental and emotional wellbeing has been limited by a shortage of ecologically robust experiments. More research is required, especially studies with an experimental methodology, to fully parse out the relationship between social media and mental health. One impact that social media use has on general well-being that is better supported by the literature is on sleeping

habits. A wealth of research has demonstrated a potentially harmful effect relationship between being active on social media and getting adequate sleep every night.

Social Media and Sleeping Habits

Smartphone and tablet use has become ubiquitous in our lives and has found its way even into one of our most personal environments: our beds. Findings suggest that up to 60% of young adults report engaging in some type of screen-related behavior within an hour before bedtime (Alonzo et al., 2021). Unlike the relationship between social media and mental health, its impact on users' sleeping habits is more straightforward. In a review of the literature regarding the association between social media use and sleep quality, Alonzo and colleagues found that fully 23 out of 24 articles analyzed demonstrated a correlation between social media use and poor sleep quality (Alonzo et al., 2021). Several different countries were represented in the review, including China, Switzerland, Italy, and Bangladesh. While several different age ranges also were present in the review, college students comprised most of the populations included (Alonzo et al., 2021). For example, one such study found that among 1,788 young adults in the United States, high social media use (measured as minutes per day) strongly correlated with subjective reports of sleep disturbances. (Levenson et al., 2016). The finding that college-age populations are susceptible to the negative effects of social media use is widely replicated in the literature (Abu-Snieren et al., 2019; Asiri et al., 2018; Bowler & Bourke, 2019). In a study examining the role of social media use on sleep quality among medical students at King Khalid University (Saudi Arabia), Twitter and Whatsapp use correlated with poorer quality sleep. Furthermore, those with the highest prevalence of poor sleep were students who used the two apps for more than 4 hours a day (Asiri et al., 2018). Facebook was also examined in a study regarding the role

of the social media network in sleep issues. Once again higher levels of engagement with social media were associated with poorer quality of sleep (Przepiorka & Blachnio, 2020).

Many sleep researchers have posited that one reason why night-time use of screens might make it harder to fall asleep is because of the unique wavelength of light that most light emitting diode (LED) screens emit (Bowler & Bourke, 2019). Research has shown that late night exposure to these short wavelengths of light inhibits the production of melatonin in the brain. Melatonin is a hormone secreted by the brain to signal several different neural networks that they are to transition from waking activity to that of the sleep state (Walker, 2018). Bowler and Bourke expanded on this area of the literature in an interesting way. Using a methodology in which participants were shown either personally relevant Facebook pages or randomly selected pages, the authors found that individuals in the former group were more highly affected by the melatonin-inhibiting effects of their screen's blue light than were those exposed to random pages. In other words, the content being viewed on social media interacted with the effect of the LEDs to amplify the power of the screen to keep participants awake (Bowler & Bourke).

Diving Deeper Into Social Media: Sentiment Analysis

As researchers like Odgers and Jensen have pointed out, current social media research suffers partly because metrics like screen-time are not sufficiently robust to describe the full extent of social media interactions. Users engage in varied activities online (even on the same network) and consequently "time spent on social media" cannot possibly capture the breadth and depth of interactions users have on these networks. As was stated earlier, social networks provide users a unique platform to voice their thoughts and feelings to a broad audience in a plethora of forms: blogs, status updates, comments, instant messages, and more. Perhaps unsurprisingly, people present themselves to the world in virtual environments just as they do in "real" ones:

they share all varieties of personal information and insights into their inner lives (Golbeck et al., 2012).

An alternative, more robust method of analyzing social media data takes advantage of this wealth of personal information and involves the use of human raters or computer algorithms to extract meaning behind these forms of communication. Sentiment analysis refers to the process of analyzing language (often online and in large quantities) in order to gain an understanding of the sentiment or meaning that the user was attempting to convey. Currently such data mining is often found in large scale operations where algorithms analyze enormous amounts of text from the Internet, such as social media networks (Kennedy, 2012). Researchers can learn a great deal about individuals by analyzing the sentiments they have posted on social networks.

Gaining insight into the personality traits of social media users via their posts is a prominent subfield in sentiment analysis. In one study, Golbeck et al. designed a machine learning algorithm to predict each of the Big Five personality traits of Facebook users within 11% of their actual values by linguistically analyzing user profiles (Golbeck et al., 2011). Similarly Sumner et al. demonstrated that the presence of antisocial personality traits belonging to the "Dark Triad" (narcissism, Machiavellianism, and psychopathy) can also be accurately predicted from social media content (Sumner et al., 2012).

Beyond personality traits, researchers are learning that they can also glean information regarding a user's general state of well-being from how they interact on social media. In one study examining how college students interact on Facebook, researchers found that language used in status updates could indicate potential depressive symptoms in the user. Words and phrases like "hopeless" and "giving up" were particularly prevalent in college students suffering

from depression (Moreno et al., 2011). In a similar vein, Settanni and Marengo showed that users with higher levels of depression and anxiety featured more negative emotions in their content than did the average Facebook user (Settanni & Marengo, 2015). The study examined a combination of status updates and comments, as well as self-reports of depression, anxiety, and stress. Like Golbeck and others, LIWC was utilized to analyze the vocabulary employed by users. The authors note that this relationship is also found in offline interactions (individuals scoring higher in depression, anxiety, and stress levels use more emotional language than do those who score lower on those variables), indicating further that social media environments might simply reflect "normal" cognitive processing (Settanni & Marengo, 2015). While these analyses more often focus on the most popular social networks, like Facebook, Instagram, and Twitter, other less common sites can also provide insights into the lives of their users. One of the less common networks, and the focus of this study, is the anonymous social media app called Yik-Yak.

Yik-Yak

One popular network, and the target of the present study, is called Yik-Yak. After its launch in 2013, the app was the target of considerable media attention, most of which was negative (Mahler, 2016). The developers were accused of creating a platform where cyber-bullying and harassment ran rampant and after a while were pressured to take down the app from the Apple Appstore. Yik-Yak is perhaps best known for its anonymity; users are not required to register with the network and create an identifiable account like most other social media networks. Instead of searching for their friends and colleagues, Yik-Yak users are simply presented with the activity of other users within a 5-mile radius. The app allows no forms of

communication other than text: links, images, videos, GIFs, and other popular media forms are absent from the forum.

The combination of anonymity and the ability to instantaneously have an audience with everyone in a certain radius has made the app particularly popular on college campuses (Black et al., 2016). As with Facebook and Twitter, a number of content analyses have been conducted on the anonymous forum. Due to the high prevalence of college-age Yik-Yak users, most of the studies regarding the app have taken place on college campuses. Consequently the research done has focused primarily on evaluating attitudes toward issues deemed relevant for college-aged populations. For example, one study investigated Yik-Yak posts as they related to their attitudes regarding substance abuse. The authors coded posts for references to particular substances (such as alcohol and marijuana) as well as the posts' authors' perceived attitude towards the indicated substance (is the user condoning or condemning use of the substance) (Hammond et al., 2018). Another study similarly evaluated Yaks (an individual post on Yik-Yak) for the presence of "risky behaviors" and their appraisal of it. The researchers found that risky behaviors were discussed more often than were non-risky behaviors and also received more "upvotes" (a sign of approval by other Yik-Yak users) (Wombacher et al., 2018).

Some studies have sought to simply explore what users commonly talk about, such as a study conducted on 42 different college campuses using 4,001 posts (Black et al., 2016). The present study introduces a novel paradigm in studying the activity of Yik-Yak users. To the author's knowledge, all studies to date that conduct content analyses of Yaks in a given community use a technique of naturalistic observation; the researchers do not interact with the Yik-Yak users but instead gather posts that have been created without their intervention. Often this approach includes scanning Yaks from several different college campuses over a certain

number of days, or sometimes several times a day for one or more days. The present study uses a framework in which the author provides Yik-Yak users with a prompt to create a post "about." In this paradigm, the researcher is concerned with the *interpretation of a provided prompt* rather than already-existing posts on the social media platform. The goal of this procedure is to create a standardization among user experiences so that the effects of sleep loss might be observed in the content of their posts.

As the introduction suggested, I am not only interested in social media behavior on its own in this study. In addition to using social media more, college students are also sleeping less (Hershner & Chervin, 2014). Consequently it is of utmost importance for researchers to investigate the intersection between these two contemporary trends and whether the profound health consequences of sleep loss might affect how young adults behave on the new digital medium. As the following section will demonstrate, these health consequences cannot be underestimated. The mounting evidence in the field of sleep research is unanimous; the human brain and body are designed for regular periods of sleep and without it they suffer in myriad ways.

The Sleeping Brain

Contrary to popular belief, the sleep state is far from a period of mental inactivity. Indeed, during sleep the brain engages in a plethora of unique neurological processes that affect nearly every part of the human physiology (Walker, 2018). Crucial anabolic hormones are released, promoting growth and repair of muscles. Levels of important neurotransmitters like norepinephrine and serotonin are replenished, which allow for normal functioning the next day (Walker, 2018). So impressive is the breadth to which the sleeps state influences the human body that new functions are still being discovered; just a decade ago a system was discovered in the

brains of rats that clears neurons of the waste they create during the day, and this process only occurs during the sleep state (Illiff et al., 2012). Despite these sweeping health implications Americans are sleeping less than they have in the past, and less than is recommended by public health experts.

As of 2016 more than one third of American adults were not attaining the recommended seven hours of sleep every night (Center for Disease Control, 2016). One study found that 44% of Americans feel sleepy between 2-4 days of the week, and 28% feel sleepy between 5-7 days (Sleep in America, 2020). Teenagers in high school face a particularly difficult situation in this area. Natural shifts in their circadian rhythm dictate that they become more tired and eventually fall asleep later than they did when they were children or pre-teens; accordingly they also naturally wake up later. Yet early school start times (the average in the United States is 8:00am) often drastically cut into this crucial early morning rest (Walker, 2018). This leads to a situation where as many as 80% of high-schoolers in some states do not get the recommended 8-10 hours of sleep that they require (Center for Disease Control, 2016). More relevant to the present study are the sleep related plights of colleges students. Rigorous academic schedules, demanding extracurriculars, and the heavy prevalence of late-night media has created a perpetual sleepiness problem on most campuses. One study found that for at least three days of the week, 60% of college students reported that they felt "dragging, tired, and sleepy" (Hershner & Chervin, 2014). As sleep trends worsen nationwide it is crucial for researchers to devote their resources to understanding the implications of sleep deprivation in all areas of human health.

One area of health in which the role of sleep is growing more evident is that of emotional regulation and expression. Research has revealed that the experience, expression, and inhibition of emotional states are all abilities made possible in part by sleep-dependent processes (Walker,

2018). The following pages will delve into this relatively new area of research, as it is particularly relevant to my hypothesis that poor sleep quality will lead to more negative social media behavior.

Imbalances in Affective Reactivity

Feeling irritable and more susceptive to negative feelings after a night of poor sleep is a common experience. A wealth of research has validated this observation in experimental settings and demonstrated that sleep deprivation can indeed lead to a host of negative emotional outcomes. These include increases in subjective reports of irritability, affective volatility, stress, fatigue, and sleepiness (Dinges et al., 1997; Horne et al., 1985; Krause et al., 2017). After restricting sleep to 5 hours a night for a 1-week period in adults, Dinges and colleagues observed increased subjective reports of mood disturbances and emotional difficulties (Dinges et al., 1997). Total sleep deprivation has been shown to raise baseline stress levels the following day, as well as make encounters with low-level stressors more anxiety and anger inducing (Minkel et al., 2014). This outsized response to emotional stimuli, or affective reactivity, is a well-documented phenomenon in sleep reduction/sleep deprivation studies. In a study that exemplifies this phenomenon, Zohar et al. had medical residents fill out hourly surveys on how they interpreted different events throughout the day. Researchers observed that residents who had slept less showed an amplified emotional reaction to goal-disrupting events, such as a machine malfunction or an issue with the availability of medication (when compared to their well-rested counterparts). These residents also experienced a dampened response to events that were considered goal enhancing, such as encountering a medically-interesting issue. (Zohar et al., 2005).

Researchers studying how individuals react to emotional events often focus on the cognitive strategies that are used to cope with said events either in healthy or maladaptive ways (Mauss et al., 2013; Shermohammed et al., 2020). One such approach to handling potentially overwhelming events is called Cognitive Reappraisal (CR). CR is the ability to reframe an emotional event so that its impact is not as severe, or to transform it into a positive experience (Mauss et al., 2013). Using a CR assessment paradigm, Mauss and colleagues demonstrated that the ability to reframe a negative experience in a more positive light might be inhibited by inadequate sleep. Participants were divided into a well-rested group and a sleep-deprived group, then showed a 2-minute clip that was intended to evoke a strong feeling of sadness. Then both groups were given CR strategies, such as instructions to "think about the situation you see in a more positive light" or to "Keep in mind that even though a situation may be painful in the moment, in the long run, it could make one's life better, or have unexpected good outcomes" (Mauss et al., 2013). In comparison to the sleep deprived group, the researchers found that the well-rested group was significantly more capable of decreasing sadness levels, leading them to believe that the use of such CR techniques might be restricted by inadequate sleep (Mauss et al., 2013).

Related to the reactivity of stress, Anderson and Platten used a "Go/No Go" task to measure the impact of sleep loss on impulsivity. In this paradigm, impulsiveness was measured via participants' ability to respond to some stimuli, and withhold a response for the others. In this version of the task the stimuli presented were either neutral or emotional words. Participants who were less rested than their counterparts were less likely to appropriately withhold responses for emotionally salient stimuli, implying an inhibitory effect on the parts of the brain responsibly for impulse control in the face of emotional stimuli (Anderson & Platen, 2011).

A majority of research regarding the effect of sleep deprivation on emotional reactivity has examined the relationship within the context of experiencing negative stimuli (Gujar et al., 2014). However there is a growing body of literature that focuses on how perceptions of positive stimuli are warped by inadequate rest, showing that sleep loss can lead to the over-appraisal of rewards and other positive stimuli. One area that has been studied frequently in this area is the role of sleep loss in the perception of food. Regardless of hunger levels, individuals rate the attractiveness of food images more positively and are more likely to spend higher amounts of money on food when they are sleep deprived (Benedict et al., 2012; Rihm et al., 2019). This excessive positive reactivity to rewards has been linked to changes in how certain brain regions process reward stimuli. Signals from the hypothalamus (a brain region responsible for alerting the body of hunger) are over amplified in sleep deprived participants, and this effect is unique to food-related stimuli (Rihm et al., 2019). Other studies have found excessive activation in the nucleus acumbens, a reward-processing center of the brain (Venkatraman et al., 2017). In a study that examined how participants perceived decisions in a game of poker, Venkatraman and colleagues found that sleep-deprived players showed greater activation in this reward-processing region when making high-risk plays. Because activation in the nucleus acumbens has been linked to the anticipation of rewards, this finding indicates that without sleep the potential gains from risky behavior have an outsized influence on behavior (Venkatraman et al., 2017). Put together, these findings demonstrate that sleep loss can influence the way that individuals react to both negative and positive stimuli, generating excessive activation in critical behavior-modulating brain regions.

Malfunction of Emotional Recognition and Expression

The ability to accurately detect the emotions that others are feeling, whether it be through their spoken language, facial expressions, or body movements, is an invaluable cognitive resource for navigating daily life. Likewise, being able to express what we feel and when we feel it is equally important. The literature surrounding the effect of sleep loss in these areas of emotional functioning indicates that it could cause a dampening effect on expression and sensitivity (Krause et al., 2017). Individuals generally exhibit less accurate abilities to discern positive stimuli from negative or neutral ones after a night of relatively less sleep (Goldstein & Walker, 2014; Walker, 2017). When shown images of people making different facial expression of varying intensities, participants who were sleep deprived had a difficult time interpreting what emotion the faces were attempting to express. This effect occurred at the mid-range of intensities; in other words, participants could recognize the most obvious facial expressions (very angry or very sad) but the more moderate facial expressions seemed ambiguous (van der Helm et al., 2020). Similar effects have been demonstrated with regards to the perception of threatening facial expressions, with sleep deprived individuals being less discerning of friendly and threatening faces (Goldstein-Piekarski et al., 2015). Given that much of face-to-face communication relies on slight nuances in expression, this finding has substantial social implications.

The capacity to express one's emotions also seems to be associated with getting adequate sleep (Walker, 2018). After one night of sleep deprivation, facial reactions to emotional stimuli (measured via electromyogram) were significantly delayed when compared to a well-rested control group (Schwarz et al., 2013). A similar emotional "blunting" of facial expression has been observed in the behavior of sleep deprived participants exposed to emotion-inducing movie

clips (Alfano et al., 2020; Minkel et al., 2011). Researchers have also examined the effects of such emotional impairment specifically in social settings to investigate the social consequences of sleep loss. When researchers gathered a group of friends in a laboratory setting and primed the group for conflict (researchers had groups of friends discuss recent disagreements they had in the past) more anti-social behavior was observed in groups that were deprived of sleep the night before compared to a well-rested group (McMakin et al., 2016). Sleep deprived individuals have been observed to perform poorly in such complex social tasks as discerning sincere statements from sarcastic ones, and rating how strongly they believe others are feeling certain emotions (the ability to show empathy) (Deliens et al., 2015; Guadagni et al., 2014). These

Sleep and Next Day Mood

The relationship between sleep loss and imbalances in next day mood is a well-documented phenomenon (Krause et al., 2017; Ong et al., 2011). Konajrski and colleagues reviewed 29 articles from 1995 to 2018 that explored the relationship between sleep variables (both subjectively and objectively measured) such as sleep quality, sleep duration, and sleep latency, and day-to-day fluctuations in general mood. All research included in the review had participants track their sleep over a number of days and complete daily mood assessments (Konjarski et al., 2018). The review found that generally better sleep quality was associated with increased reports of positive affect the following day. Studies included in the review found participants reported experiencing more "cheerfulness," as well as more "joviality and self-assurance" (Kalmbach et al., 2014). Likewise, days following a night of poor sleep generally led to greater reports of negative affect, although the magnitude of this relationship differed greatly study to study. The review included studies from older adults, college aged, children and adolescents, suggesting that the role of sleep in modulating daily mood might be present in all

age groups (Konjarski et al., 2018). Interestingly, the authors also note that these sleep effects are most consistent in studies that use subjective sleep recording (like asking participants to log their sleep in a daily diary) as opposed to using objective measures (mainly actigraphy, which measures cycles of sleep activity). This observation led the authors to believe perceptions regarding how much we slept, how long it took us to fall asleep, and how few times our sleep is interrupted is also important in next day mood regulation (Konjarski et al., 2018).

Given the preceding findings it is evident that the sleep state has an important role in the maintenance of emotion-regulatory mechanisms. Using brain imaging studies researchers can get closer to fully understanding the neural substrates behind these mechanisms. In one of the most widely cited fMRI studies investigating the relationship between sleep and emotional reactivity, Yoo and colleagues demonstrated a differential activation of the amygdala based on the amount of sleep experienced the night before. Participants were shown an image of a negative stimulus, then either sent to get a full night of sleep or were deprived of a night's rest. Then participants were shown the same negative stimuli, this time while in an fMRI machine. Participants who were sleep deprived showed a drastic 60% increase in amygdala activity when viewing the images, leading researchers to believe that the sleep loss had interfered with some form of emotional processing that occurred unabated in those who slept. This cohort also showed decreased connectivity between their amygdala and their medial prefrontal cortex, an area which (among other functions) serves to exert control over amygdala activation (van der Helm & Walker, 2017). These studies demonstrated that the excessive reactivity to stimuli that often accompanies sleep loss has a neurological basis in the underperforming of some brain regions.

In the preceding literature I established that sleep quality is linked a host of emotional processes, such as reactivity to both negative and positive stimuli, recognition and expression of

emotional cues, and maintaining a stable mood. These findings are not only grounded in behavioral observations but also evidence from a neurological standpoint. Many of the studies referenced in this section utilized a standardized database of affectively rated stimuli in order to empirically evaluate the relationship between sleep deprivation and emotional processing. The following pages elaborates on these databases and how they are used to delve into the psychology behind emotional processing and expression.

How Researchers Empirically Investigate Emotion

Standardized Stimulus Databases

In order to answer questions about the nature of human emotions, researchers have created standardized databases of stimuli, or norms, rated on various scales of affective experience. In the creation of these corpuses, hundreds of participants are asked to rate each stimulus according to criteria designated by the researchers. Based on the specific research at hand, stimuli of differing nature are collected. One type of stimuli frequently used are images. Databases like the International Affective Picture System (IAPS) and the Geneva Affective Picture Database contain thousands of negative, neutral, and positively rated stimuli for emotion researchers to pull from and present in their studies (Dan-Glauser, 2011; Lang et al., 2008). Some visual stimulus databases have specific categories of photos for researchers to use. For example, the Geneva Affective Picture Database (GAPED) has categories of stimuli that commonly elicit negative emotions from the general population, such as snakes, spiders, and images of human rights violations (Dan-Glauser, 2011). Also common are databases of emotionally rated words. Affective Norms for English Words (ANEW) is the most widely cited of these lexicons (Bradley & Lang, 1999; Delatorre et al., 2019). There are also auditory

stimulus databases containing various sounds and noises, as well as excerpts from popular musical compositions (Bradley & Lang, 2007; Imbir & Golab, 2016).

In a paper where she presents her own lexicon of 13,915 words, Warriner et al. categorizes four areas of research for which such emotional ratings of stimuli are utilized (Warriner et al., 2013). First are investigations into the emotions themselves: how they are produced, experienced, and their behavioral manifestations. In one example, Lewis and colleagues presented affectively rated words to participants and observed the neural correlates of different emotional dimensions using fMRI (Lewis et al., 2013). The second approach is for studying how affective experiences influence cognitive processes, like attention, learning, and memory. Third is the line of research that involves pooling large amounts of data and attempts to affectively evaluate different aspects of their language. These kinds of studies will be discussed in a later section, as they are relevant to the present study. Lastly, affectively rated stimulus databases can be used in gauging the emotional value of additional words to create novel databases (Warriner et al., 2013). ANEW, which is used in the present study, is frequently used in the pursuit of creating new lexicons.

Affective Norms for English Words (ANEW)

The Affective Norms for English Words database ANEW is one of the most widely cited databases of affectively labeled words and is used in a wide variety of experimental settings, although generally focused on emotion and emotional processing of language (Delatorre et al., 2019). The corpus was designed using the dimensional view of emotion, which posits that affectual experience is best described through the lens of three primary dimensions (Osgood et al., 1959; Russel, 1980). These dimensions include valence (a bipolar scale ranging from unpleasant to pleasant), arousal (a bipolar scale ranging from calm to excited), and dominance (a

bipolar scale ranging from being in-control of the emotional response to out-of-control of the emotional response) (Bradley & Lang, 1999). It contains 1,034 English nouns, verbs, and adjectives that have been systematically rated on these three dimensions (Bradley & Lang, 1999). ANEW includes the mean valence, arousal, and dominance ratings for each word and their standard deviations, along with gender specific mean ratings and the "total" mean ratings (the male and female scores averaged together). The database was made to complement existing collections of emotionally rated stimuli, specifically the International Affective Picture System (IAPS, Lang et al., 1999) and the International Affective Digitized Sounds (IADS, Lang et al., 1999).

Since it was developed in 1999, there have been countless iterations of the database for different languages including Spanish (Redondo et al., 2005), French (Monnier & Syssau, 2014), and Portuguese (Sores et al., 2012). New databases have also been created for the purpose of adding additional stimuli. ANEW only includes 1,034 stimuli, which Warrnier argues is insufficient for the kinds of large-scale "mega-studies" emerging with the advent of online sentiment analysis. Warrnier and others have built on ANEW and its methodology in order to build lexicons that better capture more of the affectual experience in the English language (Mohammed, 2018; Warriner et al., 2013).

The present study is interested in the valence ratings of each of the words in ANEW. These are rated on a scale of 1-9, 1 being "unpleasant" to 9 being "pleasant". For example, "beach" has a mean valence of 8.03, while "betray" is rated 1.68 (Bradley & Lang, 1999). It is common for researchers investigating emotions or emotional processing to divide standardized stimuli (such as those found in the ANEW) into three categories based on measured valence: negative, neutral, and positive. Several studies, including the present one, define negative,

neutral, and positive stimuli as having mean valence ratings falling in between 1- 4, 4- 6, and 6- 9, respectively (Delatorre et al., 2019; Ferré et al., 2012; Scott et al., 2012).

The Present Study

In order to examine the effects of sleep quality on social media behavior, I employed a novel paradigm in which I asked participants to make social media posts that were related to a provided prompt word. These prompt words were taken from the ANEW database and rated as emotionally neutral (as described above). This standardization was employed to establish a uniformity between participants so that responses could not be associated with reactions to unique words. For the present study I formed the following hypothesis: participants who report poorer sleep quality (as defined in this study as shorter sleep duration and a greater number of nightly disturbances) will craft Yik-Yak posts that are rated as more negative than participants who get higher quality sleep.

Method

Participants

Before recruitment began for this study, two undergraduate students (one from Connecticut College and one from the University of Vermont) were informally recruited to participate in a "pilot study" so that I could further refine the clarity of the study instructions. In this study, 63 undergraduate students from Connecticut College signed up; 30 completed the study (20% male, 80% female). A majority of participants in this study identified as White (73%). There was a fairly even spread with regard to class year: 36.7% were seniors, 30% were juniors, and both sophomores and first years consisted of 16.7% of the population. I used the larger Connecticut College student body as a participant pool, recruiting mainly through fliers

and social media. Participation from Psychology 100 students was also used, who received credit rather than a monetary reward for their participation. The study was posted to the participant management software SONA so that these Psychology 100 students could find the study and sign up for credit. Lastly, I made a special effort to request students enrolled in Psychology of Sleep (PSY204) to participate because they were already knowledgeable about the sleep recording software used in the present study (SleepScore) for their class curriculum.

Stimuli and Measures

Affective Norms for English Words (ANEW)

The Affective Norms for English Words (ANEW) database consists of 1,034 English words rated based on how they elicit varying dimensions of affective experience (Bradley & Lang, 1999) (see Appendix A). The present study focused on each word's valence value, rated on a scale from 1 (unpleasant) – 9 (pleasant). Words that were considered "neutral" in valence (values ranging from 4.5 – 5.5) were extracted from the database and presented to participants in this study to be used as "prompt words." These prompt words were displayed for participants in a daily email that requested they create a post on Yik-Yak about said topic. My goal in this process was to imitate the natural process of making a post of the social media app; instead of generating a topic themselves to make a post about, they were given a pre-determined prompt that was of neutral valence so that any difference in rated post affect could be assigned to the participant, not the prompt. These prompts were sent to participants every day for the duration of the study (five days) for them to make a post triggered by the prompt. The range of 4.5 to 5.5 was based on a number of studies in which negative, neutral, and positive words were categorized as words having mean valences between 1 – 4, 4- 6, and 6 – 9, respectively

(Delatorre et al., 2019l; Ferré et al., 2012; Scott et al., 2012). In total 271 words of neutral valence were extracted from the larger ANEW database and were used as "prompt words".

Furthermore, any words that I deemed inappropriate for undergraduates in the experimental context were removed. For example, in ANEW, the words "lesbian" and "military" are both are rated at the midrange of valence means, or "neutral." However due to the cultural idiosyncrasies present on an undergraduate campus I predicted that these words would evoke feelings that were not neutral.

Positive and Negative Affect Schedule (PANAS)

In order to control for general affect during the week of the study (which could influence the subjective negativity or positivity of a social media post), participants completed the Positive and Negative Affect Schedule (PANAS) (Watson et al., 1988) after completing the five nights of sleep recording (see Appendix B). Participants rated how often they felt 20 different emotions over the past week, half referring to positive emotions and half referring to negative emotions. The items are rated on a 5-point scale, ranging from feeling them "very slightly or not at all" to "extremely". During analysis these items would be transformed into a "positive score" and a "negative score".

Instruments

SleepScore App

While the gold standard in the field of sleep tracking remains polysomnography (PSG: a combination of instruments that can measure brain activity, heart rate, and eye movement, among other physiological markers of sleep), alternatives do exist. Wearable trackers and smartphone apps that track quantitative and qualitative data about sleep can be more affordable and convenient than traditional PSGs. Research has demonstrated that for some of the more basic

aspects of sleep tracking, like total hours spent sleeping, these alternatives can be just as accurate as PSG (Chinoy et al., 2020). One such alternative is a free app for both Apple and Android devices called SleepScore (SleepScore Official Website). The app uses sonar technology to record the breathing patterns of users end extract a variety of sleep data from those recordings. These data include total time spent sleeping, how much time was spent in each unique sleep stage, and number of nightly disruptions, among others. SleepScore was utilized in the present study to obtain sleep related data from participants.

Participants were given full instructions on how to download and operate the app in the informed consent, as well as in the Study Instructions Email (see Appendix C). For ease of data submission, participants only reported two sleep markers and sent them to me via the Daily Sleep and Post Log Qualtrics Survey (see Appendix D). These markers were total time spent asleep and number of nightly disruptions.

Yik-Yak Social Media App

Yik-Yak is a social media platform that, after being taken down in 2017, was recently relaunched in February of 2020 under new ownership. The app is essentially one long message-board: no forms of communication (e.g., images, videos, links, etc.) can be posted other than text. Posts are limited to 200 characters and can only be seen by other users within a 5-mile radius (with the exception of features such as "Peeks," a feature that allows users to see users' posts from varying locations of their own). To make a post on Yik-Yak one only needs to download the app; no user actually has an "account," so to speak. In this way Yik-Yak provides total anonymity to its users. The combination of anonymity and the ability to see the opinions of those in close proximity has made Yik-Yak popular on college campuses, including Connecticut College.

In the informed consent document, the participant was made aware that they must already have Yik-Yak, or be willing to download it, to participate in this study. Participants were asked to make five posts on the app, one for each day of the study. These posts were created after participants viewed the "prompt word" that was sent to them that day.

Survey Software (Qualtrics)

Participants used the survey software Qualtrics to submit their sleep data and Yik-Yak posts daily throughout the study, as well as to sign up and submit their demographics information and complete the PANAS after the data submission. All responses were anonymous: participants were given a Participant ID number in the beginning of the study, and all subsequent entries were identified via this ID. While there was a record of which participant's emails were linked with which each participant's ID during data collection, once data analysis began this identifying information was deleted.

Procedure

Recruitment and Signup

For this study, participants were recruited mainly through fliers placed in strategic places of high student traffic throughout the Connecticut College campus like the Crozier Williams Student Center and Harris Dining Hall (see Appendix E). Participants were also recruited through my personal Instagram social media account (see Appendix F). Posts on Instagram account "stories" are able to be seen by all users following the account for 24 hours. All forms of recruitment lead students to the Sleep and Social Media Signup Form, where they officially signed up for the study (there were QR codes on the fliers that sent students directly to the Signup Form when scanned) (see Appendix C). This form contains an introductory video that is about a minute long and gives the student a general gist of the study (see Appendix G). Then the

informed consent document was presented, which contains instructions for completing the study and what it would entail (see Appendix H). Minor deception was used in the Informed Consent document; participants were led to believe that their social media posts would be compared to alternative "posts" made by students in a non- social media setting. The purpose of this cover story was to draw attention from "what" they were posting and shift attention to "how" they posted, so that participants would undergo a more natural experience engaging with social media.

Completing the study

After signing up, participants were emailed the "Study Instructions Email" with all of the instructions required to complete the study in a more accessible way than the informed consent, in the form of a longer instructional video (Appendix I). This communication included instructions on operating the SleepScore app, Yik-Yak, and how to submit the sleep and social media data. It also made clear the exact timeline of the study, and answered some questions that I had envisioned participants might have had. The email included each participant's unique Participant ID Number for their daily data submission. This ID number was used in order to keep the identities of participants anonymous once data submission ended and analysis began.

After reading the instructions on how to proceed with the study, the participants began with a "pilot night" of sleep data collection. The pilot night was included so that the participants could have the opportunity to get acquainted with the technology. Once the first night passed, the participants were instructed to fill out the short "Start Study Survey," which simply notified me that the participant had successfully logged one night of sleep and was ready to begin the study (see Appendix J). This survey included an option to contact me if the SleepScore app did not function correctly. Once this survey was filled out the first Daily Topic Email was sent (see

Appendix K). The Daily Topic Email contained two elements: the participant's "prompt word" of the day (chosen from the ANEW database) about which they were asked to make a Yik-Yak post, and a link to the Sleep and Post Log. The participant was asked to "…post the first thought that comes into your head after reading the following word: [insert prompt word]". This statement was chosen to mimic the natural process of conjuring up something to post on Yik-Yak. Once they had posted, they used the Sleep and Post Log to submit their post and sleep data to me. This process repeated for five days, so that by the end of the data collection period each participant posted five Yik-Yak posts, recorded their sleep for five nights (including the pilot night), and submitted all of these data anonymously via Qualtrics. I used a Google Spreadsheet to keep track of all participant information while data collected occurred. The final entry on Qualtrics was accompanied by a debriefing document, demographics question, the Positive and Negative Affect Schedule, and questions regarding the medium of compensation that the participant favored (participants had a selection of different $10.00 gift cards to choose from including cards from Target, Amazon, or Dunkin' Donuts) (see Appendix L and Appendix M). This compensation was made possible by funding provided to me from the Connecticut College Psychology department. The amount of $500.00 was provided with the hope that 50 participants would sign up, each being reward $10.00.

Content Analyses

Data submission lasted 5 weeks and ended on March 15th, 2022. Once all of the data were collected and exported to SPSS from Qualtrics, the identifying information connecting each participant's email with their participant ID was deleted. This process ensured that each participant's data were kept connected via their unique ID number while the information could be analyzed anonymously. Once the window for data submission closed, two content analyses

were performed on the submitted Yik-Yak posts. Both of these analyses required that a portion of Yik-Yaks be removed; those that were either one word posts or whose meaning was not interpretable were deleted ($N = 41$). After this process, 105 Yaks remained to be analyzed (see Appendix A for all posts and their respective prompt words). For the first content analysis, I and an independent coder reviewed and coded the posts for common semantic themes. Six categories of posts were established: Announcement, Humor, Observation, Question, Campus Life, and Pop Culture (see Table 1 for category definitions and examples; some definitions are borrowed from Black et al., 2006, which found similar categories in their content analysis of Yak-Yak posts). I assigned each post a primary category and an optional secondary category if the post were deemed to fit two simultaneously.

I recognize that content analyses require that categories be mutually exclusive; this limitation of the study is elaborated on in the Discussion section. Then an independent coder was asked to place a sample of the total posts (n = 20) into one of the six categories. If the coder thought that one post could be identified by two categories simultaneously, they were instructed to give the post a secondary category as well. After this first round of ratings a Cohen's Kappa coefficient value was calculated for each category to determine the level of agreement between the two raters. For all six categories, Cohen's Kappa coefficient was not high enough for the standards accepted in my field, indicating a low level of agreeability and unclear operation definitions for each code (Semler, 2000). Following the procedure laid out in "An Overview of Content Analysis," I reconciled differences in rating tendencies with the independent coder to develop a new set of guidelines (Semler, 2000). Two major changes in coding occurred. First, the independent coder suggested that the Observation category ($n = 4$) be subsumed into the much larger Announcement category ($n = 54$) because of the similarity of their definitions.

Second, the coders decided that the "Campus Life" category be used generally as a secondary category, since a large portion of posts seemed to include elements of its definition but primarily belonged to other categories. For example, the post "Harris making my stomach hurt" would primarily be rated as an announcement, but secondarily rated as campus life because it features an element of the college campus (the dining hall). All primary categories, Announcement ($\varkappa$ = .90), Question ($\varkappa$ = ..70), Pop Culture ($\varkappa$ = ..86)., and Humor ($\varkappa$ = .83) all had $\varkappa$ values that were either "Substantial" or "Almost Perfect" (Stemler, 2000s).

For the second content analysis I was attempting to determine the perceived positivity or negativity of each post, or its affective rating. A five point scale was created, ranging from 1 (negative) to 5 (positive) (see Appendix N) (see Table 2 for frequency and examples of each rating). I initially coded all posts according to this scale, then an independent coder was given a sample (n = 11) to code in order to establish a degree of inter-rater reliability, in the form of Cohen's Kappa Coefficient. A second content analysis was performed after the coders discussed differences in opinion and the $\varkappa$ value reached a "Substantial" level of agreement ($\varkappa$ = .7317).

Results

Content Analysis 1

The first content analysis categorized posts (N = 105) into five different categories based on their thematic content (Announcement, Question, Humor, Pop Culture, and Campus Life) (see Table 1, which provides the operational definitions for each category and examples). All posts received a primary coding (N = 105) and a substantial portion also received a secondary coding (n = 35), meaning that the post encompassed more than one category. For primary coding, most posts fell in the Announcement category (n = 56). These included observations about the user's

surroundings or an event that recently occurred in their lives such as “It's a swamp outside” and “Some people at this school are like skyscrapers.” More common were self-referential posts that explicitly featured the user such as “I wish my boyfriend could bench press me” and “coffee is my medicine.”

Announcement posts varied greatly in their perceived negativity/positivity ratings. Posts in this category constituted 8 out of 13 “negative” posts; posts such as “I feel like I’m locked up” and “Harris making my stomach hurt” expressed negative self-experiences whereas statements like “The fire alarm in Hamilton was nonsense I was falling asleep to it” acted more as a way to express discontent with something that had just happened. After Announcements the next most frequently occurring code was Question (n = 31). Most of these posts genuinely posed a question to the Yik-Yak community, such as “is it hard to get freeman tower if you’re not a senior” and “who thinks aliens will visit earth in our life time?”. Some of these posts were likely rhetorical in nature, like the post “can we please get new chairs” or “Why are razor blades so expensive?”. Less common primary codes were Pop Culture (n = 8), Humor (n = 9), and Campus Life (n = 1) (regarding Campus Life, the independent coder and I agreed that the category should mostly be used as a secondary category, to denote that a post centered around campus life).

Out of the 35 posts that included a secondary category, most were coded as Campus Life (n = 24). This group differed greatly in its content, though some common themes emerged. Most prominent was that more than half of the posts in this group (n = 13) featured some type of complaint, whether about academics (“I would rather watch paint dry than go to lab again”), specific utilities (“The bathrooms at this school have no privacy at all)” or the campus in general (“Not missing the slushy sidewalks”). Several posts included references to specific buildings, like “Whoever’s zoomin their car down cro Blvd rn [right now]: no thank you”. The Harris

Dining Hall specifically was posted about four times. Interestingly, all three posts regarding academic topics were complaints; two of these were rated as “negative” and one was rated as “slightly negative”.

Content Analysis 2

The independent coder and I also rated the posts (N = 105) on how negative or positive they were perceived to be on a five point scale was, ranging from 1 (negative) to 5 (positive) (see Appendix N) (see Table 2). Most were rated as neutral (n = 41). There was a substantial variation in content for this category. Some posts were simple personal statements that were interpreted neither as positive or negative, such as “I used to be addicted to peanut butter jelly sandwiches” or “I want an old fashioned typewriter.” Others were questions or pop culture references that were too ambiguous to assign a positive or negative label, e.g., “How do you pronounce museum” and “Who lives in a pineapple under the sea?” Posts that were rated as slightly negative (n = 21) or slightly positive (n = 24) appeared at similar rates in the total sample. Thirteen posts were rated as negative, expressing general feelings of sadness (“Does anyone else feel like a tool?”, or “I feel like I’m locked up”) or specific dissatisfaction with certain topics like classes or campus life (“8:00AM classes make me want to join the nunnery instead of getting a degree” or “Is it just me or has COVID decreased potential social spheres"). Lastly, strikingly few posts (n = 6) were rated as “positive”.

Table 1

Frequency and Description of Primary Codes

Code	Frequency, *N*(%)	Description	Example
Announcement	56 (53.3%)	The announcement category includes posts that are making a statement or imparting wisdom. This category included posts that were not able to be contextually understood or otherwise categorized.	*I just saw a hawk attack a squirrel, RIP little buddy.*
Question	31 (29.5%)	This category includes posts that are posing questions to the Yik-Yak community.	*Why are razor blades so expensive?*
Humor	9 (8.6%)	Posts within the category included explicit jokes, absurd references, or otherwise attempts to be funny.	*Call me ranch cuz I be Dressin*
Pop Culture	8 (7.6%)	These posts reference a well-known musician, actor/actress, television series, restaurants, etc.	*Who lives in a pineapple under the sea?*
Campus Life	1 (1%)	Posts that referenced campus buildings, events, finances, or other campus-related sentiments	*Upvote for Honey Siracha Wings everyday*

Table 2

Frequency of Post Affective Ratings

Rating	Frequency, *N* (%)	Example
Negative	13 (12.4%)	Does anyone else feel like a tool?
Slightly Negative	21 (20.0%)	No way I'm doing homework today
Neutral	41 (39.0%)	do market baskets still exist??
Slightly Positive	24 (22.9%)	Anyone wanna go cliff jumping
Positive	6 (5.6%)	What are the contents of snow? Who cares its fun to play in?

Relationship Between Post Content and Sleeping Habits

The primary hypothesis in this study was that poorer quality of sleep (measured by a greater number of nightly disruptions) and shorter sleeping duration would correlate with more negative Yik-Yak posts. This hypothesis was not supported; a correlational analysis showed that there was no significant relationship between either duration of sleep, $r(70) = -.063$, $p = .637$, or nightly disruptions, $r(70) = -.128$, $p = .290$, with the rated negativity/positivity of each Yak. The number of posts included in this analysis ($n = 70$) was only a subsection of the larger population ($N = 105$) because a large number of participants failed to accurately record their sleep.

Post Hoc Analyses

Relationship Between Prompt Word Valence and Post Rating

Each prompt word that I chose from the ANEW database had a valence value between 4.5 and 5.5. To determine whether the variation in valences between different prompt words and the affective rating of the posts that arose from them were related, a post hoc correlational analysis was conducted. The recorded valence of each prompt word had no significant correlation with their respective post's rated level of negativity/positivity, $r(105) = .161$, $p = .101$.

Gender Analyses

I conducted several post hoc analyses to determine whether there were any significant differences in the way that people who identified as men or women behaved on social media in this study. In this study, the only gender identities that were self-reported were along the binary of men and women. First, I conducted a chi-square analysis to investigate a relationship between gender and the primary and secondary coding of Yik-Yak posts. An association trending towards significance was observed, ($X^2 (4, N = 105) = 8.18$, $p = .085$) (see Table 3). There was no

association found between gender and secondary post category (X^2 (3, N = 105) = 3.34, p = .340) (see Table 4). I also conducted an independent samples t-test to determine if the mean positivity/negativity ratings for posts differed between males and females (the only genders people self-reported). A significant difference in mean rating between posts written by men and women was found at the specified $p < .05$ level, $t(36.55) = -1.39$, $p = .030$. The average rating for women was 2.98, whereas the average rating for men was 2.62 (on a scale where 1 = negative and 5 = positive).

Lastly a MANOVA analysis was conducted to determine if the gender of participants had any relationship with their positive or negative scores on the Positive and Negative Affect Schedule (PANAS). Results indicated no significant multivariate effects for Gender, Wilks's Lambda = .799, $F(2,15) = 1.88$, $p = .187$. Univariate findings revealed no significant effect for PANAS Positive Score, $F(1, 16) = 0.46$, $p = .507$ or PANAS Negative Score $F(1, 16) = 2.65$, p = .123 (see Table 5 for Means and Standard Deviations). The number of participants included in this analysis (n = 18) was only a subsection of the larger population (N = 30) because a large number of participants failed to complete the PANAS inventory.

Table 3

Frequencies and Chi-Square Results for Primary Coding of Posts by Gender (*N* = 105)

Primary Code	Male Posts		Female Posts	
	n	%	*n*	%
Announcement	12	46.2	44	55.7
Campus Life	1	3.8	0	0
Humor	4	15.4	5	6.3
Pop Culture	0	0	8	10.1
Question	9	34.6	22	27.8

Table 4

Frequencies and Chi-Square Results for Secondary Coding of Posts by Gender (*N* = 35)

Secondary Code	Male Posts		Female Posts	
	n	%	*n*	%
Campus Life	9	90	15	60
Humor	1	10	5	20
Pop Culture	0	0	4	16
Question	0	0	1	4

Table 5

Means and Standard Deviations of PANAS Scores by Gender

	Male		Female	
	M	(*SD*)	*M*	(*SD*)
Positive Score	18.86	2.37	20.82	5.54
Negative Score	30.75	6.95	26.35	4.10

Note. Scores (negative and positive) range from 10-50 on the PANAS measure.

Discussion

General Findings

The purpose of this study was to investigate the intersection between two topics that are uniquely pertinent in the lives of college students today: social media and sleep quality. The primary hypothesis of the study, that poorer sleep quality would lead to more negative social media posts on the anonymous app Yik-Yak, was not supported. Neither number of nightly disruptions nor total sleep duration was related to the content of posts made during subsequent days.

A post hoc analysis that was conducted to investigate the relationship between the posts and their affective rating revealed a significant correlation; Yik-Yak posts that were written by women were rated as significantly less negative than posts written by men. This observation is largely consistent with existing literature on gender differences in social media behavior. On Facebook, women use warmer, more polite, and more compassionate language than do men, whose language was described as colder, more hostile, and more impersonal (Schwartz et al., 2013). Men are more likely to swear and discuss potentially sensitive topics such as politics and current events, as well as violence and death (Park et al., 2016) than are women. In a sweeping study of 700 million Facebook posts across 75,000 participants, Schwartz and colleagues demonstrated substantial gender differences. For example, females tend to use more emotion words, first person singulars, and reference social/psychological processes (e.g., expressing feelings towards other, or discussing relationships). Men were more likely to use object-oriented and impersonal language (Schwartz et al., 2013). Both of these findings are commonly found in the literature regarding gender differences in language (Newman et al., 2008).

The second analysis conducted to investigate the relationship between gender and social media post content only partially supported the existing literature. One of the chi-square analyses found results trending towards significance but not meeting the study's requirements ($p = .085$). This outcome could be explained in a number of ways. First, while other studies include thousands, even tens of thousands of participants, the current study only analyzes posts from 30 individuals. Furthermore, there was not an even split of men and women; only 6 participants identified as men, vastly undermining the ability to observe a relationship of gender to behavior. The medium of posting might have also presented me from observing a gender effect that is similar to what other researchers have found. Yik-Yak, like all other social media sites, has trends and communication styles unique to the platform and might reflect gender disparities present in other networks. To the best of my knowledge, no study has specifically examined the differences in social media behavior between men and women on Yik-Yak, and so to make comparisons between activity on other networks (like Facebook) and this app might not be justified.

Content Analyses

The two results of the two content analysis showed interesting trends in the posting habits of college students on Yik-Yak. Some of these patterns are unique to this study, whereas others are supported by the existing literature regarding post content on the app. The first content analysis sought to categorize over 100 user-created posts into several different thematic categories (see Appendix A). After analyzing the posts an independent coder and I categorized them into five different groups: Announcements, Questions, Humor, Pop Culture, and Campus Life (posts that were perceived as fitting into two different categories were given a secondary code as well). The categories that occurred with the greatest frequencies were Announcement

and Questions, comprising a combined 82.8% of all posts. The prevalence of these categories on Yik-Yak has also been found by Black and colleagues, who conducted a content analysis on the app and found announcements and questions to be in the top five most common types of posts (Black et al., 2016). About a fifth of the posts were coded secondarily as Campus Life, meaning that they made some reference to an element of Connecticut College's campus life. Since college aged, young adults are Yik-Yak's primary demographic, it is not surprising that a portion were dedicated to campus topics.

For the second analysis, the independent coder and I rated each post on a scale of perceived negativity/positivity. Out of the 105 posts, only 39% were rated as neutral, which is interesting because the prompt words on which each post was based were rated as emotionally neutral. A majority (61%) of posts were not rated as neutral: they were either negative, slightly negative, slightly positive, or positive. A number of conclusions could be reached from this finding. One could interpret this as a sign that Yik-Yak, like other social media networks, rewards more affectively charged posts and therefore users would be more encouraged to craft content that is designed to elicit an emotional reaction from readers. However one could also argue that this effect would take place regardless of the medium participants use to create statements from prompt words. For example, I might have gotten the same results if I simply gave participants neutral prompt words and had them write down related statements on paper. To the best of my knowledge, no study has given participants words of neutral valence and asked them to write a simple statement based on that word. Further research is needed regarding individuals' reactions to affectively standardized stimuli for me to make a justified claim regarding the validity of this interpretation.

A basic inferences that can be made from this content analysis is that people tend to express emotions on Yik-Yak. Even when presented with a neutral stimulus, they are more likely to make a post that reflects some type of internal affective state, either on the negative end or the positive end of the spectrum of emotions. With regard to this novel methodology, generalizing the results to the general Yik-Yak-user population must be done with caution. The methodology of this study (presenting users with prompts and asking them to make Yik-Yak posts with them in mind) is not identical to the natural process of a user thinking of an original post and sharing it on the app.

Limitations

The present study contains several limitations that might limit its generalizability. First and perhaps most importantly, the low number of participants ($N = 30$) limited the statistical power and generalizability of the results. This issue became more problematic during the post hoc analyses on gender differences because it was not evenly split between men ($n = 6$) and women ($n = 24$). With such a small sample of men it is extremely difficult to claim that any finding is generalizable to the larger population. Along the same vein, the demographics of my population was not diverse and consequently not representative of larger populations. All 30 of my participants came from a small, liberal arts college in the Northeast and were ages 18-22. Within the context of my study, this most likely greatly affected how the participants acted on social media. A female college student in the Northeast will behave differently on social media than will other demographics, which is why it is difficult to claim that the findings of my study could be replicated in other areas and with larger populations.

As I stated in the Method section, 63 participants signed up for the study, yet only 30 completed it. For context, this means that those participants who signed up viewed the

introductory video, which gave a gist of the study, signed the Informed Consent, and then did not actually begin recording their sleep or making posts on social media. There are a variety of reasons why the participant dropout rate was so high. In retrospect, the methodology of the study (generally speaking) was convoluted. The idea of downloading two separate apps (SleepScore for sleep recording and Yik-Yak for social media posting) was possibly quite daunting to students, especially those who had neither app prior to the study. The idea of recording sleep and making social media posts every day for five days also could have dissuaded participants from going further than the Informed Consent.

The use of the sleep recording app SleepScore ended up being a detriment to the study. A majority of the participants had difficulty recorded their sleep- in fact, only three participants managed to get accurate recordings of their sleep for all five nights! In the context of this study, this either meant two outcomes occurred. Either SleepScore simply stopped working halfway through the night, or it did record the sleep but the participant told me that they were confident it was not accurate (they were sure that they slept more or fewer hours than was recorded). Most participants succeeded in recording at least 2-3 nights, but a large number had no accurate sleep data to submit. Clearly if this many students had trouble recording their sleep, then choosing the instrument that I selected (SleepScore) was not a wise decision. Curiously, the pilot study that I ran before I began recruiting participants was conducted for this very reason: to determine the practicality of using this particular app. Both participants in the pilot study managed to record their sleep successfully for a majority of the nights, leading to my decision to use the app in the larger study. I was also inspired to use SleepScore because of PSY204, a class at Connecticut College where students use the app to record their sleep for credit. In retrospect it would have been a better decision to have the students self-report their sleep duration using a nightly journal.

Self-report sleep studies are by no means rare in the field of sleep research. While it is generally accepted that such self-reports are not as veridical as objective measures and probably more accurately reflect participants' *perceptions* about how much sleep they got, in the context of a college aged demographic this approach might have had a number of advantages. First, the prospect of simply writing down your weekly sleep duration on paper is much less daunting than downloading an app and figuring out how to operate it. This aspect would most likely increase the number of participants in my study. Second, each participant would have more sleep data to submit (albeit less reliable than the SleepScore data, but more than half the time that was not accurate either).

Another issue regarding the methodology of the study was the way I conducted the content analysis of the posts. Ideally, categories that are used in content analyses should be mutually exclusive; the groups do not overlap. In other words, each post should only belong to a single category (Stemler, 2000). Following the lead of Black and colleagues, who also conducted a large content analysis of Yik-Yak posts, I gave each post a primary and secondary category (Black et al., 2016).

Sleep Research: Recommendations for Undergraduates

This study represents the second research project I have conducted at Connecticut College pertaining to the field of sleep research. The first, completed for my Research Methods class, had participants record the content of their dreams for two nights. For both studies I ran into considerable challenges. Given my experience, I submit the following list of three recommendations I have for students eager to track the sleep of participants based on the limitations I encountered in my studies;

1) Collecting participants will easily be the biggest hurdle. Unlike your colleagues, who might have students fill out a single Qualtrics survey, you will be asking your participants to record and submit multiple pieces of data over several days. Make data collection/submission as straightforward and simple as possible as to not "scare off" potential participants. If possible, secure funding from the department to compensate participants.
2) Take care to identify the best possible method of sleep recording for your specific purposes and situation. Self-reports can be inaccurate and be more representative of sleep perceptions (which are also important) than actual sleep duration, but are far more feasible and attractive to busy college students than more involved, objective means. More veridical data collection, like using an app or a PSM device, will produce more reliable data but will be far more difficult to employ and advertise to a college population.
3) With regard to the duration of the study, attempt to strike a balance between what a commonly found in the literature for your specific topic and what is attainable with a college aged population.

Future Directions

There are a number of ways that this research could be expanded upon. Ideally this study would be done with a greater amount of sleep data. To achieve this goal could mean either having participants self-report their sleep duration in a journal or use polysomnography to get a more accurate and holistic picture of the participants' sleep state. Along this same idea it would be interesting to examine the relationship between social media activity and the prevalence of certain sleep stages. For example, given the theories regarding REM sleep's role in emotional

regulation (Walker, 2018) do nights of sleep with less REM time result in more affectively loaded social media content?

Another direction to take this research would be to look at metrics of social media activity other than the content of posts. As was discussed in the introduction, research regarding social network engagement sorely lacks in-depth analyses that go beyond factors like "screen-time." Regarding Yik-Yak specifically, researchers could examine how sleep quality affects what posts are liked or disliked, how long users spend reading each post, or how likely they are to make comments on the content of others. Furthermore, this research can be expanded to the multitude of other social media networks that are used by the college-aged demographic.

This question regarding the intersection between sleep quality and social media can also be reversed; what kinds of attitudes regarding sleep are spread on social media? Given that sleep reduction is already associated with higher rates of social media use, it would benefit researchers to track the perceptions of sleep on social networks. For example, a content analysis could be conducted that analyzes every post in a given time frame that relates to sleep, similarly to how Hammond et al. isolated Yik-Yak posts pertaining to substance abuse in order to investigate common attitudes about the topic (Hammond et al., 2018). Perhaps there are common myths that circulate social media sites regarding how much/little sleep the average person needs, or how long it is acceptable to stay up online every night. Given that so much of our public discourse is informed by what is discussed on social media, it would be useful to empirically analyze the virtual discourse around sleep hygiene.

Lastly, this line of research should be expanded past traditional modes of online engagement like social media or news consumption. One example could be video games. American, especially teens and adolescents, spend huge chunks of time playing with others in

multiplayer games. Anyone who has played a video game with highly competitive players, like many “first-person-shooters,” knowns that online communities can be hostile at times to total strangers. How sleep loss affects this behavior could serve to inform the public about the potential hazards of engaging in highly stimulating and competitive activities while sleep deprived. Similarly, as virtual reality becomes more mainstream and consumers spend more time immersed in a world other than their own, it would be worthwhile to investigate how much the well documented effects of sleep loss on behavior translate to the virtual world.

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Appendix A

Prompt words and their respective posts

Prompt Word	Yik-Yak Post
alien	e.t. phone home
alley	Diagon Alley is still one of the best puns of our lifetime
appliance	anyone have an extra microwave
arm	Unpopular Opinion: arm day is overrated
avenue	Park side avenue
banner	Winning a championship
barrel	I already know I'm going to need a barrel of coffee to make it through today alive
basket	I want a basket of muffins rn
bench	I wish my boyfriend could bench press me
black	color
board	Are anyone else's floorboards extra squeaky this semester?
body	Body ody ody ody ody ody ody
book	book pages *insert book emoji*
bowl	Who else hasn't washed their bowls yet?
building	views from skyscrapers
bus	Dumpy
butler	Some of y'all think the custodial staff are butlers
cabinet	helpppp. how do i get back my clothes from behind the dresser??
cannon	Should I take pictures today ? 🤔
cat	dogs >>> cats
cellar	I feel like I'm locked up
chair	can we please get new chairs
chin	chinnies workout
circle	doesnt post malone have a song about circles
cliff	Anyone wanna go cliff jumping
clock	It's time to wake up 🌇
coast	california
column	Not gonna lie I'm 19 years old and still don't know the difference between a column and a row

contents	What are the contents of the snow? Who cares it’s fun to play in.
context	Sometime I'm afraid to open this app in public
cord	ConnChords - when's the next CONNcert?
cork	Feeling like tonight is a wine night 🍷
corner	the shadows from the library stacks when the lights turn off are so spooky
corridor	Scary dreams 🤔
curtians	my ultimate goal in life is to make a prom dress out of curtains
custom	Custom ink
dark	i be fighting demons in the dark and they got darkvision :/
detail	the details and vibes of each coffee shop are so different from each other
dirt	worm
door	why are all of the dorms’ doors open
egg	Omelet
elbow	Funny bones 🤔
elevator	stairs
engine	Whoever’s zoomin their car down cro Blvd rn: no thank you.
errand	I have so many errands to run and actually no time or car to do them
fabric	thinking about the fabric of reality
farm	Always thought it’d be kinda cool to live on a farm
finger	rings
fire hydrant	upvote if you can whistle…
foot	Sometimes I get the incredible urge to grab someone’s foot in the bathroom stall next to me just to feel alive again
frog	the princess and the frog!!
fur	Feed
glacier	I need a pile of the hash browns from Harris the size of a glacier
glass	People who wear glasses, have you noticed that sometimes you just forget there’s a rim?
golfer	whack
hairdryer	my hairdryer is working overtime lately
hammer	do you guys think there are sharks in the snow 😟
hand	mano
hat	some days you just need to wear a fun hat
hawk	I just saw a hawk attack a squirrel, RIP little buddy.
hay	Do horses actually eat hay

inhabitant	who thinks aliens will visit earth in our life time?
ink	I wish we could go back to writing in pen and quills
item	it’s so easy to lose hairpins, imagine how many are just lost all over the world
jelly	i used to be addicted to peanut butter jelly sandwiches
journal	Today is gonna make an interesting journal entry...
ketchup	mustard
kettle	Upvote for Honey Sriracha Wings everyday
knot	Snow today definitely not 🅿️
lamp	I love lamp… (a quote from some stupid movie but it was funny)
lantern	I want to go to a lantern festival like in the repunzel movie.
lightbulb	Why does a lightbulb represnt a new idea in cartoons?
lighting	Lightning McQueen
locker	lock me in a safe and have zendaya bust me out
machine	Those yellow suited people removing the snow today were literally like a MACHINE—but in all seriousness, thank you to everyone who showed up today, we appreciate you ❤️
market	do market baskets still exist??
medicine	coffee is my medicine
metal	Anyone else randomly get the taste of metal in their mouth?
metal	one time i used a metal detector on the beach and found someone's wedding ring
methods	the scientific method can solve many problems.
milk	cow
moment	Back in a flash 😈 gone in an instant 😲
month	How is it only the fourth of February
museum	How do you pronounce museum
mushroom	Shrooms
name	name your fav song atm plz
noisy	I swear the radiators have become noisier over break
nonsense	The fire alarm in Hamilton was nonsense I was falling asleep to it
nun	8:00AM classes make me want to join the nunnery instead of getting a degree
nursery	I sell rhymes like dimes
odd	Isn't it odd that we spend 1/3 of our life sleeping...
office	Michael Scott is dope.

owl	Hoot
paint	I would rather watch paint dry than go to lab again
pamphlet	Upvote if you've been on vacation with your significant other. I'm trying to see something.
paper	New toilet paper please?
part	huh
passage	passages malibu
pencil	No way I'm doing homework today
phase	the phases of the moon get me going frfr
pig	Pork is probably one of the wurst meats
plant	green
prairie	Prairie doggin in blaustein once again
privacy	The bathrooms at this school have no privacy at all
quart	The word quart reminds me of thanksgiving food like a quart of mashed potatoes
rain	if you're looking for a little treat, listen to the spanish version of a year without rain
razor	Why are razor blades so expensive?
reptile	Snakes don't always wear green. Sometimes they wear good smelling cologne and vintage Nike shoes 🥵.
reserved	he's such a reserved gentleman
rock	i love throwing rocks in the river and seeing how far I can throw it and the sound it makes when it hits the water.
rough	Brush
runner	she a runner she a track star
salad	Call me ranch cuz I be dressin
scissors	Should I cut my hair ?
seats	Anyone else find certain seats really uncomfortable
shadow	Chair in corner with alll my clothes on it, thank u
ship	Who do we ship from Euphoria? (No spoilers plz, just opinions!)
skyscraper	Some people at this school are like skyscrapers
slush	Not missing the slushy sidewalks.
sphere	Is it just me or has COVID decreased potential social spheres
square	Who lives in a pineapple under the sea?
statue	british museum should return those statues frfr
stomach	Harris making my stomach hurt

stool	Who wants to donate a squatty potty to Smith 3rd floor?
stove	They did not use the stove when they made waffles this morning…
swamp	It's a swamp outside.
table	The high top tables in Harris>
tail	Tail
taxi	Saw a taxi by Laz this morning, nice to see people still arriving on campus.
teacher	an apple a day keeps the teacher away... if you throw it hard enough
theory	Einstein
thermometer	just sat on and broke my infrared thermometer 😭😭😳
time	Father
tool	Does anyone else feel like a tool?
tower	is it hard to get freeman tower if you're not a senior
truck	did anyone else just hear that huge truck go by
trumpet	Trumpet noise !
trunk	junk in the trunk baby
umbrella	Under my umbrella Ella Ella aye
utensil	Office of sustainability should work on getting sporks. It'll save tons of plastic. Jk… unless.
vanity	I look into the mirror and see my true beauty
violin	VIBIN
volcano	I miss the days when science classes meant building a baking soda volcano
wagon	Can people please hop on the bandwagon and bring Conn spirit tomorrow
watch	Time
whistle	Can you blow my whistle baby
windmill	Clogs
wine	Tasting
writer	I want an old fashioned typewriter

Appendix B

Positive and Negative Affect Schedule

Positive and Negative Affect Schedule

PANAS

This scale consists of a number of words that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you have felt this way during the past week

Use the following scale to record your answers.

1 = Very slightly or not at all

2 = A little

3 = Moderately

4 = Quite a bit

5 = Extremely

_____ interested

_____ distressed

_____ excited

_____ upset

_____ strong

_____ guilty

_____ scared

_____ hostile

_____ enthusiastic

_____ proud

_____ irritable

_____ alert

_____ ashamed

_____ inspired

_____ nervous

_____ determined

_____ attentive

_____ jittery

_____ active

_____ afraid

Appendix C

Study Instructions Email

Dear Participant,

Thank you again for participating in this study! **In order to complete the study properly, please read the instructions below and watch the video attached.**

In this study, I will be investigating the relationship between sleeping habits and how students voice their opinions on social media, as opposed to in-person.

In this email you will find comprehensive instructions for completing the study. If you have any questions, please feel free to contact me anytime at imoskowi@conncoll.edu.

In order to provide you with anonymity in your responses, you will be given a unique participant ID number to identify yourself with when you submit your data. That way, after data collection, when I analyze your sleep data and Yik-Yak posts, your information cannot be tracked back to you. *Please remember your participant ID: you will need it to submit your data every day.*

Your participant ID is: [insert participant ID]

How to Proceed

This study will take place over **six days**. You may begin whenever is convenient for you, but the days must be consecutive. The first night of sleep recording will act as a "pilot-night" so that you can be assured you know how the Sleepscore App works. Please watch the video below, which will provide you with an in-depth explanation as to how to proceed.

[Insert Instructional Video]

SleepScore Instructional Video: https://vimeo.com/274948540

disregard "Smart Alarm" instructions and comments about getting sleep advice

How to use Yik-Yak: https://mashable.com/article/how-to-use-yik-yak

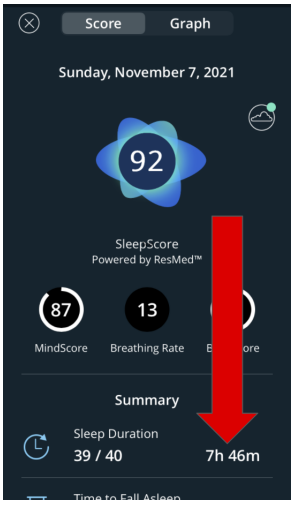
If you have any additional questions, feel free to email me at imoskowi@conncoll.edu

Appendix D

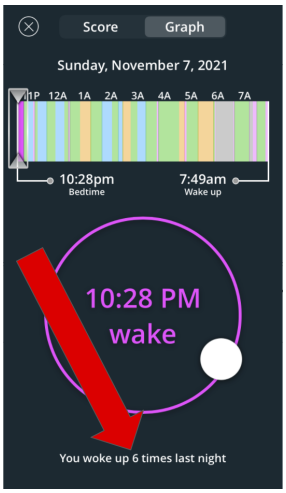
Daily Sleep and Post Log

What is your participant ID Number?

What was your Sleep Duration? See image below for where on SleepScore your Sleep Duration is recorded, indicated by the red arrow. Please enter in hours and minutes.



How many times did you wake up? See image below for where on SleepScore your Sleep Duration is recorded. Indicated by the red arrow.



Please enter the post you made on Yik-Yak today (exactly how you posted it)

Appendix E

Recruitment Flier

PARTICIPANTS NEEDED!

For sleep and social media study

Yik Yak

I am a senior currently working on a thesis that is investigating the relationship between sleeping habits and social media use.

What will you have to do? Over 6 consecutive days...

- track your sleep with a free iPhone app
- complete a series of social-media related tasks on Yik-Yak

$10.00 giftcard reward! (from a brand of your choosing)

Interested?
Scan QR Code or email me to start

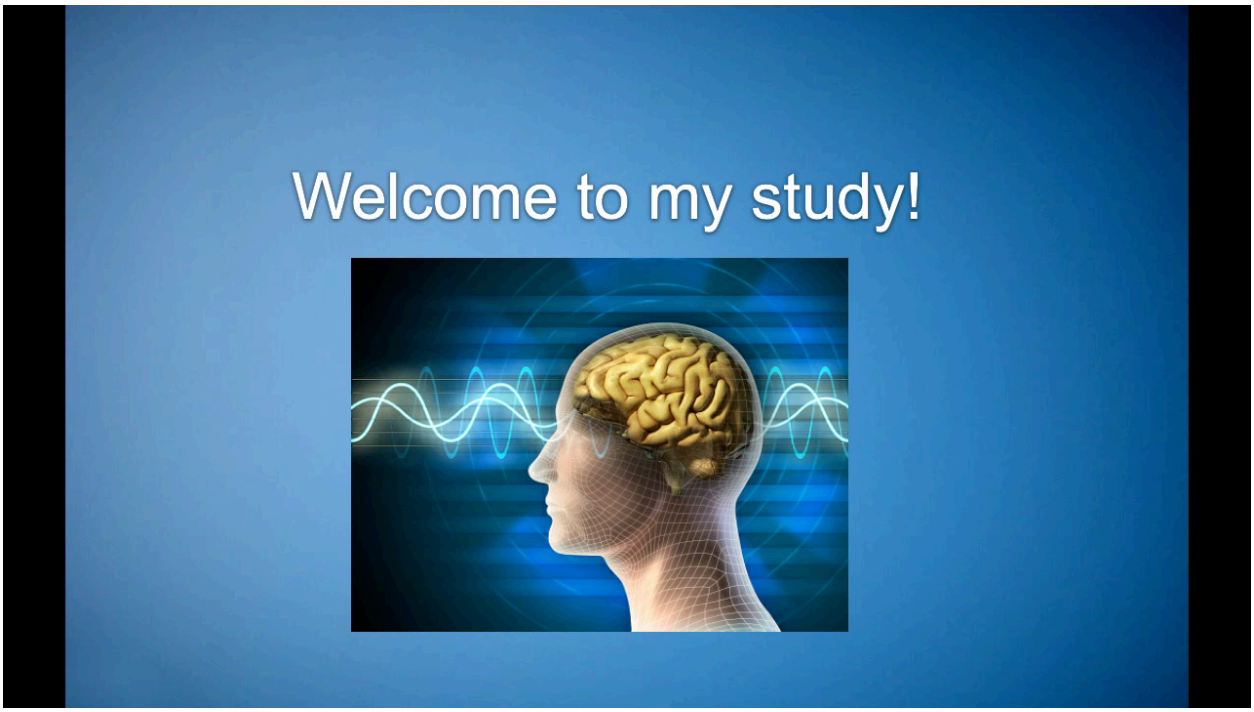
imoskowi@conncoll.edu

Appendix F

Social Media Advertisement

Appendix G

Introductory Video



Appendix H

Informed Consent

Informed Consent

Sleep and Social Media Habits

Principal Investigator (PI): Isaac Moskowitz

Study Title: The Relationship Between Sleep and Social Media Post Content

Address: Bill Hall

Connecticut College

270 Mohegan Avenue

New London, CT 06320

I am asking you to choose whether or not to volunteer in the research described below. The text below provides key information that may help you to make this decision.

Why is this research being done and what is involved?

The purpose of this study is to investigate whether there is a relationship between an individual's sleeping habits and how they interact with social media.

You will be asked to record your sleep using the SleepScore app for six nights, and submit the appropriate sleep data on the following days. You will also be asked to make five posts on the social media app "Yik-Yak". Instructions for downloading both apps can be found below.

You are also being asked to consent to the publication of the study results as long as the identity of all participants is protected. In this study, names are collected to contact you about the study details. For your data entries, you will be using a unique Participant ID number so that your sleep data and Yik-Yak posts will remain anonymous during data analysis.

This study should take about 20-25 minutes total over six days (four-five minutes a day).

It is anticipated that about 50 people will be involved in this study.

Do I have to participate?

Participation in this research study is completely voluntary and you are free to withdraw from the research at any time.

Your decision to volunteer for this study will not affect your current or future relationship with Connecticut College.

What are the risks and benefits?

I do not anticipate any risks to participating in this research other than those encountered in everyday life. The benefits of participating include a $10.00 participation compensation, provided in the form of an gift card (which could be redeemable at Amazon, Target, or Dunkin Donuts, depending on the participant's choice), as well as the opportunity to potentially

contribute to the scientific literature surrounding the relationship between sleep and social media.

Data Security

Participants will always be submitting their sleep data and Yik-Yak posts using their Participant ID number, so during data analysis their identities will remain anonymous. During data collection, there will be records of which participant's emails are associated with their participant ID numbers, but this association will be deleted once data analysis begins so that no identifying information will be kept during analysis.

Whom can I talk to if I have questions or concerns?

If you have any questions or concerns about this research, you can contact Isaac Moskowitz, the lead researcher at imoskowi@conncoll.edu in the Department of Psychology at Connecticut College or Professor Devlin, Chair of the CC IRB, at asdev@conncoll.edu

Statement of Consent

If you have read the above information, consent to take part in the study, and are at least 18 years of age, please go forward to confirm your consent. This research is considered Exempt from further Connecticut College IRB review under Exemption 3 (Benign Behavioral Intervention of the Code of Federal Regulations (45 CFR 46.104(d)(3).

Appendix I

Informational Video

Appendix J

Start Study Survey

What is your participant ID Number?

Have you recorded one night of sleep using the SleepScore app?

Yes
No

If yes…

Now that you have successfully operated the SleepScore app, you will be emailed your Yik-Yak topic for today, as well as a link to input that post and your sleep data.

If no…

Please explain the issue with the SleepScore app that did not allow you to record your sleep properly below.

Appendix K

Daily Topic Email

Dear Participant:
Your topic of the day to post a Yik-Yak about is: [insert topic here]

Once you have made your Yik-Yak post, please report your sleep data and your post using this link: [Insert Link]

Thank you, and have a nice day!

Appendix L

Debriefing Document

Debriefing Statement

First of all, thank you for participating in this research dealing with the relationship between sleep and social media habits. In this research, I am using statistical analysis to determine whether a relationship exists between the quality and quantity of people's sleep and how they act on social media, specifically on the content of their posts. In order for participants to make authentic posts and not feel like their behavior was under scrutiny, participants were deceived to believe that I would be primarily analyzing their responses in comparison with pre-determined responses made by students in-person. In actuality, the posts were analyzed on

their own, without any such comparison. The goal of this deception was to draw away your attention from what you were posting about, and focus it on how you were posting (on social media versus in person). I reasoned that if you knew I was scrutinizing the content of your post as much as I planned on doing, your content might be affected by that pressure. After you have submitted all five posts, your identifying information will be deleted so that your responses remain truly anonymous during data analysis. Members of the Connecticut College student body were recruited to participate in this study. While there are many studies examining the effect that social media has on sleeping habits, there are no studies to my knowledge investigating the relationship between sleeping habits and how individuals subsequently interact on social media. This kind of content analysis of user posts, in relation to sleep, has not been done to the best of my knowledge. The goal of this research is to advance the existing literature in this way. If you are interested in the relationship between sleeping habits and social media use, here are two resources to look at.

- Gil de Zúñiga, H., Diehl, T., Huber, B., & Liu, J. (2017). Personality Traits and Social Media Use in 20 Countries: How Personality Relates to Frequency of Social Media Use, Social Media News Use, and Social Media Use for Social Interaction. In Cyberpsychology, Behavior, and Social Networking (Vol. 20, Issue 9, pp. 540–552). Mary Ann Liebert Inc. https://doi.org/10.1089/cyber.2017.0295

-Guerrero, M. D., Barnes, J. D., Chaput, J.-P., & Tremblay, M. S. (2019). Screen time and problem behaviors in children: exploring the mediating role of sleep duration. In International

Journal of Behavioral Nutrition and Physical Activity (Vol. 16, Issue 1). Springer Science and Business Media LLC. https://doi.org/10.1186/s12966-019-0862-x

If you have any questions or concerns about the manner in which this study was conducted, please contact the sitting IRB Chairperson for this study, Audrey Zakriski, alzak@conncoll.edu.

You may also contact me, Isaac Moskowitz at imoskowi@conncoll.edu for additional resources.

Appendix M

Demographics Questions

What is your gender?

What is your race/ethnicity?

What is your class year?

What is your major?

What is your primary ethnic identity?

Appendix N

Content Analysis Instructions #2

Content Analysis Instructions #2

The following is a list of Yik-Yak posts created by Connecticut College students. Rate each post based on how negative or positive you perceive them to be. Use the first impression you get from reading every post to make your judgment.

1 - negative
2 - slightly negative
3 - neutral
4 - slightly positive
5 - positive

For example, a post that reads “Wow it is so freaking nice outside, I can’t wait to go hang with my friends” would be rated as 5. A post that reads “This campus really sucks sometimes” would be rated as 1.