# ADOLESCENT SOCIAL MEDIA USE AND PSYCHOSOCIAL ADJUSTMENT: TOWARD A NEW RESEARCH AGENDA

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## ABSTRACT

Jacqueline Nesi: Adolescent Social Media Use and Psychosocial Adjustment: Toward a New Research Agenda
(Under the direction of Mitchell J. Prinstein)

As social media becomes a ubiquitous presence in the lives of teenagers, a growing body of research across disciplines has examined potential associations between adolescents' social media use and the development of psychopathology. Much of this research has been limited to investigating the main effects of adolescents' frequent social media use (or use of social media at all) on maladaptive outcomes. However, as the landscape of modern technology evolves, it has become clear that the use of social media—at high frequencies—is the norm among adolescents. As such, advancing our understanding of social media in the context of adolescent development requires a shift in theoretical perspective. The current studies represent a critical shift in the conceptualization of associations between adolescent social media use and adjustment. Drawing on a developmental psychopathology approach, these studies examine the specific ways in which adolescents use social media, the individual characteristics that may make them more or less susceptible to maladaptive social media behaviors and outcomes, and the developmental time periods during which they rely on these tools. These studies offer a rare opportunity in the field of adolescent social media use to examine longitudinal processes in multiple large, diverse samples of adolescents. Furthermore, they take a unique, multi-method approach, incorporating methodologies that include self-report measures, observational coding of social media pages, and peer sociometric nomination procedures.

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# CHAPTER 1: ADOLESCENT SOCIAL MEDIA USE AND PSYCHOSOCIAL ADJUSTMENT: TOWARD A NEW RESEARCH AGENDA

The use of social media has seen rapid growth among adolescents in recent years. Social media, encompassing such technologies as social networking sites (SNS) and text messaging, is broadly defined as any digital tool that allows users to share content and interact socially with others (Moreno & Kota, 2013). Although iterations of social media have been available to the public for over 25 years (Ellison & boyd, 2013), adolescents are currently using social media at unprecedented rates and with staggering frequency. Recent estimates suggest that as many as 89% of adolescents belong to a social networking site, and 71% belong to more than one (Lenhart, 2015). A full 92% of adolescents go online daily, and 24% report going online "almost constantly," with as many as three-quarters of teenagers having access to a smart phone (Lenhart, 2015). Text messaging has also reached unprecedented levels of popularity, with 91% of adolescent cell phone owners participating in text messaging, and teenagers sending an average of 30 to 80 text messages per day to friends, family, and romantic partners (Lenhart, 2015; Lenhart, Anderson, & Smith, 2015). Indeed, social media is fully engrained in the lives of adolescents, most of whom have never known a world without it.

As social media becomes a ubiquitous presence in the lives of teenagers, a growing body of research across disciplines has examined potential associations between adolescents' social media use and the development of psychopathology. Much of this research has been limited to investigating the main effects of adolescents' frequent social media use (or use of social media at all) on maladaptive outcomes. Researchers have, for example, examined associations between adolescents' and young adults' general use of social media and social adjustment (Pea et al.,

2012; Quinn & Oldmeadow, 2013), anxiety (Ferguson, Muñoz, Garza, & Galindo, 2014; Mazalin & Moore, 2004), ADHD (Rosen et al., 2014), eating disorders (Tiggemann & Miller, 2010; Tiggemann & Slater, 2013), substance use (Gommans et al., 2015) and, most commonly, depression or depressed mood (e.g., Jelenchick, Eickhoff, & Moreno, 2013; Pantic et al., 2012; van den Eijnden, Meerkerk, Vermulst, Spijkerman, & Engels, 2008). In general, however, this research has produced mixed results, with many studies showing no overall associations between frequencies of use and well-being (Best, Manktelow, & Taylor, 2014). Rather, as the landscape of modern technology evolves, it has become clear that the use of social media—at high frequencies—is the norm among adolescents. As such, advancing our understanding of social media in the context of adolescent development requires a shift in theoretical perspective.

Separate from the growing body of research examining adolescent social media use and adjustment has been a critical movement toward developmental psychopathology approaches for understanding patterns of youth behavioral maladaptation (Sroufe & Rutter, 1984). Developmental psychopathology theories emphasize the presence of multiple systems and levels of analysis, both internal and external to the individual, which interact in complex ways to shape developmental trajectories toward risk or resilience to psychopathology (Cicchetti, 1993). Furthermore, this approach considers the process of development as a series of reorganizations among biological, psychological, and social systems, with adolescence characterized as a period of rapid and dramatic changes in these areas (Cicchetti & Rogosch, 2002). During this period of rapid reorganization, social media may be considered one such sociocultural system that interacts with adolescents' internal and external environments in contributing to adaptation.

Thus, drawing on developmental psychopathology approaches, the impact of social media use on adolescent adjustment should be informed not simply by frequencies of time spent,

but a range of factors involving both the social media context itself and characteristics of the individual and his or her environment. Specifically, we must consider *who* adolescents are before logging on to social media, including differences by gender and offline functioning that may impact their use and risk for psychopathology. We must consider *when* adolescents are using social media within the context of larger developmental processes and tasks. And, most importantly, we must consider *how* adolescents are using social media, or the specific behaviors in which they are engaging online.

As we aim to understand the specific ways in which adolescents use social media, it is critical to examine the range of unique behaviors and experiences that are possible within this context. Beginning with the earliest forms of electronic communication, scholars across various disciplines, including communications and mass media, computer-mediated communication (CMC), and developmental and organizational psychology have sought to identify the unique features of social media that differentiate it from traditional, face-to-face social interactions. Early theories of CMC introduced "cues-filtered-out" approaches (Culnan & Lynne, 1987), such as media richness theory (Daft & Lengel, 1986), which suggest critical differences between online and offline communication, including the number of cues offered (e.g., verbal cues, facial expressions), immediacy or synchronicity of feedback, and ability to use "natural language," or language that mimics verbal speech (Walther, 2011). Although social media has changed drastically since the advent of cues-filtered-out approaches, some of these features are still present to varying degrees in today's social media tools (e.g., Facebook posts, text messages). Modern developmental and media psychologists suggest that many social media tools provide greater anonymity, asynchronicity, and reduced social cues compared to offline communication (Subrahmanyam & Šmahel, 2011; Valkenburg & Peter, 2011).

More recent work suggests other unique features of the social media environment, as well. For example, social media tools provide more public and permanent communication experiences for adolescents, in which posted content remains visible for large audiences, often for an extended period of time (boyd, 2010; McFarland & Ployhart, 2015; Valkenburg & Peter, 2011). Furthermore, social networking sites, which incorporate built-in mechanisms for peer feedback and visible connections (e.g. "likes," "followers"), may create a more "quantifiable" social experience for adolescents than traditional environments (Chua & Chang, 2016; Singleton, Abeles, & Smith, 2016). Finally, social media may be more readily accessible compared to offline communication, allowing adolescents unprecedented access to peers at any time of day, regardless of physical location (McFarland & Ployhart, 2015; Valkenburg & Peter, 2011).

Taken together, these features create in social media a psychosocial context that allows for a variety of unique experiences and behaviors. As research moves away from examining adolescents' overall frequencies of social media use, it is critical to identify these specific behaviors and their associations with adolescent psychopathology. The current studies uncover a variety of technology-related behaviors, including engagement in social comparison and feedback seeking via social media, posting and viewing friends' SNS posts containing references to alcohol, seeking out online indicators of status (e.g. likes, comments), and using electronic communication at the expense of face-to-face interactions with romantic partners. These behaviors are examined in the context of adolescents' adjustment, including health risk behaviors, depressive symptoms, and social functioning.

In addition to examining *how* adolescents are using social media, and the potential risks or benefits associated with those behaviors, it is necessary to examine *who* adolescents are before engaging in these behaviors. Prior research has begun to examine a subset of adolescents'

individual characteristics in relation to social media use. For example, studies have investigated the impact of personality factors such as extraversion, narcissism, and shyness on such online behaviors as self-disclosure, friendship formation and self-presentation (Michikyan, Subrahmanyam, & Dennis, 2014; Ong et al., 2011; Van Zalk, Van Zalk, Kerr, & Stattin, 2014).

In addition, a small number of studies have investigated how individuals with existing symptoms of psychopathology may use social media. For example, studies have indicated that adolescents with depression, anxiety, or ADHD may be more likely to interact with strangers online (Mikami, Szwedo, Ahmad, Samuels, & Hinshaw, 2015), post inappropriate photos (Mikami, Szwedo, Allen, Evans, & Hare, 2010), and, when engaged in face-to-face friendships that are low in quality, more frequently communicate with geographically distant friends online (Ranney & Troop-Gordon, 2012). Finally, preliminary work has examined sex differences in social media use, suggesting, for example, that adolescent girls are more likely than boys to post photos online (Mesch & Beker, 2010), whereas boys may be more likely to engage in online self-disclosure (Valkenburg & Peter, 2009). Despite these initial findings, much further work is needed in order to examine how certain adolescents use social media, and the ways in which these individual differences moderate maladaptive outcomes. As such, one of the current studies examines adolescent depressive symptoms as a longitudinal predictor of technology-based social comparison and feedback seeking, with gender moderating these associations. In addition, one study examines gender differences in the development of social competencies among adolescents who engage in higher proportions of technology-based (versus in-person) communication with romantic partners. Furthermore, individual characteristics (e.g., popularity, importance of peer approval, gender) are examined as potential correlates of online status-seeking behaviors.

In addition to examining *who* adolescents are and *how* they are using social media, a final consideration in examining associations between social media use and adjustment is *when* adolescents are using social media. Drawing again on developmental psychopathology approaches, adolescence is considered a critical period of development, in which adolescents face numerous stage-salient tasks, including the development of sophisticated, complex peer relationships, the forging of a cohesive self-concept and identity, the establishment of independence from adult caretakers, and the exploration of sexual and romantic relationships (Cicchetti & Rogosch, 2002; Hill, 1983; Steinberg & Morris, 2001). Social media represents a compelling context for the navigation of these tasks, as adolescents may explore their emerging identities and sexualities online while engaging in frequent peer interactions, typically outside of the view of authority figures (Peter & Valkenburg, 2013; Subrahmanyam & Šmahel, 2011). However, it may be essential to consider how these developmental tasks are transformed in the context of social media, and whether, during a sensitive period of development, social media provides the necessary tools for their successful resolution. Thus, the current studies examine the timing of certain social media behaviors within the context of development. For example, one study investigates exposure to alcohol-related content on social networking sites during a time period in which adolescents are considering the initiation of alcohol use milestones (e.g. drinking a full drink, becoming drunk). In addition, one study examines the concomitant increase in technology-based communication and adolescents' engagement in their first romantic relationship experiences, during which time the development of key interpersonal skills has implications for relationship functioning throughout the lifespan.

In summary, the current studies represent a critical shift in the conceptualization of associations between adolescent social media use and adjustment. Drawing on a developmental

psychopathology approach, these studies examine the specific ways in which adolescents use social media, the individual characteristics that may make them more or less susceptible to maladaptive social media behaviors and outcomes, and the developmental time periods during which they rely on these tools. Four studies are proposed, examining a range of social processes and behavioral outcomes relevant to psychopathology. These studies offer a rare opportunity in the field of adolescent social media use to examine longitudinal processes in multiple large, diverse samples of adolescents. Furthermore, they take a unique, multi-method approach, incorporating methodologies that include self-report measures, observational coding of social media pages, and peer sociometric nomination procedures.

Study 1 investigates the use of technology-based communication during a key developmental period in which adolescents are engaging in romantic relationships for the first time. Findings suggest that higher proportions of technology-based, versus face-to-face, communication with romantic partners is associated with lower levels of social competencies one year later, particularly among boys. Study 2 examines technology-based social comparison and feedback-seeking behaviors as potentially problematic interpersonal behaviors that occur via social media. This study finds that depressed adolescents are concurrently more likely to engage in these behaviors, and that for boys only, depressive symptoms predicted prospective increases in these behaviors. Study 3 identifies exposure to friends' alcohol-related SNS postings as a potential risk factor for initiation of alcohol use and escalation, with the development of more alcohol-favorable peer injunctive norms as a mechanism by which this may occur on social media. Finally, Study 4 will introduce the construct of "digital status seeking," aiming to identify adolescents who engage in a set of social media behaviors reflecting investment in their online peer status. Correlates of these behaviors will be examined, as will the possibility that

such behavior longitudinally contributes to engagement in heath risk behaviors and poor social adjustment.

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## CHAPTER 2: TECHNOLOGY-BASED COMMUNICATION AND THE DEVELOPMENT OF INTERPERSONAL COMPETENCIES WITHIN ADOLESCENT ROMANTIC RELATIONSHIPS: A PRELIINARY INVESTIGATION[1]

The ubiquitous use of technology among youth provides a new context for the establishment and maintenance of intimate relationships in adolescence (Subrahmanyam & Greenfield, 2008). Over 89% of adolescents report using social networking sites (Lenhart, 2015) and 92% report text messaging with their romantic partners (Lenhart, Smith, & Anderson, 2015). Further, it is common for adolescents to use technology to resolve arguments and discuss sensitive family or health-related issues with romantic partners (Lenhart et al., 2015; Widman, Nesi, Choukas-Bradley, & Prinstein, 2014). Although it is well established that romantic relationships provide a critical context for adolescents' development of social competence (Collins & Steinberg, 2006), little is known regarding how technology-based communication may affect this process.

Social competence is a multidimensional construct, with two particular domains that may be important to adolescent romantic relationships: negative assertion (the ability to assert displeasure with others or stand up for oneself) and conflict management (the ability to work through disagreements and solve problems; Buhrmester, Furman, Wittenberg, & Reis, 1988). These skills are particularly salient within the context of romantic relationships, where they

[1]This chapter previously appeared as an article in the *Journal of Adolescent Health.* The original citation is as follows: Nesi, J., Widman, L, Choukas-Bradley, S. & Prinstein, M.J. (2017). Technology-based communication and the development of interpersonal competencies within adolescent romantic relationships: A preliminary investigation. *Journal of Research on Adolescence, 27*(2), 471-477. doi:10.1016/j.jadohealth.2017.01.009

influence relationship satisfaction, negotiation of autonomy, and general socioemotional competence (Collins, 2003).

The rising popularity of computer-mediated communication tools (e.g., texting, social media) has shifted the way youth communicate with romantic partners (Lenhart et al., 2015). Cues-filtered-out theories suggest that some of these tools contain fewer nonverbal cues than traditional interactions; this may make technology-based communication less "rich" (Walther, 2011). On the one hand, technologies with fewer cues may provide a "safe space" for adolescents to practice self-disclosure and communicate asynchronously (Koutamanis, Vossen, Peter, & Valkenburg, 2013), thus providing opportunities for greater relationship maintenance, self-disclosure, and intimacy (Valkenburg & Peter, 2011). On the other hand, these technologies may result in lower quality interactions. Indeed, some work suggests that technology-based communication is associated with less warmth and affection, fewer expressed affiliation cues, and lower feelings of bonding (Sherman, Michikyan, & Greenfield, 2013; Subrahmanyam & Smahel, 2011).

While technology may simply supplement traditional forms of interaction (Valkenburg & Peter, 2007), in some situations technology may provide a substitute for youths' traditional communication (Szwedo, Mikami, & Allen, 2012). If technology-based communication is replacing traditional communication for some adolescents, and some technological tools lack the "richness" necessary for practicing complex romantic relationship interactions (Sherman et al., 2013; Walter, 2011), higher proportions of technology-mediated communication could adversely affect young people's social skill development and relationship satisfaction (Luo, 2014). This may be particularly true of high-conflict interactions, wherein more interpersonal cues are required to express and manage negative affect (Burge & Tatar, 2009). However, research has

yet to examine the role of technology-mediated communication in the romantic relationships of middle or high school-aged adolescents, or the role such communication may play over time.

Additionally, little is known about potential gender differences in the role of technology in the development of interpersonal competencies. There are known gender differences in the frequency of technology use, with adolescent girls reporting more social media use and texting than boys (Lenhart, 2015), but such research has not clarified how technology use differentially affects girls and boys. A separate, longstanding line of work indicates that relationship skills differ by gender, with girls reporting higher levels of intimacy, self-disclosure, and positive conflict-resolution strategies within same-gender friendships beginning in childhood (Rose & Rudolph, 2006). Girls may thus enter romantic relationships "better prepared" for handling intimacy and conflict (Maccoby, 1998). It is possible that increases in technology-based communication are detrimental to boys' development of romantic relationship competencies, as girls may have developed stronger foundations of relationship skills through childhood friendships.

This study utilized a longitudinal cross-lagged design to examine associations between adolescents' communication patterns and the development of interpersonal competencies within romantic relationships over one year. It was hypothesized that greater levels of technology-based communication versus traditional forms of communication with romantic partners would be negatively associated with interpersonal competencies over time. It also was hypothesized that this association would be stronger for boys.

## Methods

### Participants

This study included 487 participants (58.0% girls; ages 13-16; $M_{age}$ = 14.1; 48.5% White/Caucasian, 23.8% Hispanic/Latino, 20.6% African American/Black, 7.1% other ethnicities). Participants were 85.9% heterosexual, 0.6% gay/lesbian, 5.5% bisexual, and 8.0% unsure/other; for multiple group analyses, both heterosexual and sexual minority youth were present in each gender group.

All 7th and 8th grade students from three rural, low-income schools ($n$ = 1,463) were recruited for a study of peer relations and health risk behaviors. Consent forms were returned by 1,205 families (82.4%), with 900 granting consent for participation (74.7%). Baseline data were collected from 868 students (32 consented adolescents had moved, were absent, or declined participation). The current study utilizes data from the one-year ("T1") and two-year ("T2") follow-ups, when relevant measures were administered. Retention exceeded 88% at T1 ($n$ = 790) and T2 ($n$ = 772).

Only participants who reported having had a "dating partner" within the past year at both time points were included in analyses. A dating partner was defined as "a boyfriend/girlfriend or someone you like 'more than friends' who you have 'talked to' or hung out with." This definition was developed based on past literature (e.g., Furman & Hand, 2006), as well as pilot testing and focus groups. Of the 734 participants who participated at both T1 and T2, 66.5% ($n$ = 488) reported having dating partners at both waves. One participant was missing data on all other study variables. Thus, the final sample included 487 participants.

No significant differences in age or ethnicity were found between these participants and those who reported no romantic relationships at either wave ($n$ = 233). Girls were more likely

than boys to report relationships at both time points ($\chi^2 = 6.49$, $p < .05$). Adolescents' proportion of engagement in technology-based communication at T1 did not predict whether they reported a relationship at T2.

Procedure

Following informed assent procedures, surveys were administered in classrooms via computer-assisted self-interviews. Each participant received a $10 gift card at both time points. All measures were collected at both waves.

Measures

Proportion of technology-based vs. traditional communication with partner. Participants were oriented to the construct of "technology-based communication," with "technology" defined as "texting, Facebook, and other social media (e.g., Twitter, Instagram, Snapchat, Tumblr)." Relative frequencies of the use of technology, versus traditional forms of communication, were assessed by asking, "How much do you communicate with your dating partners using your voice (in-person or phone call) versus using technology on a typical day?" These definitions of "technology" and "traditional" communication were chosen based on cues-filtered-out approaches (Walther, 2011). Specifically, phone and in-person communication are similar in nature given their allowance for immediate feedback and a multiple vocally-based interpersonal cues, compared to text messaging and social networking sites. Responses were indicated on a 9-point scale (1 = *I communicate with my romantic partners mostly in person/on phone calls*, 5 = *About half in person/phone calls and about half using technology*, and 9 = *I communicate with my romantic partners mostly using technology. We rarely communicate in person/on phone calls*). Higher scores indicated higher proportions of technology-based communication relative

to traditional communication. This measure was developed through a focus group and two pilot samples of 437 high school students.

Interpersonal competencies within romantic relationships. The Interpersonal Competence Questionnaire (ICQ; Buhrmester et al., 1988) was used to assess negative assertion (e.g., "Turning down a request by your dating partner that is unreasonable"; $\alpha$ = .84 and .91 at T1 and T2, respectively) and conflict management (e.g., "Admitting that you might be wrong when a disagreement with your dating partner begins to build into a serious fight"; $\alpha$ = .83 and .90) with adolescents' current or most recent dating partner. Responses were indicated on a 5-point scale (1 = *I am very bad at this*, 3 = *I am okay at this*, and 5 = *I am very good at this*). Several items were reworded to accommodate the sample's reading level. Each subscale contained eight items; however, one item was dropped from each scale due to low factor loadings.

Analysis Plan

Hypotheses were examined within a structural equation modeling (SEM) framework in Mplus 7.0. Negative assertion and conflict management at T1 and T2 were estimated as latent variables by creating three parcels of items for each variable, with items randomly assigned to parcels. Using parcels allowed for increased parsimony, fewer chances for correlated residuals or dual loadings, and reductions in sampling error (MacCallum, Widaman, Zhang, & Hong, 1999). A confirmatory factor analysis demonstrated the unidimensionality of each variable.

Cross-lagged panel models were used, providing a useful framework for testing the strength of temporal relations between variables collected through longitudinal, non-experimental designs (Finkel, 1995). Four separate models were specified: (a) a baseline model with only autoregressive paths (i.e., paths from negative assertion at T1 to T2, conflict

management at T1 to T2, and proportions of technology-based communication at T1 to T2); (b) a model with these autoregressive effects and paths from T1 proportions of technology-based communication to T2 negative assertion and conflict management; (c) a model with the autoregressive effects and paths from T1 negative assertion and conflict management to proportions of T2 technology-based communication; and (d) a fully cross-lagged model with autoregressive effects and all T1 variables predicting all others at T2. In these models, all T1 predictors and T2 error terms were correlated with one another (Martens & Haase, 2006). Models were compared using chi-square difference tests to determine the optimally fitting model (Bollen & Curran, 2006). Moderation by gender was then tested using a multiple group SEM.

**Results**

Descriptives

Descriptive statistics examined patterns of technology-based versus traditional forms of communication and gender differences in those patterns (Table 2.1). Correlations between all variables were also calculated (Table 2.2).

Roughly one-third of participants (34.9%) reported that, on a typical day, they communicated with their dating partners approximately half the time using technology and half the time through traditional communication forms (in-person or phone calls); another third (32.3%) reported using primarily traditional forms; and the remaining third (32.8%) reported that the majority of their communication with partners occurred via technology.

Associations Among Technology-Based Communication, Negative Assertion, and Conflict Management

Four cross-lagged panel models were constructed (see Table 2.3). Chi-square difference testing indicated that Model 2 was the optimally fitting and most parsimonious model; the added

constraints of this model over Model 1 resulted in a significant improvement in fit, while those of Model 3 did not. In addition, Model 4 did not provide a significant improvement in fit over Model 2, suggesting that the more parsimonious model (Model 2) should be retained. Paths from T1 negative assertion and conflict management to T2 proportions of technology-based communication were not significant in any models.

Tests of Measurement Invariance and Gender Moderation

First, measurement invariance was established across gender groups. Tests of measurement invariance revealed no statistical benefit when allowing the factor structure, $\chi^2(147) = 221.47$, $p < .0001$, factor loadings, $\Delta\chi^2(8) = 7.337$, $p = .50$, and all but one of the indicator intercepts, $\Delta\chi^2(6) = 11.43$, $p = .08$, to vary across gender. Thus, partial strong invariance was established, indicating that latent constructs were assessed using the same metric across groups. This allowed for meaningful gender comparisons in subsequent analyses.

Initial fit for the structural model was good: $\chi^2(161) = 240.43$, $p < .001$, CFI = 0.98, TLI = 0.97, RMSEA = 0.05, SRMR = 0.08. Chi-square difference tests indicated a marginally significant gender interaction for the association between T1 technology-based communication and T2 conflict management, $\Delta\chi^2(1) = 3.36$, $p = .07$; this path was thus left free to vary across groups. Standardized path coefficients in the final model revealed that greater proportions of technology-based communication with romantic partners, relative to traditional communication at T1, were associated with lower levels of T2 negative assertion for both genders, and with lower levels of T2 conflict management for boys only (see Figure 2.1).

**Discussion**

This study investigated associations between adolescents' technology-based communication and the development of interpersonal competencies within romantic

relationships, and examined gender differences in these associations. Given that adolescents' technology-based communication within romantic relationships is an emerging field of research, and that this study is the first to examine these associations, results should be considered preliminary. Findings suggest that adolescents who engaged in proportionally more technology-based versus traditional communication with partners exhibited lower levels of specific interpersonal competencies (negative assertion and conflict management) within romantic relationships one year later; this association was somewhat stronger for boys.

Notably, engagement in greater proportions of technology-based communication preceded, rather than followed, lower competencies in these areas. Poorer self-reported interpersonal skills did *not* predict later engagement in technology-based communication. Technology-based interactions may provide a qualitatively different communication experience, thought which adolescents lack optimal opportunities to learn or practice complex social skills, such as negative assertion and conflict management.

These preliminary findings are consistent with prior work demonstrating concurrent associations between high proportions of technology-based communication, less satisfaction, and higher avoidance in young adults' romantic relationships (Luo, 2014). However, some past studies have found positive associations, including between more social media use and higher levels of social skills (Koutamanis et al., 2013). These mixed findings may be due to measurement differences, as most studies (with the exception of Luo, 2014) have assessed overall frequencies, rather than proportional levels, of technology-based communication. Mixed findings may also be due to unexamined third variables (e.g., opportunity for in-person interaction; relationship duration, intimacy). Further work is needed to clarify such discrepancies.

Although both girls and boys showed similar patterns of results, technology-based communication significantly predicted conflict management deficits for boys only. Based on childhood interpersonal experiences that involve greater intimacy, self-disclosure, and conflict-mitigating strategies, girls may enter into romantic relationships better equipped with interpersonal skills (Maccoby, 1998; Rose & Rudolph, 2006). Romantic relationships may provide a unique environment in which boys can develop these skills. This may be especially true for conflict management, as romantic relationships provide an important context for boys' development of compromise strategies, a departure from the more confrontational strategies common within their same-sex friendships (Connolly & McIsaac, 2011). The use of technology-based communication in romantic relationships may limit the social "practice" of in-person conversations that is crucial for adolescent boys' interpersonal skill development.

Limitations and Conclusions

Although this study is strengthened by its large, diverse sample of adolescents and longitudinal, cross-lagged research design, results should be considered preliminary given the study's limitations. First, while this study offered a unique opportunity to investigate the specific interpersonal skills of negative assertion and conflict management, only two ICQ subscales were administered. Future research should build on these findings by investigating other social competencies (e.g., self-disclosure, emotional support) over a longer developmental period. Additionally, the measure of romantic relationships was broad. Although this definition has the benefit of being inclusive and consistent with adolescents' concepts of relationships (Furman & Hand, 2006), some adolescents may have reported on unreciprocated relationships, which could involve higher proportions of technology-based communication. Future work should examine the role of technology within romantic relationships of varying duration, intimacy, and quality,

as well as within friendships. Finally, this study used a single item self-report measure of communication, which did not specify how adolescents should categorize newer forms of communication that blur the lines between traditional and technology-based communication (e.g., Skype and FaceTime), and which may indirectly assess total amount of communication with partners.

Future research will benefit from the development of innovative and nuanced measures of technology use, including replacing or supplementing measures of proportional communication with those that measure raw communication frequencies. Because technology-based communication can significantly differ in quality (across both individuals and forms of technology), it would also be fruitful to incorporate measures of communication quality. Future research should also examine technology-based communication among adolescents with differential in-person access to peers (e.g., rural vs. urban environments), although initial evidence suggests that these phenomena may be universal (Lenhart, 2015).

Adolescents increasingly use technological tools for communication. It is possible that adolescents are replacing traditional communication forms with this technology, and thus lacking opportunities to develop essential interpersonal skills within romantic relationships. These preliminary findings highlight the importance of further investigation into associations between adolescents' technology-based communication and development of interpersonal skills.

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TABLE 2.1

*Descriptive Statistics*

| | Full Sample | | Girls | | Boys | | Gender Comparison |
|---|---|---|---|---|---|---|---|
| | *M* (*SD*) | *N* | *M* (*SD*) | *n* | *M* (*SD*) | *n* | *t* (df) |
| Time 1 Variables | | | | | | | |
| Negative Assertion | 3.67 (0.82) | 484 | 3.75 (0.81) | 279 | 3.58 (0.83) | 205 | 2.20 (482)* |
| Conflict Management | 3.61 (0.81) | 483 | 3.46 (0.80) | 279 | 3.83 (0.77) | 204 | -5.08 (481)*** |
| Proportions of Technology-Based Romantic Partner Communication[a] | 4.85 (2.32) | 449 | 4.83 (2.40) | 264 | 4.89 (2.25) | 185 | -0.24 (447) |
| Time 2 Variables | | | | | | | |
| Negative Assertion | 3.82 (0.78) | 483 | 3.81 (0.79) | 280 | 3.28 (0.93) | 203 | 6.73 (481)*** |
| Conflict Management | 3.37 (0.89) | 483 | 3.40 (0.82) | 280 | 3.34 (0.98) | 203 | 0.69 (481) |
| Proportions of Technology-Based Romantic Partner Communication[a] | 5.04 (2.11) | 485 | 5.02 (2.19) | 281 | 5.05 (2.00) | 204 | -0.15 (483) |

[a]Higher scores indicate greater proportions of technology-based communication (texting, social media) relative to traditional communication (in-person, phone calls) with romantic partners.
*$p < .05$; **$p < .01$; ***$p < .001$

TABLE 2.2

*Bivariate Associations by Gender*

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 1. T1 Negative Assertion | -- | .33*** | .10 | .47*** | .24*** | -.09 |
| 2. T1 Conflict Management | .38*** | -- | .02 | .14* | .44*** | -.05 |
| 3. T1 Proportions of Technology-Based Romantic Partner Communication[a] | .14 | -.08 | -- | .01 | -.00 | .13* |
| 4. T2 Negative Assertion | .30*** | .09 | -.15* | -- | .53** | -.09 |
| 5. T2 Conflict Management | .06 | .27*** | -.27*** | .65*** | -- | -.02 |
| 6. T2 Proportions of Technology-Based Romantic Partner Communication[a] | .02 | .15* | .09 | -.04 | .01 | -- |

*Note:* Results for girls reported above the diagonal. T1=Time 1; T2=Time 2.

[a]Higher scores indicate greater proportions of technology-based communication (texting, social media) relative to traditional communication (in-person, phone calls) with romantic partners

*$p < .05$; **$p < .01$; ***$p < .001$

TABLE 2.3

*Fit Statistics for Four Competing Cross-Lagged Panel Design Models*

| Model | $\chi^2$ | df | p-value | RMSE | SRMR | CFI | TLI |
|---|---|---|---|---|---|---|---|
| Model 1: Autoregressive | 101.88 | 64 | .002 | .04 | .05 | .99 | .98 |
| Model 2: T1 Communication→T2 Interpersonal Competence | 91.80 | 62 | .008 | .03 | .04 | .99 | .99 |
| Model 3: T1 Interpersonal Competence→T2 Communication | 100.65 | 62 | .001 | .04 | .05 | .99 | .98 |
| Model 4: Fully Cross-Lagged | 90.57 | 60 | .007 | .03 | .04 | .99 | .99 |

*Note:* RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual; CFI = comparative fit index; TLI = Tucker-Lewis index; T1=Time 1; T2=Time 2. Chi-square difference tests indicate that Model 2 is the optimally-fitting model. "Communication" refers to proportions of technology-based romantic partner communication.

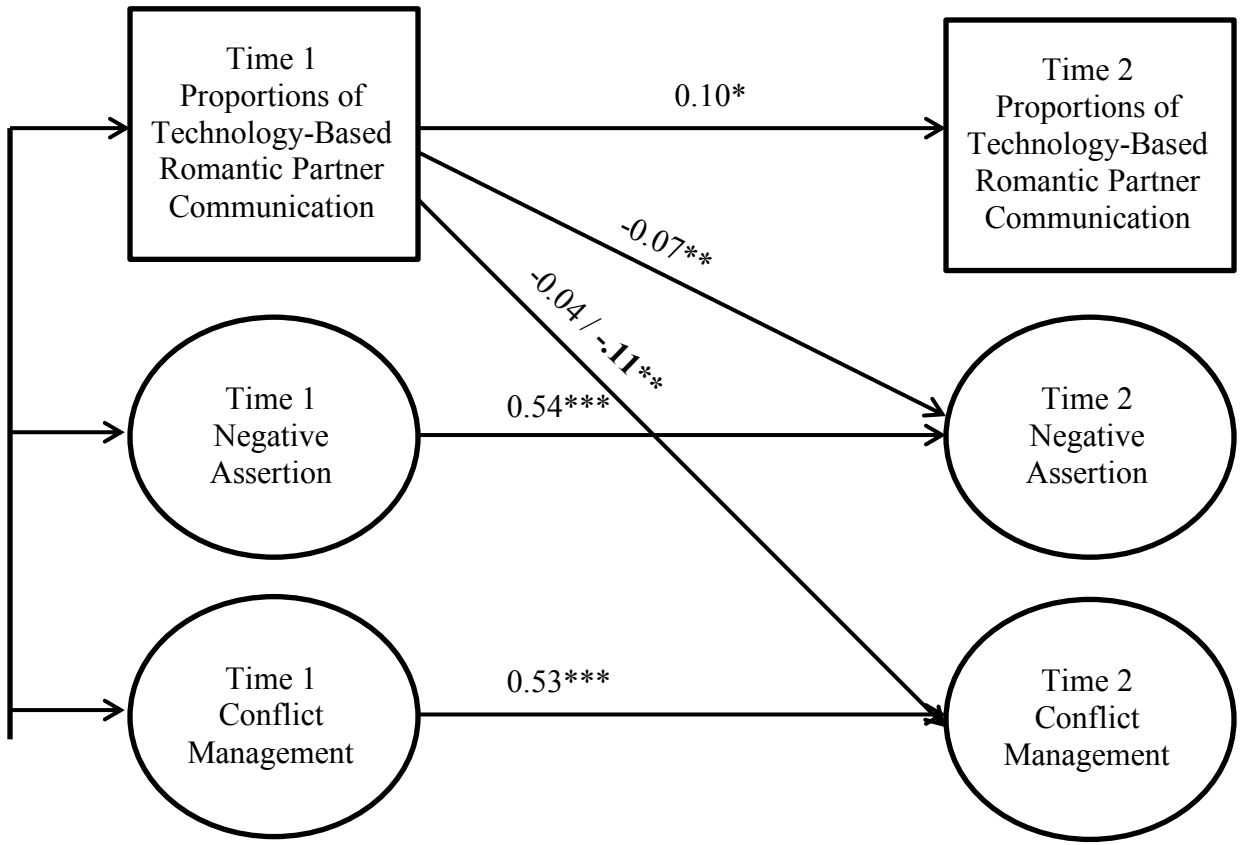



*Figure 2.1*. Cross-lagged panel model (Model 2) for the relationship between technology-based vs. traditional romantic partner communication and interpersonal competencies (Conflict Management and Negative Assertion), with path coefficients. Correlations between error terms for Time 2 variables not shown. For path moderated by gender, coefficient for boys in **bold**. Indicators for latent variables not included in figure.
$^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$

## CHAPTER 3: ADOLESCENTS' DEPRESSIVE SYMPTOMS AND SUBSEQUENT TECHNOLOGY-BASED INTERPERSONAL BEHAVIORS: A MULTI-WAVE STUDY[2]

Adolescence is a developmental risk period for depression, and evidence suggests that this risk may be due, in part, to the normative, developmental reorientation of the social landscape that takes place during this time period (Hankin & Abramson, 2001). Adolescents begin to engage in more frequent, intimate, and autonomous peer relationships during this stage (Choukas-Bradley & Prinstein, 2014) and to rely on peer feedback and experiences as a primary means of identity development and self-esteem (Harter, Stocker, & Robinson, 1996). Adolescents also experience far greater interpersonally-themed stress than do younger youth (Rudolph, 2009). While prior work has emphasized the role of interpersonal difficulties in contributing to the emergence of adolescents' depression (Rudolph, 2009), only recently have researchers begun to examine symptoms-driven models, whereby depressive symptoms precede and predict poor peer relationships (Kochel, Ladd, & Rudolph, 2012). Remarkably little is known regarding the specific maladaptive interpersonal behaviors that may contribute to peer difficulties among those with elevated depressive symptoms, and even less is known regarding the developmental factors that may make adolescents particularly vulnerable. It may be especially important to consider these developmental factors in light of recent changes in the social worlds of adolescents. This study focuses specifically on adolescents' interpersonal

[2]This chapter previously appeared as an article in the *Journal of Applied Developmental Psychology*. The original citation is as follows: Nesi, J., Miller, A.B. & Prinstein, M.J. (2017). Adolescents' depressive symptoms and subsequent technology-based interpersonal behaviors: A multi-wave study. *Journal of Applied Developmental Psychology, 51,* 12-19. doi: 10.1016/j.appdev.2017.02.002

experiences online, and a set of behaviors that may be relevant to the type of experiences afforded to this social context.

For many years, research has suggested that individuals experiencing elevated levels of depressive symptoms may be especially likely to engage in maladaptive interpersonal behaviors, perhaps in an effort to augment their self-worth, or alternatively to validate their sense of low self-concept (Coyne, 1976; Hames, Hagan, & Joiner, 2013). For instance, substantial research has suggested that depressed individuals may engage in excessive reassurance seeking (ERS; Joiner & Metalsky, 2001), or the tendency to repeatedly ask others for reassurance of personal worth, leading to interpersonal rejection and poor friendship quality, and ultimately, exacerbation of depressive symptoms (Prinstein, Borelli, Cheah, Simon, & Aikins, 2005). Findings also have suggested that depressed adults and youth may be especially likely to engage in negative feedback-seeking (NFS), or the tendency to seek out criticism or negative feedback in close relationships, as well as to report high levels of sociotropy (Rudolph, 2009). Each of these behaviors contributes to *dependent* interpersonal stressors, or events in which depressed individuals may inadvertently contribute to their own interpersonal difficulties (Flynn & Rudolph, 2011; Rudolph et al., 2000). Depressed adolescents also have been shown to engage in higher levels of social comparisons, particularly unfavorable comparisons that result in negative self-evaluation, compared to non-depressed individuals (Allen & Badcock, 2003; Irons & Gilbert, 2005). In the social world of today's teens, a heavy reliance on interpersonal communication within technology-based platforms may make social comparisons and feedback- or reassurance-seeking especially easy.

As researchers increasingly turn to symptoms-driven models to explain the ways in which depressed youth engage in maladaptive behaviors with peers, it has become necessary to

examine such behaviors as they occur within the developmental contexts most relevant to modern adolescents. Social media, which has become ubiquitous in the lives of adolescents, represents one such context. On an average day, adolescents report spending almost seven hours using screen media (Rideout, 2015) and sending an average of 67 text messages (Lenhart, 2015). Adolescents report that a significant proportion of their social interactions now take place via social media, with 89% belonging to at least one social networking site and 88% engaging in regular text messaging (Lenhart, 2015). Identifying maladaptive interpersonal behaviors that occur via social media has critical implications for understanding how depressed adolescents may inadvertently contribute to their own interpersonal distress and poor peer relationships.

Within research examining social media use, there has been a growing recognition of the importance of identifying such maladaptive online behaviors in the context of adolescents' depressive symptoms (Davila et al., 2012; Feinstein et al., 2013). Although many studies have used cross-sectional data and inferred that certain technology-based behaviors may contribute to depressive symptoms, it is equally plausible that problematic social media use may follow from prior depressive symptoms. For example, studies have indicated concurrent associations between higher levels of depressive symptoms and technology-based behaviors that include: disclosure of personal information online (Ybarra, Alexander, & Mitchell, 2005), sexting (Dake, Price, Maziarz, & Ward, 2012), cyberbullying (Ybarra, 2004), and frequent surveillance behavior, or passively browsing others' photos or posts without actively engaging by commenting or posting (Tandoc, Ferrucci, & Duffy, 2015). In addition to cross-sectional work, a few studies have provided preliminary evidence that depressive symptoms longitudinally predict certain maladaptive online behaviors, including posting inappropriate photos (Mikami, Szwedo, Allen, Evans, & Hare, 2010) and engaging in negative interactions with romantic

partners (Feinstein et al., 2013). Although these studies provide an important foundation, further examination of the role that depression may play in predicting adolescents' technology-based social dysfunction remains critical.

One potentially problematic online behavior, which may be conceptually distinct from similar offline behaviors, is technology-based social comparison and feedback seeking (SCFS; Nesi & Prinstein, 2015), or the use of social media to seek out information regarding one's appearance, behaviors, and social status, relative to one's peers. One study indicated that this online behavior was associated concurrently with higher levels of depressive symptoms (controlling for prior levels of depressive symptoms), and that this relationship was particularly strong among females (compared to males) and adolescents lower (versus higher) in popularity (Nesi & Prinstein, 2015). However, no studies have longitudinally examined the ways in which depressive symptoms may precede and predict engagement in technology-based SCFS over the course of multiple years.

It is particularly important to examine technology-based SCFS as a consequence of adolescents' depressive symptoms given the ways in which this behavior may be uniquely facilitated within the environment of social media. As a context for social behaviors, social media encompasses a number of features that create the potential for new and different behaviors than are possible offline. For example, communication on social media is often public, allowing an adolescent's requests for reassurance or feedback to instantaneously reach a vast network of peers (boyd, 2010). Furthermore, communication via social media is immediate and accessible from any location (Peter & Valkenburg, 2013), which may create a constant feedback loop that heightens the frequency and intensity of social comparisons. Other relevant features of social media include its affordances for asynchronous and anonymous communication, perhaps

creating a false sense of "safety" for adolescents to engage in problematic social behaviors (boyd, 2010; Peter & Valkenburg, 2013).

Technology-based SCFS may be facilitated by the large, public audience to whom photos and posts are displayed, the opportunity for immediate peer feedback and commentary, and the ease with which information about peers can be accessed and scrutinized (Manago, Graham, Greenfield, & Salimkhan, 2008). Thus, we might expect adolescents who engage in offline excessive reassurance-seeking and social comparison to similarly exhibit higher levels of technology-based SCFS. However, we might also expect that the features of the social media environment facilitate engagement in technology-based SCFS among adolescents who might otherwise have engaged in fewer maladaptive interpersonal behaviors. Similarly, depressed adolescents, who might previously have withdrawn from social interactions, may find in social media an opportunity to engage in high levels of feedback-seeking and social comparison. The unique affordances of the online environment for depressed adolescents' social interactions render technology-based SCFS a critical area for further investigation.

In examining the prospective relationship between depressive symptoms and technology-based SCFS, it is critical to consider the role of gender. It is well known that rates of depression are higher among adolescent girls, compared to boys (Nolen-Hoeksema, 2001). The elaborated cognitive vulnerability-transaction stress model of depression suggests that girls are more likely to generate interpersonal stressors than boys, and that they may react to stressors with more ruminative and negative inferential response styles, which may explain these different prevalence rates (Hankin & Abramson, 2001). Furthermore, a meta-analytic review of cross sectional studies showed a stronger relationship between ERS and depressive symptoms for adult women, compared to men (Starr & Davila, 2008). In general, girls may show higher levels of social-

evaluative concerns and need for approval, and may engage in greater self-disclosure in the offline context (Rose & Rudolph, 2006). In the online context, girls have been shown to engage in more frequent technology-based SCFS than boys, and the concurrent relationship between SCFS and depressive symptoms may be stronger for girls (Nesi & Prinstein, 2015). However, the literature on gender differences in the association between depressive symptoms and later interpersonal difficulties, both offline and online, remains surprisingly limited. It remains unclear whether depressive symptoms may more strongly predict increased engagement in technology-based SCFS among girls or boys longitudinally.

The current study examined longitudinal relationships between depressive symptoms and technology-based social comparison and feedback-seeking (SCFS) among adolescents over a three-year period, and specifically examined whether depressive symptoms were predictive of higher levels of SCFS in the subsequent year. Using latent growth curve modeling techniques, this study offers a unique opportunity to examine intra-individual change in technology-based SCFS over time. Specifically, this approach allows for the examination of individual adolescents' typical levels of engagement in technology-based SCFS, or trajectories, and to test deviations from these patterns at each time point. Each adolescent exhibits a baseline tendency to engage in high or lower levels of technology-based SCFS; latent growth curve modeling examines within-person increases in this behavior, relative to the adolescents' baseline, following higher depressive symptoms at a concurrent or previous time point.

Within this analytic framework, Hypothesis 1 predicted that adolescents who reported higher levels of depressive symptoms at a given time point would engage in greater levels of SCFS at that same time point, controlling for their underlying trajectories of technology-based SCFS and overall frequency of technology use. Hypothesis 2 predicted that adolescents

reporting higher levels of depressive symptoms at a given time point would report greater levels of SCFS one year later, above and beyond what would be expected from their underlying trajectories of SCFS and overall frequencies of technology use. Given literature suggesting gender differences in rates of depression and technology-based SCFS, we explored whether the longitudinal associations between depression and SCFS differed by gender.

## Methods

### Participants and Procedure

The current study included 816 participants, assessed at three waves, each one year apart. It offers a longitudinal follow up of a sample used in prior work (*citation removed for blind review*). At Time 1, students were eighth and ninth grade students, between the ages of 13 and 16 (mean age = 14.1). Self-report measures were used to assess participants' gender identity (54.7% female) and ethnicity (47.5% White/Caucasian, 24.9% African American/Black, 24.9% Hispanic/Latino, 2.8% other ethnicities). Students came from three, rural, low-income schools in the southeastern United States, and the sample closely matched the demographic makeup of the district from which participants were recruited.

As part of a large, longitudinal study on adolescent health risk behaviors and peer relationships, all students in seventh and eighth grade in these schools were recruited ($n$ = 1,463). Consent forms were returned by 82.4% of families ($n$ = 1,205), and of these, 74.7% ($n$ = 900; 61.7% of total recruited) consented to participation. Four waves of data were collected from participants, with measures for the current study only collected at the one-year ("Time 1"), two-year ("Time 2"), and three-year ("Time 3") follow-ups. Of the 900 consented students, a total of 92% ($n$ = 831) at least partially completed surveys at a minimum of one of the current study's three time points. Of these, six participants did not complete any of the measures used in the

current analyses, and thus were excluded. Another six participants were excluded because they indicated that they did not use any technology (cell phones, Facebook, or Instagram) at any of the study's three time points. Three participants were excluded because they did not report their gender, and thus could not be included in multiple group analyses. Thus, the final sample for analyses was 816 participants. Out of these 816 participants, the number who completed at least some of the measures at each time point was $n$ = 745 at Time 1, $n$ = 765 at Time 2, and $n$ = 707 at Time 3.

Following informed assent procedures, surveys were administered during the school day using computer-assisted self-interviews (CASI). All measures were self-reported by participants at each of the three time points. Participants were compensated with $10 gift cards at each time point. All procedures were approved by the university human subjects committee.

Measures

Depressive Symptoms. Depressive symptoms were assessed using the Short Mood and Feelings Questionnaire (SMFQ; Angold et al., 1995). The SMFQ contains 13 items that assess depressive moods and behaviors over the past two weeks, for example, "I felt miserable or unhappy" and "I did everything wrong." Items are endorsed on a 3-point scale (0 for *not true*, 1 for *sometimes true,* 2 for *true*). A mean of all items was computed, with higher scores indicating higher levels of depressive symptoms. Good psychometric properties have been reported for the SMFQ as a reliable and valid measure of depressive symptoms among adolescents (Angold, Erkanli, Silberg, Eaves, & Costello, 2002). In the present sample, the SMFQ demonstrated good internal consistency across all time points: Time 1 ($\alpha$ = .93), Time 2 ($\alpha$ = .95), and Time 3 ($\alpha$ = .94).

Technology-based Social Comparison and Feedback-Seeking (SCFS). The Motivations for Electronic Interaction Scale (MEIS) was designed to assess adolescents' attitudes and behaviors regarding the use of "electronic interaction," defined for participants as "texting, Facebook, and other social media (e.g. Twitter, Instagram, Snapchat, Tumblr"). It was developed through a series of focus groups and pilot testing with over 419 adolescents of similar age, gender, and ethnic composition to the current sample (see Nesi & Prinstein, 2015 for more information on measure development). The social comparison and feedback-seeking subscale is a 10-item measure, loading onto a single factor, which assesses adolescents' use of social media to seek out information regarding one's appearance, behaviors, and social status, relative to one's peers. This subscale includes items such as "I use electronic interaction to compare my life with other people's lives" and "I use electronic interaction to see if others think I am cool, funny, or popular." Participants endorsed the personal relevance of each item on a 5-point Likert scale (1 for *Not at all true* and 5 for *Extremely true*). A mean of all items was computed, with higher scores indicating higher levels of technology-based SCFS. The technology-based SCFS subscale demonstrated good internal consistency across all time points in the current study: Time 1 ($\alpha$ = .92), Time 2 ($\alpha$ = .93), and Time 3 ($\alpha$ = .94).

Frequency of Technology Use. The Electronic Interaction Scale for Time (EIS_T) was designed to assess average daily frequencies of technology use and other forms of interpersonal communication. This measure was similarly developed using focus groups and pilot testing (see Nesi & Prinstein, 2015), and information on frequencies of use from national surveys of adolescent technology use (e.g. Lenhart, 2015). Participants indicated frequencies of use on a 7-point scale (0 for *I don't use this,* 1 for *Less than 1 hour*, and 6 for *5 or more hours*), and were asked about a series of activities, including daily in-person communication, voice

communication, non-voice cell phone use (i.e., for "texting, games, or Internet"), Facebook use, and Instagram use. The Frequency of Technology Use variable was created by computing a mean of the final three items (non-voice cell phone use, Facebook use, and Instagram use). Among all participants in the current sample, 92.6%, 92.2%, and 94.6% had engaged in at least one of these activities at each of Time 1, Time 2, and Time 3, respectively. Participants who had not engaged in any of these three activities at any time point were excluded from analyses ($n$ = 6). Notably, prior research indicates that Facebook and Instagram were the most popular social media sites used by adolescents, ages 13 to 17, at the time of data collection (Lenhart, 2015).

Analysis Plan

To examine relationships between depressive symptoms and technology-based SCFS over time, latent growth curve models were tested using MPlus 7.0 (Muthén & Muthén, 1998-2016). Full information maximum likelihood estimation was used to handle missing data. An unconditional latent growth model for technology-based SCFS over three time points was tested, with both depressive symptoms and frequency of technology use at each time point entered as time-varying covariates. This allowed for the examination of Hypothesis 1, that adolescents who reported higher levels of depressive symptoms at a given time point would report greater engagement in SCFS at that same time point, controlling for their underlying, longitudinal trajectories of technology-based SCFS and overall frequency of technology use. In order to examine Hypothesis 2, that adolescents reporting higher levels of depressive symptoms at a given time point would report greater levels of SCFS one year later, above and beyond what would be expected from their underlying trajectories of SCFS and overall frequencies of technology use, the addition of lagged effects of depressive symptoms and frequency of technology use on technology-based SCFS was tested (see Figure 3.1). Multiple group models

were used to examine gender differences, with a series of likelihood ratio tests used to determine which model parameters should be constrained across groups and which should be left to freely vary.

**Results**

Descriptive Statistics

Descriptive statistics were conducted to examine the means and standard deviations of all study variables (see Table 3.1). In addition, independent sample t-tests were conducted to examine gender differences in the means of all study variables. Results indicated that girls reported higher levels of depressive symptoms, technology-based SCFS, and overall frequencies of technology use at every time point. Pearson correlations were also conducted to examine bivariate associations among all study variables (see Table 3.2). Additional analyses were run to examine whether, at each time point, adolescents who reported using any technology (cell phones, Facebook, or Instagram) differed in levels of depressive symptoms from those who did not. At Time 1, those who did not use technology ($n$ = 53) reported lower levels of depressive symptoms than those who did ($n$ = 659), $t(64.71) = -3.33$, $p < .001$. At Time 2, those who did not use technology ($n$ = 59) also reported lower levels of depressive symptoms than those who did ($n$ = 701), $t(75.83) = -4.32$, $p < .001$. At Time 3, the same pattern emerged comparing those who did not use technology ($n$ = 38) to those who did ($n$ = 669), $t(705) = -2.57$, $p = .01$. In addition, boys were more likely than girls to report not using any technology at Time 1 ($\chi^2 = 13.97$, $p < .001$), Time 2 ($\chi^2 = 14.23$, $p < .001$), and Time 3 ($\chi^2 = 9.14$, $p = .003$).

Latent Growth Curve Models

Unconditional Models. First, unconditional latent growth models for technology-based SCFS over three time points were constructed separately for males and females, in order to

determine the optimal functional model form prior to testing hypotheses. Intercept only models were first constructed. Model fit was modest for girls [$\chi^2(4)=15.05$, $p=.005$; CFI=.96, TLI=.97, RMSEA=.08, SRMR=.05] and poor for boys $\chi^2(4)=57.36$, $p<.001$; CFI=.68, TLI=.76, RMSEA=.19, SRMR=.10]. Next, models were fit with both latent intercept and linear slope factors. Model fit was good for both girls [$\chi^2(1)=0.84$, $p=.36$; CFI=1.00, TLI=1.00, RMSEA=.00, SRMR=.01] and boys [$\chi^2(1)=7.27$, $p=.007$; CFI=.96, TLI=.89, RMSEA=.13, SRMR=.04]. Thus, likelihood ratio tests confirmed significant improvement in model fit with the addition of the slope factor for both boys [$\Delta\chi^2(3)=50.09$, $p<.001$] and girls [$\Delta\chi^2(3)=14.21$, $p<.01$]. Thus, linear models were identified to be the optimal functional model form for both males and females (Bollen & Curran, 2006).

Next, all participants were combined into a single, unconditional multiple group model in order to examine differences by gender. A multiple group model was first run with all parameters free to vary across groups, showing good fit to the data ($\chi^2(2)=8.11$, $p=.02$; CFI=.99, TLI=.96, RMSEA=.09, SRMR=.03). Likelihood ratio tests were conducted to determine which parameters could be set equal across groups (Bollen & Curran, 2006). First, latent factor means (slope and intercept) were set equal across group, resulting in a significant decrement in model fit [$\Delta\chi^2(2)=18.80$, $p<.001$]; thus factor means were left to vary freely across group. Next, within each gender, the heteroscedasticity of residuals was tested. For girls, the addition of equality constraints on the time-specific residuals did not result in a significant decrement in fit [$\Delta\chi^2(2)=2.92$, $p=.23$]; thus, these were retained. For boys, the addition of these equality constraints caused model nonconvergence, and thus a heteroscedastic residual structure was retained for boys. Overall, a linear multiple group model with homoscedastic residuals structure

for girls and heteroscedastic residuals for boys was identified to be the optimally fitting functional form.

The unconditional multiple group model, without the addition of depressive symptoms as a time-varying covariate, revealed excellent model fit [$\chi^2(4)=11.03$, $p=.03$; CFI=.98, TLI=.98, RMSEA=.07, SRMR=.03]. Results indicated a significant, positive mean slope for both males and females. This means that, on average, participants' levels of engagement in technology-based SCFS increased over time. However, results also indicated significant variances in slope and intercept for both genders, meaning that there was significant individual variability around this mean trajectory, which may be explained by the addition of predictors (i.e., depressive symptoms) in a conditional model (see Table 3.3).

Addition of Depressive Symptoms as a Time-Varying Covariate. Depressive symptoms, measured at each of the three time points, were then entered into the model as a time-varying covariate. First, depressive symptoms at each time point were regressed on time-specific measures of SCFS (Hypothesis 1). Initial model fit was excellent [$\chi^2(4)=6.42$, $p=.17$; CFI=1.00, TLI=.97, RMSEA=.04, SRMR=.02]. In order to test whether the regression parameters of depressive symptoms on time-specific measures of SCFS were equal at each time period, these parameters were constrained to equality (Bollen & Curran, 2006). This did not result in any significant reduction in model fit [$\Delta\chi^2(4)=6.85$, $p=.14$]; thus, these constraints were retained for parsimony. Setting these regression parameters equal across time points *and* across gender also did not result in any significant reduction in model fit [$\Delta\chi^2(1)=0.82$, $p=.37$]; thus, these constraints were also retained for model parsimony. Results indicated that the contemporaneous effects of depressive symptoms on time-specific measures of SCFS were significant for both boys and girls.

In order to test whether depressive symptoms at a given time point predict higher levels of SCFS one year later, controlling for adolescents' underlying trajectories of SCFS *and* the contemporaneous effects of depressive symptoms, lagged effects of depressive symptoms on technology-based SCFS were added to the model (Hypothesis 2). The addition of these lagged effects significantly improved model fit [$\Delta\chi^2(2)=7.57$, $p=.02$], indicating that they should be retained. Likelihood ratio tests indicated that these lagged effects could be constrained to be equal across time [$\Delta\chi^2(2)=0.15$, $p=.93$], but that they should be left to vary freely across gender [$\Delta\chi^2(1)=4.17$, $p=.04$]. Thus, the model supported the inclusion of lagged effects of depressive symptoms on later technology-based SCFS, with effects set equal within gender across time points, but free to vary across gender (see Figure 3.1). Model fit was excellent [$\chi^2(7)=6.73$, $p=.46$; CFI=1.00, TLI=1.00, RMSEA=.00, SRMR=.02]. Results indicated significant lagged effects of depressive symptoms on technology-based SCFS for boys only.

Addition of Frequency of Technology Use as Time Varying Covariate. Finally, in order to examine whether the effects of depression on technology-based SCFS remained when controlling for the effects of overall technology use on SCFS, frequency of use was added as a time-varying covariate (Hypotheses 1 and 2). Both contemporaneous and lagged effects of frequency of technology use on SCFS were included, in order to test for the effects of depression over and above this covariate (see Figure 3.1). Likelihood ratio tests indicated that the contemporaneous effects of frequency of technology use on SCFS could be constrained to be equal across time [$\Delta\chi^2(4)=7.68$, $p=.10$], but that they should be left to vary freely across gender [$\Delta\chi^2(1)=4.37$ $p=.04$]. Further likelihood ratio tests indicated that lagged effects could be constrained to be equal across time [$\Delta\chi^2(2)=0.59$, $p=.75$] and gender [$\Delta\chi^2(1)=0.50$, $p=.50$]. Final model fit was excellent [$\chi^2(10)=13.87$, $p=.18$; CFI=1.00, TLI=.98, RMSEA=.03, SRMR=.02].

Interestingly, frequency of technology use showed a significant, contemporaneous association with time-specific increases in technology-based SCFS for boys only. All other contemporaneous and lagged effects of frequency of technology use on SCFS were non-significant for both genders. The pattern of results regarding the effects of depression on technology-based SCFS remained the same with the addition of frequency of technology use.

Final Model Results

Overall, results indicated that, for both genders, higher levels of depressive symptoms were uniquely associated with technology-based SCFS at each time point, above and beyond the influence of the underlying growth factors for SCFS and the effects of frequency of technology use. In other words, adolescents who reported higher levels of depressive symptoms at a given time point also reported higher levels of technology-based SCFS at that time point than would be expected solely based on their underlying trajectories of SCFS and technology use frequency (Hypothesis 1). With the addition of lagged effects, the contemporaneous effects of higher depressive symptoms on time-specific elevations in technology-based SCFS remained for both genders. However, lagged effects were significant for boys only. For boys, above and beyond the influence of underlying trajectories of SCFS, the contemporaneous effects of depressive symptoms, and the contemporaneous and lagged effects of frequency of technology use, higher levels of depressive symptoms at Time 1 were associated with higher levels of SCFS at Time 2. The same pattern held for boys between Times 2 and 3. For girls, the lagged effects of depressive symptoms on SCFS were not significant. Thus, boys, but not girls, who report higher levels of depressive symptoms at a given time point reported higher levels of SCFS one year later, over and above what would have been expected based on their underlying trajectories of SCFS and technology use frequency (Hypothesis 2).

Effects of Depressive Symptoms on Frequency of Technology Use. Although final conditional models controlled for the contemporaneous and lagged effects of frequency of technology use on technology-based SCFS, further exploratory analyses were run to determine whether depressive symptoms were predictive of mere increases in overall technology use, rather than technology-based SCFS in particular. Specifically, latent curve models of frequency of technology use over time were constructed, with depressive symptoms entered as a time-varying covariate. First, unconditional latent growth models for frequency of technology use over three time points were constructed separately for males and females. Intercept only models were compared to models with latent intercept and linear slope factors. For girls, model fit improved significantly with the addition of the slope factor [$\Delta\chi^2(3)=8.00$, $p<.05$]. For boys, however, the addition of the slope factor did not significantly improve model fit [$\Delta\chi^2(3)=3.211$, $p=.36$], indicating that, on average, frequencies of technology use did not change significantly over time for boys. Thus, a linear model was fit for girls, and a separate intercept-only model was fit for boys. Results for girls showed a significant, negative mean slope for frequency of technology use ($b=-.09$, $se=0.04$, $p<.05$), indicating that, on average, frequencies of use decreased over time.

For both genders, after adding depressive symptoms as a time-varying covariate, results indicated that the contemporaneous effects of depressive symptoms on frequency of technology use, controlling for underlying growth factors, were not significant ($p$'s > .12). Further, the addition of lagged effects did not significantly improve model fit for boys [$\Delta\chi^2(3)=3.211$, $p=.36$], or girls [$\Delta\chi^2(3)=0.78$, $p=.85$]. Taken together, these results indicate that depressive symptoms were neither associated concurrently nor across time points with greater frequencies of technology use, controlling for underlying trajectories of technology use.

## Discussion

The current study provides a novel investigation of the longitudinal role of adolescent depressive symptoms in predicting maladaptive online social behaviors. Findings suggest that depressive symptoms may have important implications for adolescents' engagement in technology-based social comparison and feedback-seeking behaviors (SCFS), or the use of social media to seek out information regarding one's appearance, behaviors, and social status, relative to one's peers. Specifically, results demonstrate that for girls and boys, higher depressive symptoms at a given time point are associated with higher engagement in SCFS after accounting for individuals' typical patterns of SCFS and overall frequency of technology use. Further, results suggested that boys, but not girls, who report higher depressive symptoms at a given time point also prospectively report greater engagement in SCFS at later time points. Importantly, results from the current study suggest that depressive symptoms did not predict overall *frequencies* of social media use, but rather, engagement in the specific behavior of technology-based SCFS. Results have important implications for understanding the ways that social media may present a new context for experiencing interpersonal distress among depressed adolescents.

Understanding the ways in which social media may uniquely contribute to the social experience of depressed adolescents is critical. Symptoms-driven models of depression suggests that, within an offline context, depressed adolescents exhibit a number of social-behavioral deficits, including negative behavioral self-focus (e.g., ERS, NFS), as well as social disengagement and withdrawal (Rudolph, 2009). However, as adolescents increasingly turn to cell phones, text messaging, and social networking sites, these tools represent a primary context within which social interaction with peers now takes place (Lenhart, 2015). With public postings and feedback, large networks that provide an "audience" for online behaviors, and immediate

accessibility at any time of day (boyd, 2010; Peter & Valkenburg, 2013), social media represents a fundamentally different social environment for adolescents.

These aspects of social media may create opportunities for engagement in behaviors with particularly problematic interpersonal consequences for depressed adolescents. For example, technology-based SCFS may represent a new, *online* social-behavior deficit, whereby youth with depressive symptoms use social media to seek out information regarding their social standing in relation to peers. Although this behavior may not always involve synchronous, direct peer interaction, it represents a new type of social interaction—with posting requests for reassurance to a larger audience of peers, viewing (and commenting on) the publically available interactions of one's peers, or comparing oneself to peers' photos and the comments on those photos—that is indicative of adolescents' new social landscape.

Importantly, whereas depressed adolescents might have previously withdrawn from social relationships, the advent of social media now allows for engagement in problematic social behaviors like technology-based SCFS, at any time of day, from any location, and, often, in the presence of a large number of online peers. It is thus possible that technology-based SCFS may have unique implications for adolescent adjustment, above and beyond what would be expected of similar offline behaviors, such as ERS or NFS. Indeed, the public and interconnected nature of social media may create an environment in which depressed adolescents' sociobehavioral deficits can be immediately observed by a large social network, perhaps creating more widespread and severe interpersonal difficulties compared to typical offline ERS or NFS. For example, depressed adolescents' attempts to gain peer feedback online or compare themselves to peers based on posted content may be seen by others as aversive or lacking in social skill. Furthermore, the fact that social media environments provide fewer interpersonal cues than

traditional, offline environments (e.g. tone of voice, facial expressions) may lead individuals to feel less inhibited online (Walther & Parks, 2002). This may lead depressed adolescents to feel "safer" engaging with peers online, and to interact with others in potentially maladaptive ways. Together, technology-based SCFS behaviors represent a unique way that depressed adolescents can engage in problematic social behaviors.

Consistent with hypotheses, results indicated that both boys and girls who reported higher depressive symptoms at a given time point also reported time-specific increases in technology-based SCFS at that time point, controlling for their typical patterns of SCFS and overall frequencies of technology use. This finding is consistent with past research indicating concurrent associations between depressive symptoms and other problematic social behaviors on social media (e.g., Tandoc, Ferrucci, & Duffy, 2015; Ybarra et al., 2005). Furthermore, these findings suggest the utility of examining the influence of depressive symptoms on short-term, intra-individual changes in technology-based SCFS, with analyses suggesting that depressive symptoms at a given time point may result in increased levels of technology-based SCFS compared to an adolescent's baseline level of this behavior. Similar to offline depressogenic behaviors like ERS, technology-based SCFS may represent an in-the-moment, maladaptive strategy for coping with stressful negative life events or decreases in self-esteem (Joiner, Katz, & Lew, 1999). Depressed boys and girls may be increasingly turning to social media, which is readily available at all times of day, as a means of seeking reassurance or feedback regarding their standing in relation to peers, likely with negative implications for their self-esteem and relationships with peers more generally.

In addition, results indicated that for boys, but not girls, higher levels of depressive symptoms at a given time point were also associated with higher levels of SCFS *one year later*,

controlling for underlying trajectories of SCFS and overall frequency of technology use. These results are interesting, and may be interpreted in light of theories regarding gender differences in both online and offline social behaviors. Prior research indicates that girls, on average, are more likely to generate and experience interpersonal stressors within their relationships in adolescence (Rudolph, 2002). Similarly, results from the current study indicate that overall, girls were more likely to engage in technology-based SCFS than boys. Among girls, overt displays of social comparison and feedback-seeking behaviors may be more normative or socially sanctioned. As such, it may be that this behavior is particularly unusual or problematic for boys, and that only those boys exhibiting the interpersonal deficits characteristic of depression will display long-term increases in this behavior.

In addition, prior work demonstrates that, due to the possibility for asynchronicity and anonymity in communication with peers online, some adolescents may perceive social media as a "safer" environment to engage in personal communication (Schouten, Valkenburg, & Peter, 2007). In general, girls are more likely to engage in interpersonally-based responses to distress, such as social support seeking (Eschenbeck, Kohlmann, & Lohaus, 2007) and co-rumination (Rose, 2002); thus, for girls, seeking *in-person* feedback and reassurance from peers may be more comfortable. Among depressed boys, for whom these types of in-person interactions are less typical, technology-based tools may represent a less threatening means of engaging in these behaviors. Indeed, prior research indicates that while adolescent girls tend to engage in higher levels of self-disclosure with peers in-person compared to online, the difference between offline and online self-disclosure is much smaller for boys (Valkenburg, Sumter, & Peter, 2011). Thus, compared to girls, adolescent boys experiencing depressive symptoms may increasingly turn to social media for problematic interpersonal interactions.

This study employed a three-year longitudinal design and an advanced analytic approach to stringently examine hypotheses. Future research would benefit by addressing issues that were not thoroughly examined in this study. One limitation to the study, as with much current research examining online behaviors, is the inability to empirically distinguish between technology-based SCFS and similar offline behaviors (e.g., ERS, NFS). Although it is likely that the affordances of the social media environment facilitate behaviors, such as SCFS, that may have a unique impact on certain adolescents' social experiences, this cannot be determined without controlling for similar offline behaviors. Prior work has indicated that concurrent associations between depressive symptoms and SCFS remain when controlling for ERS, and that ERS and SCFS are only moderately correlated, suggesting that these may be distinct constructs (Nesi & Prinstein, 2015). However, future work will be necessary to identify the unique role that SCFS may have on social adjustment longitudinally, and whether depressed adolescents are more or less likely to engage in SCFS compared to offline behaviors. In addition, future work should control for other variables that may impact associations between depression and SCFS, such as type of social media used and offline peer social status.

Despite the inclusion of a large adolescent sample, it should be noted that recruitment occurred within a community context with relatively low base rates of depression. Although this provides important information regarding the potential relevance of SCFS for adolescents' experiences more generally, it will be important to repeat this study with a clinical sample to determine whether results may be extended to those experiencing more severe levels of distress. This study also used self-report measures; future research using a variety of assessment techniques (e.g., observational coding of social media pages) will offer a more nuanced view of the specific processes involved in technology-based SCFS. Indeed, novel observational coding

systems are beginning to emerge in the assessment of adolescent social media use, and these measures have shown promising results (Moreno, Christakis, Jelenchick, & Villiard, 2012; Underwood, Rosen, More, Ehrenreich, & Gentsch, 2012). Furthermore, although this study benefitted from a large, diverse sample, differences in results by ethnicity or socioeconomic status were not observed in preliminary analyses, and future work should aim to further explore these effects. Finally, future studies with data from a short-term framework, perhaps using ecological momentary assessment (EMA) techniques. It is likely that technology-based SCFS does not act as trait-level risk factor for long-term increases in depressive symptoms among adolescents. However, it is possible that SCFS may cause short-term changes in mood, which in combination with other factors, may accumulate to impact symptoms of pathology in the long-term. Thus, future studies will benefit from examining transactional models to observe how SCFS may be associated with depressive symptoms in the moments immediately following social media participation.

Overall, results from this study suggest that as the social landscape of youth begins to reorganize at the adolescent transition, technology-based behaviors such as technology-based SCFS may become increasingly relevant and worthy of study. Depression may play a key role in determining the extent to which adolescents engage in SCFS, particularly for boys. Findings suggest that studies of interpersonal theories of depression would benefit from examining adolescents' modern social contexts.

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TABLE 3.1

*Descriptive Statistics and Gender Comparisons of Study Variables*

| | Full Sample | | Girls | | Boys | | Gender Comparison |
|---|---|---|---|---|---|---|---|
| | *M* (*SD*) | *N* | *M* (*SD*) | *n* | *M* (*SD*) | *n* | *t* (df) |
| Technology-based SCFS | | | | | | | |
| Time 1 | 1.71 (0.77) | 690 | 1.82 (0.83) | 385 | 1.57 (0.68) | 305 | 4.35 (687.16)*** |
| Time 2 | 1.87 (0.87) | 754 | 1.94 (0.89) | 409 | 1.80 (0.84) | 345 | 2.29 (752)* |
| Time 3 | 1.90 (0.89) | 701 | 1.98 (0.94) | 381 | 1.82 (0.83) | 320 | 2.34 (699)* |
| Depressive Symptoms | | | | | | | |
| Time 1 | 0.46 (0.50) | 745 | 0.60 (0.54) | 413 | 0.28 (0.37) | 332 | 9.26 (724.47)*** |
| Time 2 | 0.49 (0.54) | 764 | 0.63 (0.59) | 415 | 0.32 (0.41) | 349 | 8.76 (736.59)*** |
| Time 3 | 0.48 (0.51) | 707 | 0.61 (0.55) | 385 | 0.31 (0.40) | 322 | 8.52 (690.50)*** |
| Frequency of Technology Use | | | | | | | |
| Time 1 | 2.62 (1.67) | 703 | 3.11 (1.64) | 393 | 2.01 (1.52) | 310 | 9.15 (701)*** |
| Time 2 | 2.43 (1.52) | 754 | 2.85 (1.52) | 409 | 1.94 (1.38) | 345 | 8.53 (752)*** |
| Time 3 | 2.52 (1.39) | 701 | 2.90 (1.39) | 381 | 2.08 (1.25) | 320 | 8.16 (695.58)*** |

*Note*: SCFS = social comparison and feedback-seeking.
$^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$

TABLE 3.2

*Bivariate Associations by Gender*

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| 1. Time 1 Depressive Symptoms | -- | .57** | .41** | .37** | .20** | .07 | .02 | .10* | .12* |
| 2. Time 2 Depression Symptoms | .46** | -- | .54** | .25** | .27** | .11* | .07 | .16** | .19** |
| 3. Time 3 Depressive Symptoms | .40** | .57** | -- | .18** | .18** | .24** | -.01 | .08 | .13* |
| 4. Time 1 Technology-Based SCFS | .22* | .07 | .20** | -- | .54** | .44** | .28** | .22** | .19** |
| 5. Time 2 Technology-Based SCFS | .13* | .10 | .07 | .40** | -- | .55** | .14** | .20** | .20** |
| 6. Time 3 Technology-Based SCFS | .03 | .04 | .10 | .37** | .54** | -- | .09 | .14** | .24** |
| 7. Time 1 Frequency of Technology Use | .09 | .00 | .09 | .31** | .17** | .28** | -- | .45** | .45** |
| 8. Time 2 Frequency of Technology Use | .11 | .07 | .01 | .25** | .44** | .38** | .39** | -- | .59** |
| 9. Time 3 Frequency of Technology Use | .01 | -.01 | .04 | .18** | .26** | .25** | .33** | .37** | -- |

*Note:* Results for girls reported above the diagonal. Results for boys reported below the diagonal. SCFS = social comparison and feedback-seeking.
$^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$

TABLE 3.3.

*Means and variances of unconditional and conditional model of technology-based SCFS*

| | Unconditional Model | | | | Conditional Model | | | |
|---|---|---|---|---|---|---|---|---|
| | Mean | | Variance | | Mean | | Variance | |
| | *b* | *se* | *b* | *se* | *b* | *se* | *b* | *se* |
| Girls | | | | | | | | |
| Slope | 0.07** | .02 | 0.05* | .02 | 0.04 | .04 | 0.03 | .02 |
| Intercept | 1.83*** | .04 | 0.38*** | .05 | 1.51*** | .11 | 0.29*** | .05 |
| Boys | | | | | | | | |
| Slope | 0.12*** | .03 | 0.09** | .03 | 0.06 | .03 | 0.09** | .03 |
| Intercept | 1.59*** | .04 | 0.25*** | .06 | 1.24*** | .08 | 0.19*** | .05 |

*Note*: Unconditional model refers to the multiple group model (by gender) of trajectories of technology-based social comparison and feedback-seeking with no predictors. Conditional model refers to the multiple group model (by gender) of trajectories of technology-based SCFS with depressive symptoms and frequency of technology use entered as a time-varying covariate.
$^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$

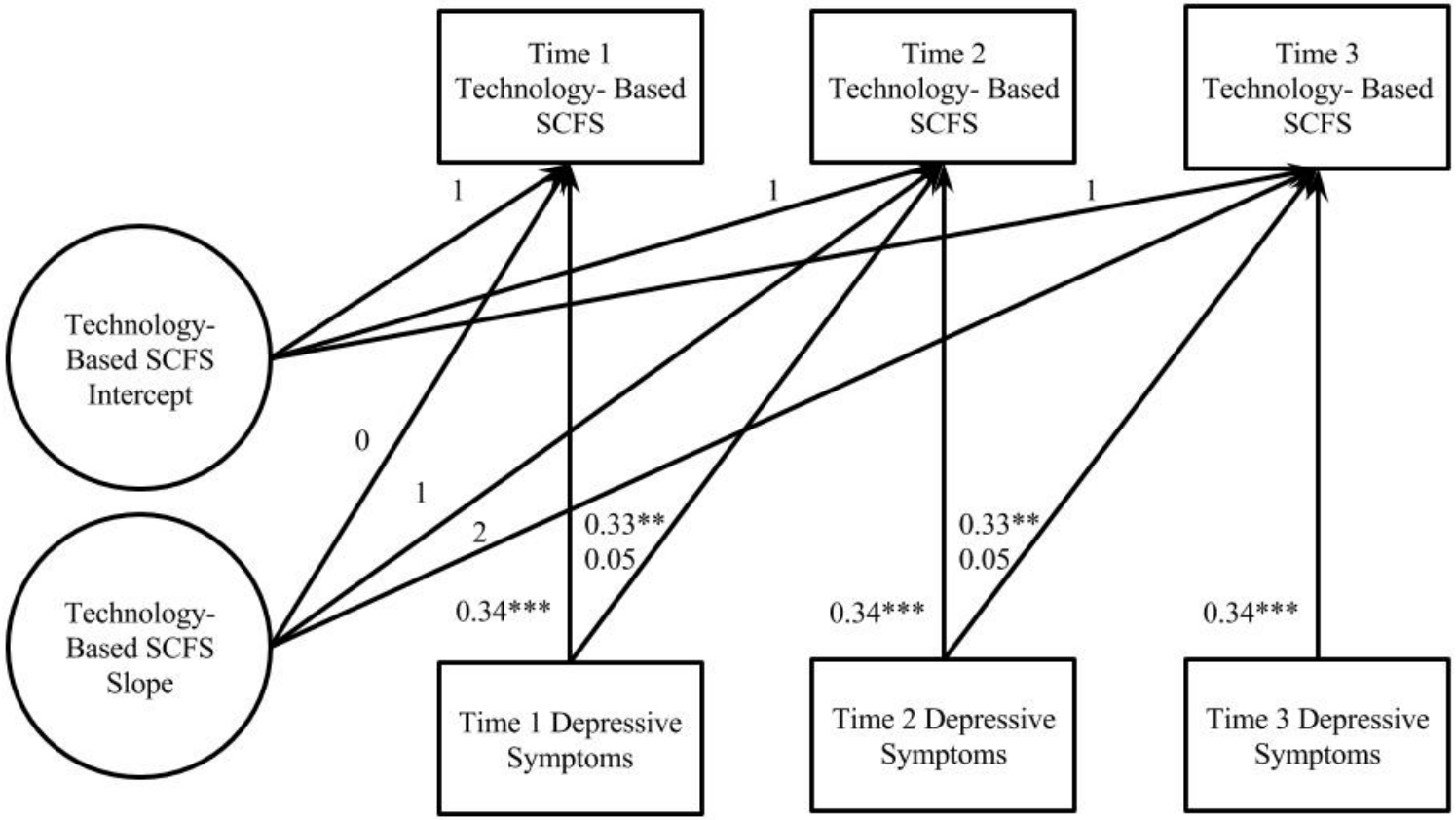



*Figure 3.1*. Final multiple group by gender linear latent growth curve model of technology-based social comparison and feedback-seeking (SCFS). To aid visual interpretation, frequency of technology use is not depicted; however, both depression (pictured) and frequency of technology use were included in the final model (see text). For paths moderated by gender, results for boys presented above. Results presented are unstandardized coefficients. Covariances among variables are not depicted for ease of interpretation. For girls, covariances between depressive symptoms and the latent SCFS slope were: -0.05, p = .002, -0.04, p = .07, and -0.01, p = .48 for Times 1, 2, and 3, respectively. For boys, covariances between depressive symptoms and the latent SCFS slope were: -0.02, p = .11, -0.03, p = .02, and -0.04, p = .004 for Times 1, 2, and 3, respectively. There were no significant associations between depressive symptoms and latent SCFS intercepts for boys or girls. $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$.

## CHAPTER 4: FRIENDS' ALCOHOL-RELATED SOCIAL NETWORKING SITE ACTIVITY PREDICTS ESCALATIONS IN ADOLESCENT DRINKING: MEDIATION BY PEER NORMS[3]

Adolescent's use of social networking sites (SNS) has increased drastically within the last decade, with 89% of adolescents using at least one SNS in 2015 (Lenhart, 2015). Such sites allow adolescents to create public profiles and connect with networks of "friends" through text, photos, and video. Adolescents' interactions via SNS may provide an important context for the development of risk behaviors (Livingstone & Smith, 2014), particularly as adolescents share and view peer-generated content about alcohol use (Moreno, Cox, Young, & Haaland, 2015). Adolescence is the highest risk period for initiation of drinking (Jackson & Sartor, 2014) and early-onset alcohol use prospectively predicts neurological, social, cognitive, and mental health impairments, as well as increased risk for problematic substance use (Bava & Tapert, 2010; J. E. Schulenberg & Maggs, 2002). Despite coinciding increases in risky alcohol-related behaviors and use of SNS where youth may share alcohol-related content, little is known regarding associations between adolescents' SNS use and initiation of alcohol use.

SNS have become an essential aspect of adolescents' social lives, with traditional peer interactions often occurring within such environments (Lenhart, 2015). Using SNS, adolescents can engage with their peers in a variety of alcohol-related activities. Prior research indicates that

[3]This chapter previously appeared as an article in the *Journal of Adolescent Health.* The original citation is as follows: Nesi, J., Rothenberg, W.A., Hussong, A. & Jackson, K. (2017). Friends' alcohol-related social networking site activity predicts escalations in adolescent drinking: Mediation by peer norms. *Journal of Adolescent Health, 60*(6)*,* 641-647. doi:10.1016/j.jadohealth.2017.01.009

individuals may use SNS to post photos or text that explicitly reference their own drinking behaviors, as well as to display more implicit references to alcohol, such as those contained in song lyrics, websites, and music videos (Beullens & Schepers, 2013; Griffiths & Casswell, 2010; Moreno et al., 2010). On SNS, adolescents may view peers' postings related to alcohol (National Center on Addiction and Substance Abuse at Columbia University, 2012) and the feedback that such postings receive from others. Research suggests that these portrayals of alcohol use are largely positive in nature (Beullens & Schepers, 2013; Moreno et al., 2010). There are many theoretical reasons to suspect that these alcohol-related aspects of SNS use have implications for adolescents' drinking behaviors.

Behavioral theories such as social cognitive theory (Bandura, 2001) and the theory of planned behavior (Ajzen, 1991) emphasize the ways in which individuals' behaviors are shaped via observation of others and the development of subjective norms. Such theories have informed models of both media and peer influences on risk behavior. For example, adolescents may adopt behaviors that are modeled via mass media, depending on their beliefs and expectations regarding those behaviors (Bandura, 2001). Indeed, portrayals of alcohol use via media channels have been shown to influence adolescents' likelihood of consuming alcohol, particularly when adolescents perceive those portrayals to be desirable, realistic, and similar to them (Austin, Chen, & Grube, 2006). Furthermore, peer substance use has been shown to be among the strongest correlates of adolescents' drinking initiation and escalation (Jackson & Sartor, 2014), with peer alcohol use longitudinally predicting early-onset drinking behaviors (Kelly et al., 2012) and progression to heavy drinking (J. Schulenberg, O'Malley, Bachman, Wadsworth, & Johnston, 1996). Social media provides both the vast quantities of digitally mediated information characteristic of mass media and the personalized, reciprocal engagement characteristic of

traditional peer interactions. It may thus represent a synthesis of peer and media influences on adolescents' behavior.

These theories suggest that peer and media influences contribute to adolescents' perceived social norms around drinking, which impact their own drinking behaviors. Descriptive norms, or beliefs about the extent to which one's peers are drinking alcohol, and injunctive norms, or beliefs about peers' approval or disapproval of drinking alcohol, have both been shown to influence drinking behaviors (Borsari & Carey, 2003). On SNS, experimental evidence suggests that youth who view Facebook profiles portraying alcohol use report greater descriptive norms of alcohol use and willingness to drink (Litt & Stock, 2011). The unique context of social media may also influence adolescents' *injunctive* norms around peers' alcohol use. Some adolescents may engage in selective self-presentation on these platforms, sharing experiences with alcohol and engaging with alcohol-related messages as a means of portraying an "intoxigenic social identity," which supports drinking as normative among youth (Griffiths & Casswell, 2010) and emphasizes positive, rather than negative, aspects of alcohol use (Beullens & Schepers, 2013). These adolescents will likely be viewed as approving of alcohol use, perhaps contributing to misperceptions of peers' beliefs about alcohol (Moreno, Briner, Williams, Walker, & Christakis, 2009). Furthermore, as adolescents' SNS often represent large networks of peers, accessible any time, anywhere, (Lenhart, 2015) an incredible volume of alcohol-related social information may be accessible and the posts of just a few alcohol-using peers can have wide influence. Thus, adolescents exposed to alcohol-related SNS activity may be uniquely positioned to develop biased perceptions of injunctive norms around alcohol, and may be at risk for early initiation of alcohol use and progression to problematic drinking behaviors.

Despite theoretical reasons to suggest that exposure to alcohol-related SNS use may be associated with adolescents' alcohol use, little empirical work has examined these associations longitudinally, with existing work primarily cross-sectional and/or limited to college student samples. The lack of research is problematic as adolescence is a critical time period for the development of alcohol use beliefs (Dunn & Goldman, 1998) and self-schemas involving future oriented self-cognitions related to alcohol (Corte & Szalacha, 2010). Initial descriptive work suggests that adolescents' exposure to alcohol-related postings on SNS is frequent. According to a 2012 national survey, 45% of adolescents reported seeing pictures posted of peers drinking, passed out, or using drugs, (National Center on Addiction and Substance Abuse at Columbia University, 2012).

Only a few studies have examined associations between exposure to alcohol-related SNS activity and alcohol use and norms in teenagers, and these largely support a positive association. Cross-sectional findings indicate that adolescents reporting more frequent exposure to SNS alcohol content, including other teens getting drunk or passed out, report more alcohol-favorable injunctive norms and greater likelihood of having used alcohol (Beullens & Vandenbosch, 2016; National Center on Addiction and Substance Abuse at Columbia University, 2012). A longitudinal study of tenth graders found that those with more close friends who posted pictures of "partying or drinking alcohol" on SNS were at increased risk of drinking alcohol six-months later (Huang et al., 2013), but a study from the same authors using stochastic actor-oriented models found no direct association between exposure to friends' postings and subsequent alcohol use (Huang, Soto, Fujimoto, & Valente, 2014). Finally, one study of seventh and eighth-grade students demonstrated that media exposure to alcohol or drugs, including SNS content, was both

predictive of greater alcohol use one-year later and predicted by prior-year alcohol use (Tucker, Miles, & D'Amico, 2013).

Building on this literature, the current study offers a unique opportunity to examine adolescents' exposure to alcohol-related SNS content and development of favorable injunctive norms using longitudinal data from a sample of secondary school students. In addition, by following a sample of initially alcohol-abstinent adolescents, this study allows for the prospective prediction of initiation of alcohol use behaviors. Thus, the primary goal of this study was to conduct a prospective longitudinal investigation of the effects of exposure to friends' alcohol-related SNS postings on adolescent initiation of drinking milestones, controlling for known developmental risk factors for alcohol use (e.g., parental monitoring, peer orientation). In addition, the study sought to examine whether injunctive norms mediate the longitudinal association between exposure to friends' alcohol-related SNS content and initiation of drinking milestones.

## Methods

### Participants

Participants were taken from a ongoing prospective study on alcohol initiation and progression among adolescents (Jackson et al., 2014; Jackson, Colby, Barnett, & Abar, 2015). Participants were 59.0% female and 21.3% non-White (4.6% Black, 3.2% Asian, 1.5% American Indian, 5.5% mixed race; 6.6% other) and 10.6% Hispanic; 36.1% of students received free or reduced price school lunch. Procedures were approved by the university IRB.

### Procedure

Students were recruited from six Rhode Island middle schools in rural, suburban, and urban areas. Data were collected from 1,023 sixth, seventh, and eighth graders in five school

cohorts (enrolled at six-month intervals). Study information was disseminated through schools; interested participants with parental consent for study participation were scheduled to attend a two-hour in-person baseline orientation session. Thereafter, participants completed a series of web surveys initially administered semi-annually and then quarterly (change in design due to new funding; 802 of the 1,023 were re-enrolled at this point). Data on SNS usage was collected on two occasions separated by one year, which were administered between the fourth and sixth years of the study, depending on school cohort. Thus, present study participants were between grades 9 and 12 at the first administration ("Time 1" or T1; $M_{T1Age}$ = 15.8) and between grades 10 and 12 at the second administration one year later ("Time 2" or T2).

A total of 791 participants completed the T1 assessment and 602 participants (76.1% of 791) completed T2; attrition from T1 to T2 was due to participants graduating from high school (ending study participation; $n$=137, 17.3% of 791) or otherwise failing to complete the survey ($n$=52; 6.6% of 791). Those who did not complete T2 were more likely to be older, $t(304.28)= -18.95$, $p<.001$, white, $\chi^2=10.33$, $p<.01$, have used a SNS, $\chi^2=4.50$, $p=.034$, and engaged in drinking behaviors, $\chi^2=28.64$, $p<.001$. There were no differences by sex or SNS alcohol content posting or exposure. The current study sample was limited to participants who reported using a SNS in the past, resulting in a final sample size of 658 (83.2% of the 791), inclusive of participants missing data on T2 outcomes and/or SNS content variables. For each drinking milestone, samples were limited to those who had *not* engaged in that drinking milestone by T1 in order to establish directionality. Of the 658, a total of 495 (75.2%) reported having never engaged in drinking by T1, 584 (88.8%) reported having never become drunk by T1, and 573 (87.1%) reported having never engaged in heavy episodic drinking by T1.

Measures

Exposure to Friends' SNS Alcohol Content. To assess whether participants had been exposed to alcohol-related content posted by friends on SNS, two binary items asked participants whether a friend had ever: 1) posted a picture of themselves with alcohol, or 2) posted a status, picture, or link about drinking alcohol. Items were combined, with endorsement of either item coded as "1" and endorsement of neither as "0," to create a binary indicator of exposure to friends' alcohol-related SNS postings.

SNS Alcohol Content Posted by Self. Five items asked whether participants themselves had ever posted alcohol-related content on a SNS (Table 4.1).

Time on Facebook. One item assed the average time that participants spent on Facebook per day rated on a 7-point scale (1=*less than 10 minutes,* 7=*4 or more hours)*.

Alcohol use Outcomes. At each wave of the larger study, participants reported whether they had ever consumed a full drink of alcohol, had ever been drunk, and had ever engaged in heavy episodic drinking (HED; defined for adolescents as consuming three or more drinks per occasion). T1 and T2 alcohol involvement were determined based on whether there was any report of a given drinking outcome at any of the intermediate assessments up to that wave. Binary variables were created for each drinking outcome indicating event occurrence or not.

Extreme Peer Orientation. The 4-item Extreme Peer Orientation Scale (Fuligni & Eccles, 1993) assessed adolescents' willingness to conform to problematic peer behavior to gain acceptance to one's peer group (e.g., "How much does the amount of time you spend with your friends keep you from doing the things you ought to do?"). A mean was taken across items assessed on a 7-point scale, with higher scores indicating greater peer orientation ($\alpha$=.75).

Parental Monitoring. The 9-item Parental Monitoring Scale (Kerr & Stattin, 2000) assessed the extent to which participants' parents/guardians monitored adolescents' daily activities (e.g., "Do your parents or guardians know what you do during your free time?"). Items were rated on a 5-point scale, from 1=*No/never (0%)* to 5=*Yes/Always (100%)*. A mean score was computed, with higher scores indicating greater parental monitoring (α=.93).

Peer Injunctive Norms. Two items from a measure of passive social influence (Wood, Read, Mitchell, & Brand, 2004) assessed perceived peer injunctive norms regarding alcohol use, with language adapted for age-appropriateness. Items were: "How do most of your close friends feel about kids your age drinking alcohol?" and "How do most of your close friends feel about kids your age getting drunk?" Response options ranged from 1=*Strongly Disapprove* to 5=*Strongly Approve.* A sum of items was taken, with higher values indicating more alcohol-favorable norms (α=.95).

Data Analytic Plan

To examine whether exposure to friends' alcohol-related SNS content predicted initiation of drinking milestones one-year later, multivariate probit regression analyses were run to predict each of the three T2 drinking outcomes. Data met all assumptions necessary for probit regression, which was utilized to ensure adequate modeling of error variances and conservative tests of hypotheses. Then, to examine injunctive norms as a mediator of the association between exposure to friends' SNS alcohol content and initiation of drinking milestones, path analyses were conducted separately for each of the three alcohol outcome variables (see Figure 4.1). Indirect effects were estimated from T1 exposure to friends' SNS posting to T2 drinking milestones via T2 injunctive norms. Robust weighted least squares estimation (in MPlus 7.0) was used to account for categorical variables and to handle missing data on T2 outcomes and/or

SNS alcohol content; sensitivity analyses using list-wise deletion did not substantively change model results. All models included relevant control variables regressed on outcomes and correlated with one another (sex, age, race, and time on Facebook).

**Results**

Descriptives

Means, frequencies, and correlations among study variables can be found in Table 4.1, with results describing participants' SNS use in Table 4.2.

Hypothesis Testing

Probit Models. Results of probit regression analyses (Table 4.3) indicated that adolescents who reported having been exposed to friends' alcohol-related SNS content at T1 were significantly more likely to have had their first drink by T2 and to have engaged in their first episode of HED by T2, above and beyond the effects of extreme peer orientation, parental monitoring, injunctive norms, and demographic factors at T1. In addition, more alcohol-favorable peer injunctive norms at T1 were associated with greater likelihood of engagement in each of the three drinking milestones by T2. Exposure to friends' alcohol-related SNS content was not associated with an increased likelihood of adolescents becoming drunk by T2.

Mediation Models. In path analyses, significant direct effects indicated that T1 exposure to friends' SNS alcohol content was associated with more alcohol-favorable T2 injunctive norms, and that more alcohol-favorable peer norms at T1 and T2 were associated with initiation of drinking behaviors at T2 (Figure 4.1). Paths from T1 exposure to friends' SNS posting to T2 initiation of becoming drunk and HED were not significant, indicating no direct effects on these drinking milestones in mediation models. Indirect effects were estimated (Table 4.4). Results indicated that peer injunctive norms were a significant mediator of the relationship between

exposure to friends' alcohol-related SNS postings and initiation of drinking, becoming drunk, and HED at T2. Indirect effects comprising a percentage of the total effects of exposure to friends' alcohol-related SNS content were 14.6% for drinking, 41.7% for becoming drunk, and 28.0% for HED.

**Discussion**

This study fills a key gap in the literature by prospectively examining adolescents' initiation of drinking behaviors following exposure to friends' alcohol-related content on SNS and testing one potential mechanism, changing peer injunctive norms, by which this may occur. Results suggest that adolescents exposed to friends' alcohol-related SNS content reported stronger alcohol-favorable peer injunctive norms and were more likely to initiate drinking. Two key findings highlight the unique role that social media may play in contributing to peer influence processes surrounding youth alcohol use initiation and progression.

First, exposure to peers' alcohol-related SNS content predicted adolescent's initiation of drinking one year later. Findings remained significant controlling for known developmental risk factors for initiation of alcohol use, suggesting that exposure to such SNS content may have an important impact on drinking behaviors among youth. SNS, where adolescents can access an immense volume of mediated content in the virtual presence of peers, may combine elements of traditional mass media and offline peer environments. As such, it may represent a synthesis of peer and media influences, both of which have critical implications for adolescents' alcohol consumption (Anderson, de Bruijn, Angus, Gordon, & Hastings, 2009; Jackson & Sartor, 2014).

Social cognitive theory suggests that adolescents' behaviors are shaped by observation and cognitive interpretations of the behaviors of peer and media models (Bandura, 2001). Two mechanisms that may account for this effect are described by the Message Interpretation Process

(MIP) model and Deviancy Training model. The MIP model of media influence (Austin & Meili, 1994) suggests that adolescents' decision-making around alcohol is influenced by positive affect induced by a media message's perceived desirability and similarity to adolescents' own experiences (Austin et al., 2006). Within SNS, where adolescents encounter alcohol references displayed by their own close friends and peers, these messages are likely seen as highly personally relevant, desirable, and realistic. Deviancy training models, drawn from the peer influence literature, suggest that adolescents reinforce one another's delinquency through positive communication about antisocial behaviors (Dishion, Spracklen, Andrews, & Patterson, 1996). Large, public SNS audiences may amplify this positive reinforcement, and associated social learning, gained by alcohol-related posting. These mechanisms represent two areas for future research to examine the interface of peer interaction and media-based influences on adolescent risk behaviors.

A second key finding is that adolescents' beliefs that peers approve of alcohol use may act as one mechanism by which exposure to friends' alcohol-related SNS content leads to initiation of drinking behaviors. The theory of planned behavior (Ajzen, 1991) suggests that subjective norms have a tangible impact on behavior, and the specific role of injunctive norms in increasing the likelihood of adolescents' alcohol use is well-documented (Elek, Miller-Day, & Hecht, 2006). SNS represents a particularly potent context for the development of such norms. Existing models suggest that social norms are developed through observation of behavior and peer communication (Miller & Prentice, 1996). On SNS, adolescents can observe the behaviors and communications of a wide range of their peers, by viewing posted photos, text, and links. However, some adolescents purposefully post positive portrayals of alcohol use, approval, and enjoyment on SNS (Beullens & Schepers, 2013; Griffiths & Casswell, 2010) in order to present a

desired identity and gain social acceptance (Nadkarni & Hofmann, 2012). Given that the SNS environment is more "disembodied" than offline environments (Subrahmanyam & Šmahel, 2011), with fewer interpersonal cues available to inform adolescents' perceptions of their peers' beliefs about alcohol, they may be more likely to misperceive (and overestimate) pro-drinking social norms (Moreno et al., 2009). Thus, powerful injunctive norms may be created via SNS and such norms may impact offline behavior.

Although this study provides a unique opportunity to prospectively examine alcohol use initiation and adolescent SNS use, several limitations should be addressed in future work. First, the study used adolescents' own reports of exposure to friends' SNS content, which may be biased due to poor recall or projection of their own drinking behavior onto peers; observational coding of SNS alcohol references has shown promise in work with college students (Beullens & Schepers, 2013; Moreno et al., 2010, 2015) and should be employed with adolescents. Second, although our measure of alcohol exposure asks about SNS use more broadly, we control only for time spent on Facebook; future work should examine whether time spent on other SNS impacts revealed associations. Third, we were unable to control for peers' actual drinking behavior in our analyses, which limits the strength of our conclusions regarding the unique impact of peers' SNS posts, versus "offline" drinking behavior, on adolescents' alcohol use.

The study's two-wave longitudinal model provides a critical improvement over previous, cross-sectional studies. However, because data on SNS use were collected at only two time points, formal examination of mediation was not possible. It is possible that initiation of drinking preceded changes in Time 2 injunctive norms or that SNS use changed considerably over the course of the study. Similarly, selection effects, a common confound in the peer influence literature whereby adolescents who are interested in experimentation with alcohol

choose to interact with drinking peers, remain a possibility. Future studies, examining short-term associations among SNS exposure, norms, and drinking behaviors across multiple time points are needed to clarify this timeline.

Our findings suggest that adolescents' perceptions of their "close friends'" beliefs about alcohol use were informed by the activity of "friends" on SNS. Prior work suggests that the majority of adolescents SNS "friends" are peers known offline (Reich, Subrahmanyam, & Espinoza, 2012). However, our measures do not capture which SNS "friends" participants were describing, and it is possible that these "friends" are older individuals or peers not known offline. Interestingly, the percentage of adolescents reporting that "friends" posted alcohol-related content (20.7%) was much greater than the percentage reporting their own posting (7.5%). Although this may indicate social desirability, it may also reflect adolescents' interpretation of "friends" to include a wider network of online peers. Future work should investigate the role of different SNS "friends" in shaping norms, and whether this differs from offline peer reference groups.

This study has several important implications. Although past studies have indicated cross-sectional associations between SNS alcohol content exposure and peer norms (Beullens & Vandenbosch, 2016), and longitudinal associations with susceptibility to alcohol use (Huang et al., 2013), this study is the first to examine *initiation* of various drinking milestones following exposure to alcohol content. Initiation of alcohol use is an important prevention target, as age of drinking onset is highly correlated with adverse outcomes. Furthermore, results may inform future intervention efforts around youth substance use. Previous work indicates the utility of "media literacy" training in teaching youth to critically evaluate media messages around alcohol (Brown & Witherspoon, 2002), and such programs may benefit from adaptation to fit the *social*

media context. Similarly, prevention programs that address peer influence and norms around substance use (Perry et al., 1996) are shown to reduce adolescent alcohol use behaviors. Such programs could explicitly address the role that SNS content plays in creating perceptions of peer norms around drinking. Finally, by examining the role of SNS in contributing risk for alcohol use, findings contribute to a growing literature (Moreno, Grant, Kacvinsky, Egan, & Fleming, 2012) indicating potential for SNS to serve as a unique platform for digital intervention efforts that explicitly target adolescents.

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TABLE 4.1.

*Means, frequencies, and bivariate correlations among study variables*

| | *M (SD)* | *%* | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. T1 Extreme Peer Orientation | 2.11 (1.07) | -- | -- | | | | | | | | |
| 2. T1 Parental Monitoring | 3.76 (0.98) | -- | -.33*** | -- | | | | | | | |
| 3. T1 Peer Injunctive Norms | 4.19 (2.06) | -- | .24*** | -.28*** | -- | | | | | | |
| 4. T2 Peer Injunctive Norms | 4.44 (2.14) | -- | .23*** | -.25*** | .47*** | -- | | | | | |
| 5. T1 Average Daily Time on Facebook | 2.56 (1.91) | -- | .05 | -.19*** | .05 | .00 | -- | | | | |
| 6. T1 Exposure to Friends' SNS Alcohol Content | -- | 20.85 | .15*** | -.11** | .26*** | .24*** | .03 | -- | | | |
| 7. T1 Self Posting of SNS Alcohol Content | -- | 7.52 | .25*** | -.25*** | .16*** | .13** | .14** | .32*** | -- | | |
| 8. T2 Initiation of Drinking | -- | 10.54 | .03 | -.02 | .07† | .14*** | -.03 | .08† | -.04 | -- | |
| 9. T2 Initiation of Becoming Drunk | -- | 7.20 | .06 | -.07* | .16*** | .24*** | -.04 | .08* | -.02 | .53*** | -- |
| 10. T2 Initiation of HED | -- | 4.88 | .07† | -.06 | .15*** | .27*** | -.02 | .13** | .01 | .41*** | .52*** |

*Note*: For associations between binary variables, phi coefficients are reported. "Initiation" refers to engaging in each drinking behavior for the first time between T1 and T2.

†$p < .07$; *$p < .05$; **$p < .01$; ***$p < .001$

TABLE 4.2.

*Rates of Adolescent Endorsement of Social Networking Site Behaviors at Time 1*

| Social Networking Site Behavior | Rate of Endorsement | |
|---|---|---|
| | *n* | % |
| *Any* Exposure to Alcohol-Related Content Posted by Friends on SNS | 122 | 20.7% |
| Friend has posted status, picture, or link about alcohol | 85 | 14.5% |
| Friend has posted pictures of themselves with alcohol | 110 | 18.7% |
| *Any* Alcohol-Related Content Posted by Self on SNS | 44 | 7.5% |
| Have posted status, picture, or link about alcohol | 38 | 6.5% |
| Have posted picture of self with alcohol | 26 | 4.4% |
| Have tagged friends in photos with alcohol | 18 | 3.1% |
| Have posted picture of self passed out or vomiting as result of alcohol | 7 | 1.2% |
| Have posted picture of friend passed out or vomiting as result of alcohol | 6 | 1.0% |

*Note*: A total of 587 participants (out of the total sample of 658) completed items related to SNS alcohol content. Percentages reported here are out of 587.
*$p < .05$; **$p < .01$; ***$p < .001$

TABLE 4.3.

*Probit Regression Analyses Predicting Adolescent Initiation of Drinking Behaviors*

| | First Drink by T2 | | First Time Drunk by T2 | | First HED by T2 | |
|---|---|---|---|---|---|---|
| | β (*SE*) | OR | β (*SE*) | OR | β (*SE*) | OR |
| Control Variables | | | | | | |
| Sex | -0.12 (0.09) | 0.67 | -0.15 (0.08) | 0.60 | -0.17 (0.10) | 0.50 |
| Race | 0.22 (0.10)* | 2.84 | 0.20 (0.09)* | 2.63 | 0.17 (0.10) | 2.36 |
| Age | 0.10 (0.09) | 1.19 | -0.01 (0.09) | 0.98 | -0.14 (0.11) | 0.78 |
| Daily Time on Facebook | -0.03 (0.10) | 0.98 | -0.12 (0.09) | 0.90 | -0.09 (0.10) | 0.92 |
| Time 1 Predictors | | | | | | |
| Exposure to Friends' SNS Alcohol Content | 0.18 (0.07)* | 2.36 | 0.08 (0.08) | 1.41 | 0.16 (0.07)* | 2.03 |
| Peer Injunctive Norms | 0.24 (0.08)** | 1.24 | 0.42 (0.09)*** | 1.45 | 0.43 (0.10)*** | 1.46 |
| Extreme Peer Orientation | -0.02 (0.08) | 0.97 | -0.03 (0.09) | 0.95 | -0.03 (0.09) | 1.01 |
| Parental Monitoring | -0.16 (0.09) | 0.74 | -0.18 (0.08)* | 0.71 | -0.15 (0.09) | 0.76 |

Note: OR = "Odds Ratio"; For Sex, female = 0 and male =1; for Race, non-white = 0 and white = 1. Odds ratios calculated by multiplying raw probit parameters by 1.7 (converting to logit parameters) and exponentiating the resulting coefficients.
*$p < .05$; **$p < .01$; ***$p < .001$;

TABLE 4.4.

*Total and Indirect Effects of Exposure to Friends' SNS Alcohol Content on Drinking Milestones*

| | Estimate | *SE* | *p-value* |
|---|---|---|---|
| T2 Initiation of Drinking | | | |
| Total Effect | 0.19 | 0.07 | .007 |
| Indirect Effect via T2 Peer Injunctive Norms | 0.03 | 0.01 | .046 |
| Percent Mediated | 14.6% | | |
| T2 Initiation of Becoming Drunk | | | |
| Total Effect | 0.08 | 0.08 | .272 |
| Indirect Effect via T2 Peer Injunctive Norms | 0.04 | 0.02 | .028 |
| Percent Mediated | 41.7% | | |
| T2 Initiation of First Heavy Episodic Drinking | | | |
| Total Effect | 0.15 | 0.07 | .017 |
| Indirect Effect via T2 Peer Injunctive Norms | 0.05 | 0.02 | .037 |
| Percent Mediated | 28.0% | | |

Note: Models were estimated using robust weighted least squares estimation. Standardized effects reported. Percent Mediated refers to the percent of the total effect that was mediated by T2 Peer Injunctive Norms

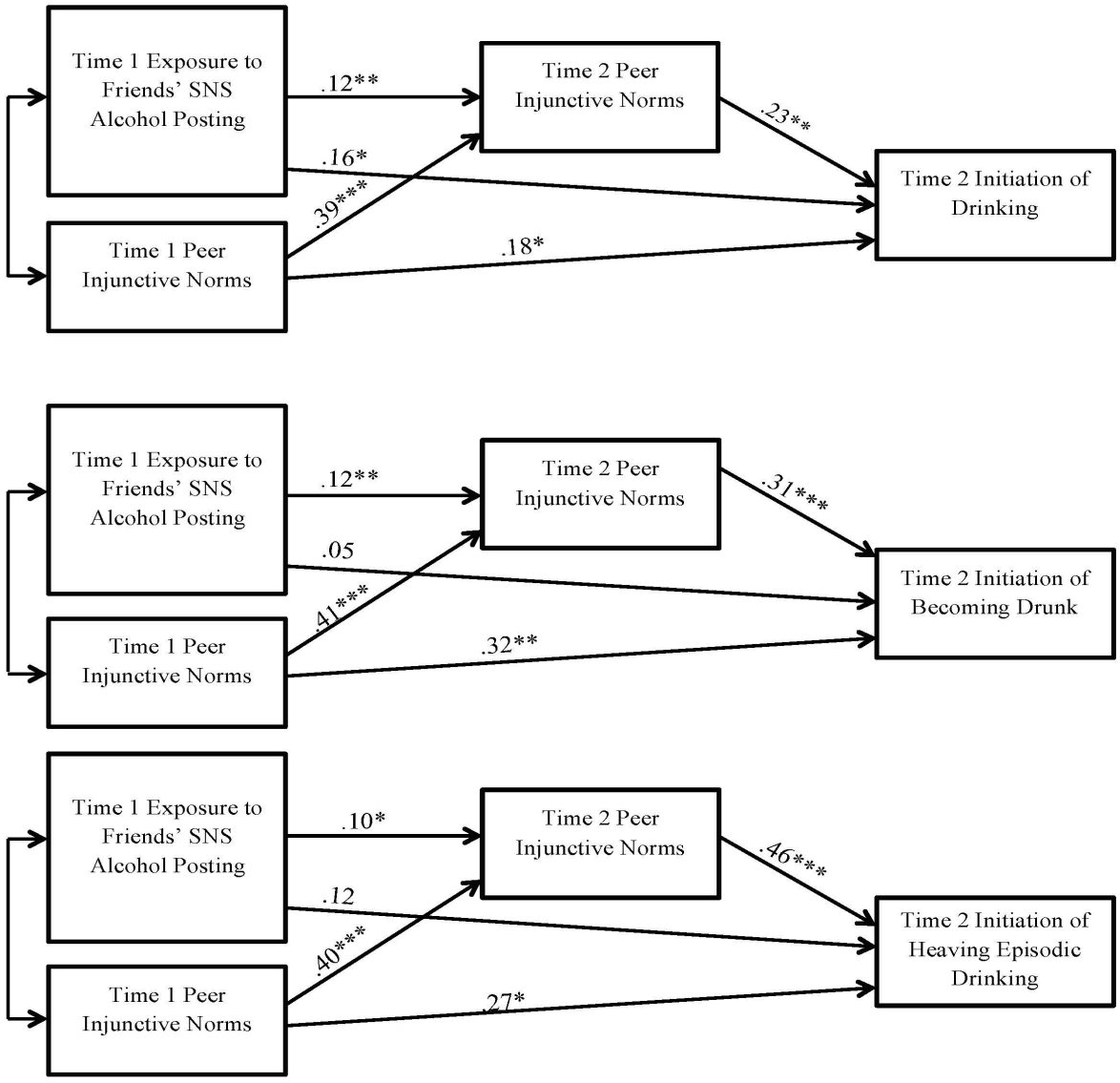



*Figure 4.1*. Path models testing mediation of pathway from exposure to friends' alcohol-related SNS posting to initiation of drinking milestones (drinking, becoming drunk, and heavy episodic drinking) by peer injunctive norms. Models also include relevant control variables (sex, age, race, and time on Facebook) regressed on drinking outcomes (not shown here). Standardized effects reported.
*$p < .05$; **$p < .01$; ***$p < .001$

## CHAPTER 5: IN SEARCH OF LIKES: LONGITUDINAL ASSOCIATIONS BETWEEN ADOLESCENTS' DIGITAL STATUS SEEKING AND HEALTH-RISK BEHAVIORS[4]

Peer status is of critical importance to adolescents. During this developmental period, young people show increased reliance on peer feedback, heightened biological sensitivity to social rewards, and motivation to secure their position in the peer hierarchy (Harter, Stocker, & Robinson, 1996; Somerville, 2013). Increasingly, adolescents' peer experiences occur within the context of social media, with up to 89% of adolescents belonging to social networking sites (Lenhart, 2015). Research has begun to examine the specific ways that adolescents use social media (e.g., Facebook, Instagram, Twitter). However, the role of social media as a powerful new context for adolescent peer status reputations has been previously overlooked. This study identifies a set of behaviors, referred to here as *digital status seeking*, which reflects attempts to obtain social media-based indicators of peer status (e.g., likes, comments), and examines whether these behaviors have implications for longitudinal health-risk behavior engagement.

Prior theoretical and empirical work has highlighted how online environments facilitate processes of reputation and impression management. The hyperpersonal model of computer-mediated communication (CMC; Walther, 2007), for example, suggests that users take advantage of CMC's technical capacities to engage in selective self-presentation. Affordances such as increased time to carefully construct or edit messages, and the ability to limit unwanted visual or

[4]This chapter previously appeared as an article in the *Journal of Clinical Child and Adolescent Psychology*. The original citation is as follows: Nesi, J. & Prinstein, M.J. (2018). In search of likes: Longitudinal associations between adolescents' digital status seeking behaviors and adjustment outcomes. *Journal of Clinical Child and Adolescent Psychology*. doi: 10.1080/15374416.2018.1437733

verbal cues, allow individuals to optimize personal impressions given off to others. Within newer social media environments, other technical affordances may increasingly highlight social reputation and encourage new kinds of status seeking behaviors. For example, content can be posted publicly, creating an audience for whom interactions can be performed, and can be accessed at any time of day (boyd, 2010). Social media environments also typically contain built-in mechanisms for quantifiable peer feedback and measurable engagement, such as likes, views, comments, retweets, and number of followers (Chua & Chang, 2016). Prior work suggests that these mechanisms may serve as markers of status within the offline peer group, as 98% of adolescents report being connected on social media to individuals they know from school (Madden et al., 2013). Within this environment of both heightened capacity for impression management and increased salience of peer feedback, adolescents may go to great lengths to increase perceptions of online popularity, such as by filtering or untagging photos (Dhir, Kaur, Lonka, & Nieminen, 2016; Underwood & Faris, 2015).

This study builds on this prior work by introducing the construct of *digital status seeking*, or the investment of effort into accumulating indicators of online status, such as likes, comments, and activity on one's posts, assessed using a multi-informant, multi-method design. Digital status seeking was assessed using a peer-reported sociometric measure, in which adolescents nominated peers whom they perceive to exert high levels of effort in soliciting online indicators of status (e.g., likes). As preliminary evidence of the construct validity of this new measure, associations were examined with theoretically related self-reported constructs, including desire to be popular among peers, time spent on social media, valuing obtaining likes and followers, and use of specific strategies to obtain status indicators (e.g., posting photos at times of day when they are likely to receive more likes). In addition, supplementary analyses provided a rare

opportunity to examine observational measures from adolescents' own social media profiles, through coding the Instagram pages of a subsample of participants. Instagram was examined due to the high potential for status seeking behavior on this platform, which is photo-based, highly visual, and centered on peer feedback in the form of "likes." Prior qualitative work suggests that adolescents may post photos with friends publically in order to prove high levels of social connection (Manago, Graham, Greenfield, & Salimkhan, 2008), and that publicly posted selfies, or photos of the self alone, may serve to elicit positive comments and curate a personal image (Katz & Crocker, 2015). Thus, concurrent validity of digital status seeking also was assessed through associations between digital status seeking and the number of photos participants posted with their same-aged peers, as well as the number of selfies posted. Associations also were examined between digital status seeking and hypothesized indicators of status on social media: average numbers of likes and "follow ratio," or the ratio of followers to following.

A second aim of this study was to offer a preliminary examination of associations between digital status seeking and adjustment outcomes. The prototype willingness model (Gibbons, Gerrard, & Lane, 2003) suggests that adolescents are likely to engage in risky behaviors to emulate the type of person, or prototype, presumed to engage in those behaviors. Research suggests that adolescents associate risky behaviors with popular peer prototypes (Gibbons et al., 2003)—perhaps accurately so, given that higher peer popularity may serve as a risk factor for substance use and sexual risk behavior (Choukas-Bradley, Giletta, Neblett, & Prinstein, 2015; Mayeux, Sandstrom, & Cilessen, 2008). Thus, adolescents who desire to be more similar to their popular peers—as digital status seekers likely do—may be more likely to engage in these behaviors.

Indeed, research examining offline processes suggests that adolescents who are more oriented toward or invested in their peer status are at greater risk for a host of negative behaviors, including deviance and rule-breaking, substance use, and sexual risk behavior (Allen, Porter, & McFarland, 2006; Fuligni, Eccles, Barber, & Clements, 2001; Prinstein, Brechwald, & Cohen, 2011). Despite these initial findings, remarkably little research has directly examined status seeking, or attempts to increase one's popularity, offline. This may be because such behaviors are simply less deliberate, transparent, or easy to identify outside the social media context, which emphasizes quantifiable status metrics and public postings. Indeed, prior theoretical work suggests that while adolescents construct their digital environments to address the same developmental issues they face offline, online interactions are also shaped by the unique affordances of the digital world (Subrahmanyam, Smahel, & Greenfield, 2006; Underwood & Ehrenreich, 2017). Thus, although offline and online processes may be distinct in certain ways, hypotheses are informed by this limited available theoretical and empirical evidence. As digital status seeking may reflect heightened desire to appear popular to others, it was expected that digital status seekers would be uniquely at risk for engagement in health-risk behaviors that match the prototype of their popular peers. Specifically, it was hypothesized that digital status seeking behaviors would be associated longitudinally with substance use and sexual risk behavior, over and above the effects of adolescents' *actual* offline peer-rated popularity.

Notably, gender, race, and socioeconomic status (SES) were examined as moderators of effects, given prior research indicating that these demographic groups may differ in their technology use, rates of health-risk behavior engagement, and associations between social status and health-risk behaviors. In particular, girls are more likely than boys to use visually-oriented social media platforms like Instagram and Snapchat (Lenhart, 2015). In addition, smartphone

ownership is higher among higher-SES and African American teenagers, and African American teens are more likely to use Instagram (Lenhart, 2015). Gender differences also have been shown in associations between social status and health-risk behaviors, with boys' engagement in risky behaviors often more highly valued in the peer context (Kreager & Staff, 2009). Furthermore, prior research has found elevated rates of substance use among higher-SES adolescents (Luthar & D'Avanzo, 1999), as well as greater associations between substance use and peer popularity among boys from affluent, suburban neighborhoods (Becker & Luthar, 2007; Luthar & D'Avanzo, 1999). Finally, associations between substance use and popularity may be stronger among Caucasian and Latino adolescents (Choukas-Bradley, Giletta, Neblett, & Prinstein, 2015).

**Methods**

Participants

This study included 716 participants (ages 15 to 18 at Time 1; $M_{age}$ = 16.01) recruited from three, rural, lower-middle class schools in the southeastern United States, assessed at two time points, one year apart. Participants self-reported their gender identity (54.2% female) and ethnicity (46.5% White/Caucasian, 20.4% African American/Black, 24.9% Hispanic/Latino, 8.2% other ethnicities). This study was part of a larger study examining adolescent peer relationships and health-risk behaviors. For the larger study, all seventh and eighth grade students in the school district were recruited ($n$=1,463). Out of 1,205 families (82.4% who returned consent forms), 900 of them (74.7%; 61.5% of total population) consented to participation. Measures for the current study were available only at the fourth (Time 1) and fifth (Time 2) waves of data collection. Of the 900 students who originally consented to participate, a total of 79.6% ($n$=716) participated at Time 1, and of these, 88.0% ($n$=630) were retained at

Time 2. Participants who did not complete Time 2 measures reported higher levels of Time 1 substance use, $t(711)=2.05$, $p=.041$.

Procedure

A total of 716 participants participated at Time 1. All self-report and sociometric measures were administered on computers in classrooms during the school day. Measures were collected during a two-week period in March of 2015. Participants were compensated with $10 gift cards. Observationally-coded measures of social media use were available for a subset of participants. To collect these measures, information regarding participants' Instagram accounts (i.e., user names) was solicited from participants over the course of one year, beginning at the Time 1 data collection period (March 2015) and finishing at the Time 2 data collection period (March 2016). Over the course of this year, a total of 287 participants provided a valid user name and consented to be followed by an account created for the purposes of the study; 251 of these 287 participants also provided self-report data at Time 2. A total of 560 participants reported having Instagram accounts at Time 1, and thus these 287 participants represent 51.3% of Instagram users in the sample at Time 1. Compared to the remaining 273 participants, the 287 who provided access to their Instagram profiles were more likely to endorse the importance of online status indicators, $t(554) = -2.03$, $p = 0.43$, and to report greater desire to be popular, $t(555) = -1.97$, $p = 0.05$. Those who provided access to their Instagram profiles were also more likely to be white, $\chi^2(3) = 27.99$, $p < .001$, and female $\chi^2(1) = 4.53$, $p = .03$. They did not differ on any other demographic or other study variables.

Measures

Digital status seeking. Sociometric procedures (Coie, Dodge, & Coppotelli, 1982) were used to obtain a measure of adolescents' digital status seeking behavior, based on the perceptions

of their peers. All participants were presented with an alphabetized roster of their grademates and asked to nominate an unlimited number of grademates in response to the question, "Who tries hard to get more activity (i.e., likes, comments, etc.) on their social media profiles (e.g., Facebook, Twitter, Instagram)?" A sum of nominations was calculated for each participant. These sums were then standardized within each school grade, yielding a global index of the level of effort each adolescent was perceived to invest in accumulating online indicators of status. The range of nominations participants received was between zero and 25, and 75.5% of the sample received at least one nomination.

Peer Status. Standard sociometric procedures also were used to measure adolescents' peer-perceived popularity at Time 1. Participants were given two separate rosters of their grademates and selected those whom they believed to be "most popular" and "least popular." After summing and standardizing nominations for each participant, a difference score was taken between most and least popular standardized scores. These difference scores were re-standardized to create a reputation-based measure of popularity, with higher scores indicating higher levels of status.

Socioeconomic Status. An estimate of students' SES was obtained through calculating the mean household income for each student's home address using US Census tract data. Values were divided by 10,000 to obtain values ranging from 1.26 to 8.91.

Validity Measures.

All validity measures were assessed at Time 1, with mean scores calculated for all variables with multiple items.

Frequency of social media use. A single item assessed participant's average daily frequencies of social media use on a 7-point scale (0 for I don't use this, 6 for 5 or more hours).

"Social media" was defined as "any website/app that involves social interaction, i.e. texting, Facebook, Instagram, Tumblr, Snapchat."

Importance of online status indicators. Two items assessed the importance that participants ascribe to receiving status indicators, such as likes, comments, and followers, on social media, on a 5-point scale (1 for *Not at all true,* 5 for *Extremely true*). Items were: 1) "I think it's important to have a lot of followers or friends on social media," and 2) "I think it's important to have people 'like' or comment on the things I post" ($\alpha = .83$).

Online status seeking strategy use. Two items assessed participants' use of strategies to manage their online presence and accumulate online status indicators, on a 5-point scale (1 for Not at all true, 5 for Extremely true). Items were: 1) "I purposefully post on social media during 'high traffic' times (i.e. times that I know most people will see it) so that my posts/photos get more likes and comments," and 2) "If something I post does not get a lot of likes or comments, I might take it down" ($\alpha = .80$).

Peer Importance. The four-item peer importance scale measured adolescents' desire to attain acceptance and popularity among peers (Prinstein & Aikins, 2004; $\alpha = .86$). Participants rated items on a 5-point scale (1 for *Not at all true*, 5 for *Very true)*. The original scale includes five items, with three reverse-coded items. For the current sample, only one item was worded conversely, and this item was dropped due to low factor loading.

Supplemental observationally-coded measures

An observational coding system was developed to assess measures of interest on participants' Instagram pages, using procedures for coding social networking sites outlined by Moreno, Egan, and Brockman (2011). Training of coders took place over a period of six weeks, followed by weekly meetings for continued training and discussion of coding decisions.

Ongoing reliability between coders was established through double coding 44 randomly selected participants (15% of the sample; 263 photos total). In the event of discrepancies between coders, decisions were made by the coding coordinator (lead author of this study). A total of 287 participants' Instagram profiles were coded. Photos selected for coding reflected the three month time period during which all baseline data were collected, February through March of 2015. A total of 233 participants (81.2% of the 287) posted at least one photo during this period, with 2,673 photos coded across all participants.

Observational Measures of Online Status Seeking. Two observational measures assessed potential online status seeking behaviors, based on prior research and information from focus groups with recent high school graduates. These included photos posted with peers, in which both the participant and same-age peers were depicted, and selfies, or photos of the participant alone. For each photo posted by a participant during the three-month coding period, coders indicated whether 1) the participant was in the photo ($\kappa = .97$), 2) whether any of the participants' same-age peers were in the photo or tagged in the photo ($\kappa = .95$), and 3) whether the participant was alone in the photo ($\kappa = .95$). Photos that contained both the participant and peers were considered photos with peers. Photos that contained the participant alone were considered selfies. Sums of the number of photos with peers and number of selfies posted during the three-month coding period were taken. In addition, proportions of the number of photos with peers and selfies to the total number of photos posted during the three-month period were taken. Note that two participants posted selfies with unusual frequency (i.e., 5.44 and 10.15 standard deviations above the mean). A winsorising approach was used, with these values set equal to the next closest value.

Observational Measures of Status. Two observational measures assessed actual online status indicators: participants' number of likes and follow ratio. Number of likes was assessed by taking a mean across likes received on all photos posted during the three-month coding period. Users' follow ratios were also assessed as a measure of status, with the number of followers (those whom users have granted permission to view their profile) divided by the number following (those whom users have received permission to view).

Health-Risk Behavior Measures

Health-risk behaviors were assessed at Times 1 and 2.

Substance use. Four substance use outcomes were assessed using items adapted from the Youth Risk Behavior Surveillance System (CDC, 2004). Two items assessed alcohol use, and were rated on a five-point Likert scale (1 for *0 days,* 5 for *10 or more days)*. Participants reported on the frequencies that they had "at least one drink of alcohol" and five or more alcohol drinks within a few hours. One item assessed the number of cigarettes participants smoked per day in the past year, (1 for *0 cigarettes,* 6 for *More than a pack per day*). One item assessed the number of times participants used "marijuana (weed/pot)" in the past year, (1 for *0 time*s, 5 for *10 or more times*). In order to create a composite substance use score, responses to each substance use item were standardized, and a mean of these scores was taken (Time 1 $\alpha = .77$; Time 2 $\alpha = .78$).

Number of sex partners. Based on expected ranges of sexual risk behaviors in a high school sample (i.e., CDC, 2004), participants were asked to report on the number of people with whom they had sex in the previous year, ranging from *0 people* (coded as 1) to *5 or more people* (coded as 5). "Sex" was defined for participants as "sexual intercourse."

Analysis Plan

First, in order to examine the construct validity of digital status seeking, Pearson correlations were conducted between digital status seeking and measures of popularity and status seeking. Second, in order to examine longitudinal associations between digital status and health-risk behaviors, analyses were conducted using path analyses in MPlus 7.0 (Muthén & Muthén, 1998-2016), with full information maximum likelihood estimation used to handle missing data. Given that the relationships among digital status seeking, popularity, and health-risk behavior outcomes were expected to differ by gender, a multiple group path analysis approach was used. A path model was examined with digital status seeking, Time 1 health-risk behaviors (substance use and number of sexual partners), and popularity entered as exogenous variables. Exogenous variables also included race and SES, as well as the interaction term of digital status seeking and SES. Interactions between digital status seeking and race were tested but did not significantly predict risk outcomes, and thus were excluded. Endogenous variables were the Time 2 health-risk behavior outcomes (see Figure 5.1). An initial path model was run with all paths constrained to equality across groups (i.e., fully constrained model). Paths were then systematically freed to vary across genders, with significant improvements in model fit indicating that these paths were moderated by gender (Bollen & Curran, 2006).

**Results**

Descriptive Statistics and Construct Validity

Descriptive statistics were conducted to examine the means and standard deviations, as well as mean-level gender differences, of all study variables (see Table 5.1). For digital status seeking, independent sample t-tests revealed that girls were significantly more likely to be nominated as digital status seekers compared to boys. In addition, levels of digital status seeking

differed significantly by race, $F(713) = 8.67$, $p<.001$, with White students showing the highest levels of digital status seeking ($M=0.30$, $SD=1.30$), followed by African American ($M=0.11$, $SD=0.83$) and Hispanic students ($M=-0.20$, $SD=0.69$); however, only the difference between White and Hispanic students remained after controlling for socioeconomic status. In addition, the construct validity of digital status seeking was examined through bivariate associations with self-reported, peer-reported, and observationally-coded variables. See Table 5.2 for a summary of these associations.

Longitudinal Associations between Digital Status Seeking and Health-Risk Behaviors

Fit of the fully constrained model was moderate, $\chi^2(18)=44.00$, $p<.001$; CFI=.97, TLI=0.93; RMSEA=0.06; SRMR=0.03. Paths were systematically freed to vary across gender groups, with models tested for significant improvements in fit. Model fit improved significantly by freeing the paths from popularity to substance use, $\Delta\chi^2(1)=6.20$, $p=.01$, and number of sexual partners, $\Delta\chi^2(1)=11.61$, $p<.001$, thus indicating that these paths are moderated by gender. Freeing paths to the two health-risk behavior outcomes from each of digital status seeing, race, SES, and the interaction term did not improve model fit, indicating that these paths should remain constrained to equality across groups. Final model fit was good, $\chi^2(16)=26.18$, $p=.052$; CFI=.99, TLI=0.97; RMSEA=0.04; SRMR=0.02. In order to ensure that results were not affected by non-normality of any study variables, the model was then re-run using robust maximum likelihood estimation, which provides standard errors that are robust to non-normality of observations (Finney & DiStefano, 2006). The pattern of significant and non-significant results remained the same using this estimator. Notably, the path from the interaction term to substance use was marginally significant ($p=.056$). Probing this interaction revealed that the

association between digital status seeking and substance use was *not* significant for adolescents higher in SES (i.e., values greater than 4.46, or .22 standard deviations above the mean).

**Discussion**

As the adolescent social hierarchy increasingly plays out on social media, it is critical to identify specific online behaviors that may contribute to adolescent adjustment. This study introduces one such set of behaviors through the construct of digital status seeking, or the investment of effort into the accumulation of social media-based status indicators, such as likes, comments, and activity on one's posts. Results suggest that digital status seeking is an important new construct that may be longitudinally associated with higher levels of engagement in health-risk behaviors, including substance use and sexual risk behavior.

Strengths and Limitations

This study represents the first investigation of digital status seeking, and thus further work will be needed to replicate and expand on findings. It offers a novel, multi-method investigation of this new construct and draws from a large sample of lower middle class, rural youth—a population often neglected in prior work on adolescent social media behavior. However, the study is unable to examine whether digital status seeking behaviors, which are aimed at gaining attention and visibility *online,* reflect efforts to obtain peer status that carry over offline. It is possible that the analyzed behaviors are specific to obtaining online notoriety, rather than popularity more broadly.

The study is one of the first to apply sociometric procedures to the study of social media behavior, and in combination with observationally-coded measures, provides a critical improvement over traditional self-report measures. However, future work should aim to develop sociometric procedures that better capture students' online networks beyond their classmates, as

well as frequencies of digital status seeking. Observational measures of status (follow ratio, likes) and status seeking (photos with peers, selfies), though innovative, were based on qualitative research and theory, rather than empirically-validated measures. In addition, this approach yielded only a small subsample for coding ($n$ = 287). Future work should examine a larger sample to limit selection bias and should control for psychological and behavioral processes for which digital status seeking may serve as a proxy—such as narcissism, low self-esteem, or tendency toward *offline* status seeking behavior. Finally, future coding systems should incorporate more online platforms, specify *who* adolescents engaged with online, and examine other potential markers of status seeking (e.g., public versus private posts, responding to others' comments on posts).

Despite its limitations, this study provides preliminary evidence for the validity of the digital status seeking construct. Adolescents who were perceived by their peers to be digital status seekers reported using social media more frequently, having greater belief in the importance of online status indicators (e.g., likes and followers) and desire to be popular among their peers, and using strategies to obtain such status indicators. In addition, digital status seeking was associated with observationally-coded measures hypothesized to indicate online status seeking: selfies and photos with peers.

Associations Between Digital Status Seeking and Health-Risk Behaviors

In addition to providing initial evidence for the validity of this new construct, this study suggests that digital status seeking may have implications for adolescents' engagement in health-risk behaviors. Digital status seeking was longitudinally associated with substance use and number of sexual partners, independent of the effects of offline social status. Although findings are preliminary, digital status seeking may be reflective of adolescents' need or desire for

popularity, with digital status seekers placing greater value on peer perceptions of their social status. In line with the prototype willingness model (Gibbons et al., 2003), digital status seekers may thus be uniquely at risk for engagement in risky offline behaviors that match the prototype of their popular peers in an effort to increase their status. Social media may provide a powerful new context for heightened awareness of the peer status hierarchy and the behaviors sanctioned within it. This same context may create possibilities for status seeking behaviors that appear more obvious or attention-seeking to adolescents' peers, potentially contributing to social difficulties and, ironically, further need for peer approval.

Findings also offer a preliminary investigation of individual and cultural factors that may be relevant to digital status seeking and its association with health-risk behaviors. Girls, White students, and adolescents of higher SES were more likely to be nominated as digital status seekers; however, no gender or racial/ethnic differences in associations between digital status seeking and health-risk behaviors were revealed. The effect of SES as a moderator of associations between digital status seeking and substance use was only marginally significant. Given prior research reflecting the diverse social implications of substance use among various demographic groups (e.g., Luthar & D'Avanzo, 1999), future work will be needed to disentangle differential effects by gender, race, SES, and geographic environment. Furthermore, future work should examine developmental differences in digital status seeking and associated outcomes. Although this study focuses primarily on older adolescents (ages 15-17), digital status seeking may have greater relevance to younger adolescents, among whom peer hierarchies and social identity are still developing, and less relevance among adults.

Conclusions

This study captures a set of online behaviors, digital status seeking, that may be common and readily identified by adolescents, yet has not been previously examined. Findings are preliminary, but contribute to a growing body of literature highlighting areas of practical application within clinical and school-based settings. For example, clinical care may be strengthened by thoroughly assessing adolescents' social media use, and in particular the various functions of that use (i.e., to communicate with close friends versus to increase one's appearance of social status). Furthermore, educational efforts targeting adolescents can acknowledge the heightened focus on status that may develop in the social media context, and work with youth to develop strategies for effectively navigating this new environment. Results of this study suggest that digital status seeking has implications for adolescent adjustment, and highlight the need for ongoing investigation into adolescents' social media use.

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TABLE 5.1
*Means and standard deviations of study variables with gender comparisons*

| | Full Sample | Girls | Boys | |
|---|---|---|---|---|
| | *M (SD)* | *M (SD)* | *M (SD)* | *t (df)* |
| Digital Status Seeking | 0.14 (1.10) | 0.36 (1.25) | -0.13 (0.84) | 6.35 (677.12)** |
| Peer-Perceived Popularity | 0.01 (0.99) | 0.02 (0.96) | -0.01 (1.02) | 0.32 (712) |
| Socioeconomic Status | 4.11 (1.57) | 4.00 (1.57) | 4.25 (1.57) | -2.07 (691)* |
| Validity Measures | | | | |
| Frequency of Social Media Use | 3.54 (2.14) | 4.19 (2.01) | 2.78 (2.05) | 9.17 (703)** |
| Importance of Online Status Indicators | 1.64 (0.91) | 1.71 (0.97) | 1.55 (0.82) | 2.43 (702.93)* |
| Online Status Seeking Strategy Use | 1.82 (1.11) | 1.96 (1.17) | 1.65 (1.01) | 3.74 (703.81)** |
| Peer Importance | 1.69 (0.83) | 1.64 (0.82) | 1.76 (0.83) | -1.96 (708)* |
| Health-Risk Behaviors | | | | |
| Time 1 Substance Use | 0.00 (0.78) | 0.01 (0.73) | -0.01 (0.82) | 0.36 (711) |
| Time 1 Number of Sex Partners | 1.63 (1.09) | 1.57 (0.92) | 1.70 (1.26) | -1.54 (567.58) |
| Time 2 Substance Use | -0.00 (0.78) | 0.00 (0.72) | -0.01 (0.84) | 0.18 (574.96) |
| Time 2 Number of Sex Partners | 1.86 (1.25) | 1.81 (1.13) | 1.93 (1.38) | -1.20 (561.85) |
| Observationally-Coded Measures of Online Status and Status Seeking | | | | |
| Photos with peers | 2.65 (4.56) | 3.13 (5.28) | 1.79 (2.69) | 2.58 (229.10)* |
| Likes (mean) | 90.75 (88.00) | 88.03 (66.35) | 95.56 (117.31) | -0.63 (231) |
| Follow Ratio | 1.19 (0.77) | 1.20 (0.73) | 1.19 (0.83) | 0.10 (285) |
| Selfies | 3.47 (5.18) | 4.16 (5.65) | 2.24 (3.96) | 3.04 (220.14)* |

*$p < .05$; **$p < .001$

*Note*: Socioeconomic status was calculated by obtaining mean household income from US Census data and dividing values by 10,000.

TABLE 5.2
*Bivariate associations among study variables*

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Digital Status Seeking | -- | | | | | | | | | | | | | | | |
| 2. Peer-Perceived Popularity | .51** | -- | | | | | | | | | | | | | | |
| 3. Socioeconomic Status | .17** | .13** | -- | | | | | | | | | | | | | |
| Validity Measures | | | | | | | | | | | | | | | | |
| 4. Frequency of Social Media Use | .19** | .14** | -.08* | -- | | | | | | | | | | | | |
| 5. Imp. of Online Status Indicators | .17** | .17** | .05 | .23** | -- | | | | | | | | | | | |
| 6. Online Status Seeking Strategy Use | .19** | .22** | .02 | .28** | .76** | -- | | | | | | | | | | |
| 7. Peer Importance | .10* | .10* | .10* | .06 | .43** | .37** | -- | | | | | | | | | |
| Health-Risk Behaviors | | | | | | | | | | | | | | | | |
| 8. T1 Substance Use | .18** | .12* | .04 | .12* | .13* | .12* | .14** | -- | | | | | | | | |
| 9. T1 Number of Sex Partners | .18** | .12* | .03 | .06 | .08* | .12* | .07† | .48** | -- | | | | | | | |
| 10. T2 Substance Use | .26** | .25** | .09* | .15** | .19** | .15** | .14** | .71** | .42** | -- | | | | | | |
| 11. T2 Number of Sex Partners | .22** | .19** | .03 | .16** | .11* | .09* | .03 | .40** | .49** | .56** | -- | | | | | |
| Observationally-Coded Measures | | | | | | | | | | | | | | | | |
| 12. Likes (mean) | .34** | .38** | .15* | .05 | .07 | .06 | .02 | -.02 | .00 | -.06 | .06 | -- | | | | |
| 13. Follow Ratio | .21** | .29** | .04 | -.02 | .00 | .01 | .01 | .07 | .09 | -.01 | .12† | .56** | -- | | | |
| 14. Photos with Peers (sum) | .20* | .24** | .12 | -.03 | .04 | .06 | .06 | .00 | -.07 | .07 | .01 | .05 | .09 | -- | | |
| 15. Photos with Peers (proportion) | .13* | .29** | .20** | -.10 | .17* | .20* | .11 | -.06 | -.10 | .05 | -.07 | .14* | .22* | .42** | -- | |
| 16. Selfies (sum) | .14* | -.06 | -.08 | .14* | -.08 | -.09 | -.13* | .11† | .05 | .06 | .03 | -.08 | -.11 | .35** | -.19* | -- |
| 17. Selfies (proportion) | .01 | -.10 | -.26** | .05 | -.04 | -.02 | -.11 | -.03 | .09 | -.11 | .03 | .16* | .00 | -.23** | -.44** | .23** |

†$p$<.10; *$p$<.05; **$p$<.001.
*Note:* Imp.= Importance. For observationally-coded measures, follow ratio refers to the ratio of number of users participants follow to number they are followed by. Sum = total number of photos posted in a given category during 3-month coding period, which ranged from 0 to 166. Proportion = proportion of photos posted in a given category out of total photos posted. Correlations with follow ratio were calculated using all participants with observational data ($n$ = 287). Correlations with remaining observational measures were calculated using only participants who had posted at least one photo ($n$ = 233).

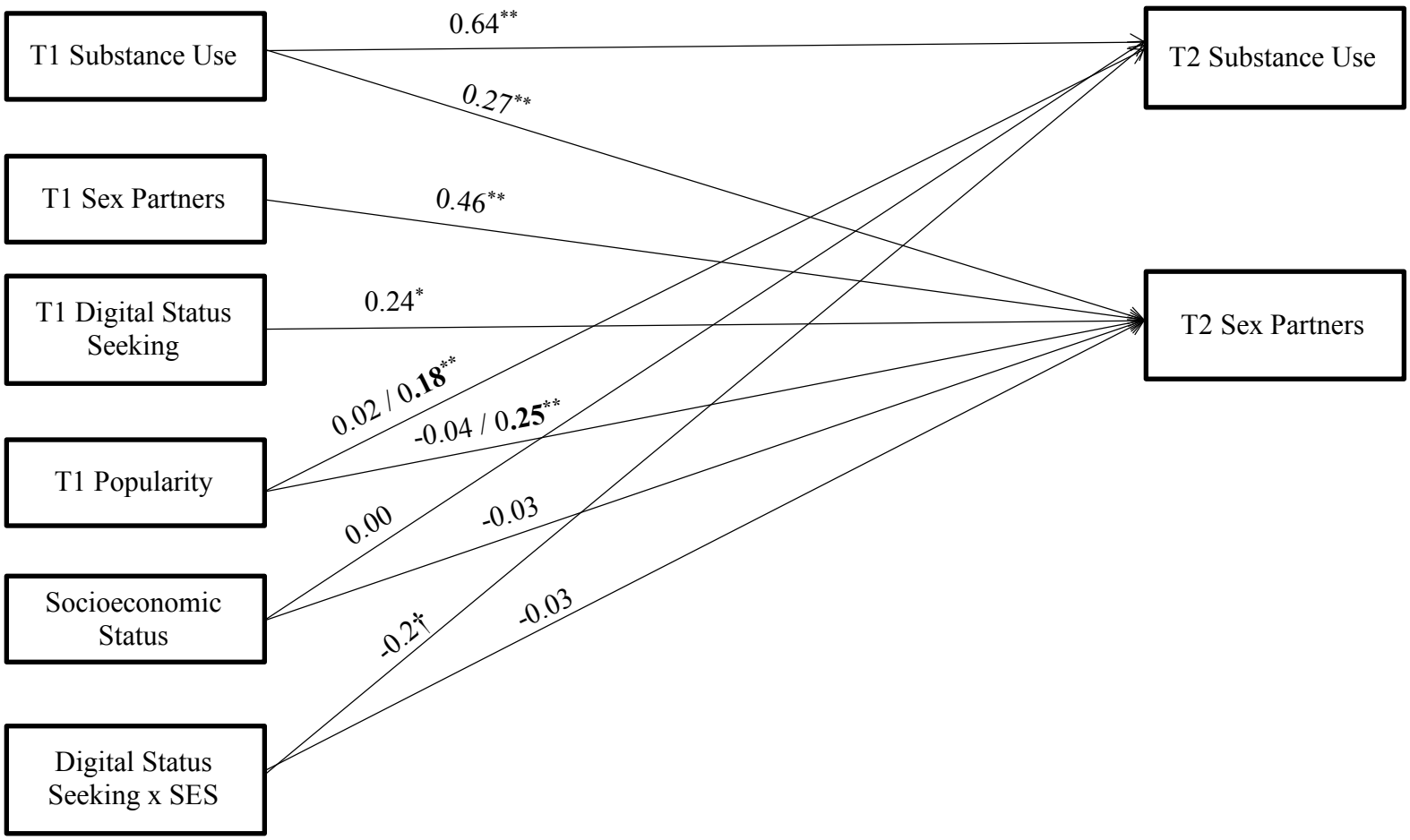



*Figure 5.1*. Final multiple group path model predicting Time 2 health-risk behavior outcomes from Time 1 digital status seeking, controlling for Time 1 peer status. For paths moderated by gender, coefficients for boys are presented in bold. Note that all models also controlled for race. Correlations between error terms for Time 2 variables not shown. Standard errors for effects of Time 1 digital status seeking on Time 2 substance use and number of sexual partners were .06 and .12, respectively. Of the 716 participants at Time 1, 49 reported that they did not use social media and 6 did not answer any survey questions related to social media. These participants were retained in analyses, with participants who do not use *any* social media considered to represent the lowest levels of the construct of digital status seeking. Analyses were also re-conducted with these participants excluded, and patterns of significant and non-significant results remained the same. *$p < .05$; **$p < .001$

# CHAPTER 6: ADOLESCENT SOCIAL MEDIA USE: CONCLUSIONS AND FUTURE DIRECTIONS

The current studies reflect a crucial shift in the conceptualization of associations between adolescent social media use and psychosocial adjustment. Contributing to a growing body of research that moves beyond the examination of mere frequencies of use, these studies highlight the importance of considering the *how, who,* and *when* of adolescent social media use. Specifically, findings aim to identify *how* adolescents are using social media, or the specific behaviors in which they are engaging online, *who* adolescents are before logging in, or the individual characteristics that may impact online behavior and adjustment, and *when* adolescents are using social media in the context of this developmental period. Within this broad framework, results offer unique insights into the role of social media in adolescent adjustment and illuminate critical future directions in this emerging field of study.

First, findings illustrate the ways in which the features of the social media environment (McFarland & Ployhart, 2015; Valkenburg & Peter, 2011) allow for a variety of online behaviors with implications for adolescents' adjustment. Studies draw on varied theoretical perspectives, such as computer-mediated communication theories (Walther, 2011), interpersonal models of psychopathology, and social cognitive theory (Bandura, 2001), to identify a range of behaviors with implications for adolescents' health risk behaviors, depressive symptoms, and social functioning. These behaviors include engagement in online social comparison and feedback-seeking, viewing friends' alcohol-related content on social networking sites, communicating with romantic partners via technology at the expense of in-person communication, and investing

significant effort into the accumulation of online indicators of status (i.e., "likes," "followers"). Notably, findings across studies do not support the idea that frequencies of social media use contribute to negative outcomes. Rather, they highlight the utility of examining the specific ways in which adolescents use social media.

As such, findings regarding *how* adolescents are using social media elucidate two critical areas for future study. First, the current work suggests that adolescents' social media behaviors vary significantly in form—from actively seeking out status indicators to passively viewing friends' posted content, and from broadly communicating with peers to specifically engaging with risk-related content. Furthermore, it suggests that these myriad uses of social media impact a variety of adjustment outcomes. Given this broad array of uses and implications, future work will benefit from continuing to identify other theoretically relevant social media behaviors.

Second, and perhaps more importantly, future work should aim to uncover the *unique* role that social media plays in relation to adjustment outcomes. The current studies suggest that social media-based behaviors have important implications for adolescent functioning. In addition, this work proposes that the unique features of the social media environment—including its greater anonymity, lack of interpersonal cues, accessibility at any location and time, potential for highly public and permanent communication, and opportunities for "quantified" peer feedback—create the possibility for fundamentally new and different behaviors. However, this assertion remains ripe for empirical investigation. Specifically, the current research, and research within this field more generally, does not yet clearly support the conclusion that social media behaviors exert a unique influence on adjustment, *above and beyond* similar offline behaviors. Questions remain regarding to what extent social media behaviors are replacing versus simply supplementing offline activities, as well as whether social media encourages new

behaviors that might not previously have taken place offline. Future work will benefit from approaching these questions with a high degree of specificity and precision. In order to determine whether social media behaviors exert an incremental effect on outcomes, it will be important to identify, measure, and control for offline behaviors that are theoretically similar to those social media behaviors of interest. In addition, as in any new field of study, descriptive research will be invaluable to capturing adolescents' subjective experiences of the differences between online and offline behaviors (Shanahan, Erickson, & Bauer, 2005).

In addition to uncovering *how* adolescents are using social media, the current studies examine individual differences among adolescents that may contribute to different uses of social media and moderate associations between social media use and outcomes. For example, one study suggests that adolescents with pre-existing depressive symptoms were more likely to use social media to seek feedback from and compare themselves to their peers. Another study indicates that adolescents reporting a higher desire for popularity were more likely to use social media for status seeking behaviors. However, the most consistent moderator of associations between social media behaviors and adjustment found across studies was adolescents' gender. Results suggest that boys, compared to girls, were more likely to longitudinally report lower levels of interpersonal competencies following higher proportions of technology based versus in-person communication with romantic partners. In addition, boys, but not girls, with higher levels of depressive symptoms were longitudinally more likely to engage in technology-based social comparison and feedback-seeking behaviors. Finally, whereas all girls showed associations between digital status seeking and substance use, only those boys who were less well-liked by peers exhibited this association. No gender differences were found in associations between exposure to alcohol-related social media content and alcohol use initiation. Interestingly,

overall, girls showed higher levels of many technology-based behaviors compared to boys, including social comparison and feedback-seeking, digital status seeking, and general frequency of use.

Taken together, these findings suggest a complex relationship between gender and social media use. Findings from prior literature have been similarly inconclusive. While certain studies suggest that adolescent boys may be at greater risk for problematic Internet use compared to girls (Jelenchick, Hawk, & Moreno, 2016), others suggest that girls may be more likely to engage in problematic online behaviors, such as comparing themselves to others (Nesi & Prinstein, 2015) and "sexting" (Mitchell, Finkelhor, Jones, & Wolak, 2012). Prior work indicates that girls are more frequent users of social media in general, and are more likely to use visually oriented platforms (i.e., Instagram, Facebook), whereas boys are more likely to use online gaming platforms (Lenhart, 2015). However, social media, and gender norms regarding its use, continue to shift rapidly over time, making it difficult to draw any definitive conclusions regarding gender differences in frequencies or motivations for online behaviors (Herring & Kapidzic, 2015). Furthermore, very little research has examined gender differences in associations between online behaviors and adjustment outcomes.

The current findings add to the scarce literature on this topic, and drive several tentative hypotheses that should be tested in future work. The current studies suggest that girls may be more likely than boys to engage in certain problematic, interpersonally-based behaviors online—such as social comparison, feedback-seeking, and status seeking. This may be consistent with girls' tendency *offline* to show greater relational concerns and social status awareness (Lafontana & Cillessen, 1999; Rose & Rudolph, 2006), as well as more appearance-related social comparisons (Carlson Jones, 2004). On the one hand, we might expect that the affordances of

social media would amplify the frequency and intensity of these processes among girls, leading to more negative adjustment outcomes, as compared to boys. An alternative hypothesis, however, is that the anonymity and lack of interpersonal cues in the online environment allows certain adolescent boys to more safely or comfortably engage in these traditionally "female" social behaviors. As such, although girls may show overall higher levels of these online behaviors, we might expect more negative adjustment outcomes among the subset of boys who engage in such behaviors. In other words, whereas adolescent girls' online interpersonal behaviors may mirror their offline behaviors, for boys, social media may create the possibility for new, potentially maladaptive interpersonal behaviors. Extending this hypothesis further, we might expect fewer gender differences in the realm of social media behaviors that relate to externalizing or risk behavior outcomes, such as substance use, that are traditionally equally or more likely among boys (Moss, Chen, & Yi, 2014). Although results provide preliminary support for this hypothesis, more research is needed to assess the differential effects of social media behaviors on adolescent boys and girls.

Finally, in addition to examining *how* adolescents are using social media, and which adolescents may or may not be at risk, the current studies examine the ways in which social media creates a compelling context for the navigation of stage-salient tasks during this critical developmental period. Findings highlight the concomitant increase in social media use that occurs during a stage of romantic and sexual exploration, alcohol and substance use initiation, and increasing reliance on peer feedback and status for the determination of self-worth. Results echo previous suggestions that social media may amplify the developmental tasks of this stage (Subrahmanyam & Šmahel, 2011), with the potential for frequent, public and quantifiable peer engagement occurring outside the view of adult authority figures (Peter & Valkenburg, 2013;

Subrahmanyam & Šmahel, 2011). Furthermore, findings regarding the navigation of these tasks within the context of social media raise several empirical questions worthy of future study. While the current work focuses on adolescents between the ages of 12 and 17, future studies should examine social media use and development among preadolescents and children. As youth turn to social media at increasingly younger ages (Rideout, 2015), one question to be explored is whether the developmental tasks of adolescence will begin earlier as well. Children who engage with social media may have opportunities for more frequent and independent peer interactions, greater identify exploration, and exposure to older peers, perhaps accelerating processes traditionally associated with adolescence. Simultaneously, it will be important for research to continue following current adolescent cohorts as they enter adulthood. Being among the first generation to grow up in a world saturated by social media, questions remain regarding the role that these platforms will play in their adult lives. Norms are likely to continue developing around social media behaviors and uses. It seems possible that, given their high levels of exposure to these tools, the current generation may experience "social media fatigue" (Bright, Kleiser, & Grau, 2015), perhaps leading to a more mindful or intentional approach to their social media use. Of course, these hypotheses are speculative, and much further research will be needed to explore these questions. In general, however, it will be critical that researchers acknowledge the centrality of social media to modern adolescents' development in order to advance our understanding of these processes.

The current research has important implications across both research and clinical domains. In terms of research, findings underscore the utility of taking a more nuanced approach to the study of adolescent social media use, and as previously discussed, highlight areas for future work in terms of specific social media behaviors, adolescents' individual characteristics,

and relevant developmental processes. In addition, recommendations for future research in this area are offered. First, the need for advancement in the measurement of social media use is apparent. The majority of existing research examining social media draws on newly developed self-report measures, the psychometric properties of which have not yet been established in adolescent samples. Measuring social media use and behaviors remains challenging for many reasons, including a rapidly changing media landscape, limited research knowledge regarding new media-based constructs, and lack of insight among some adolescents regarding their social media behaviors. In order to overcome these hurdles, multi-method approaches must be employed. Qualitative and descriptive work should be undertaken to engage adolescents and uncover new insights, and observational coding of social media platforms should be used to obtain more objective views of social media use. In addition, the current studies introduce the potential for peer-report measures to supplement self-report indices. New measures, drawing on self and observer reports, should continue to be developed and rigorously tested.

Beyond issues of measure development, the rapid pace of change and innovation in the realm of social media continues to challenge researchers in this area. As such, the field should strive to move beyond examinations of specific social media platforms (i.e., Facebook, Instagram), which are likely to quickly become "outdated" in the eyes of adolescents. Rather, broader theoretical approaches are needed to consolidate past research and drive new hypotheses going forward. The current studies take a features-based approach to social media, highlighting affordances across social media platforms (e.g. public communication, quantifiable status indicators), rather than specific media tools, that may drive social media behavior and adjustment outcomes. However, as the field continues to progress, theoretical perspectives will need to be further elaborated and applied to this changing social media landscape.

The clinical implications of the current research are numerous. Findings point to the relevance of social media for adolescent clinical intervention across two key areas. First, the current work identifies potential targets for intervention and prevention work regarding adolescents' day-to-day use of social media. Studies highlight certain social media behaviors that may be associated with maladaptive outcomes, including substance use, sexual risk behavior, depressive symptoms, and social competence. These findings, at a minimum, call for clinical psychologists to assess for the role that social media plays in the lives of their adolescent clients, and to acknowledge the potential for real, "offline" consequences to result from social media behaviors and experiences. Furthermore, findings provide preliminary evidence for the potential benefit of prevention work targeting certain social media behaviors, especially among vulnerable adolescents. For example, substance use prevention programs might be expanded to discuss the potential risks of posting and engaging with alcohol-related social media content. In addition, group therapy protocols for depressed adolescents might benefit from adding discussion of comparison and feedback-seeking online behaviors, or of the potential problems associated with replacing in-person with text-based communication.

A second key area of clinical relevance for the current work is that of social media as a tool for the delivery of intervention and prevention services. A growing body of work has emerged in recent years examining the use of social media tools within therapeutic interventions for various mental health concerns (e.g., Rice et al., 2014), as well as for prevention of health risk behaviors among adolescents (e.g., Jones, Eathington, Baldwin, & Sipsma, 2014). However, basic research regarding the ways in which adolescent social media use intersects with adjustment is needed to inform such work. The current studies offer preliminary insights into potential mechanisms by which social media based interventions could drive adolescent behavior

change. For example, given the current evidence that social networking sites plays an important role in the creation of norms surrounding alcohol use, the use of these tools for the promotion of more healthy norms surrounding drinking may be warranted. Similarly, technology-based tools lacking interpersonal cues may provide "safer" or more comfortable spaces for certain conversations. As such, these platforms may offer opportunities for education around sensitive health issues (e.g., sexual health), as well as powerful contexts for discussions of stigmatized mental health concerns.

Overall, the current studies offer a shift in theoretical perspective in regard to adolescent social media use. Rather than emphasizing simple frequencies of use, this work offers an innovate paradigm for examining specific social media behaviors, individual characteristics, and developmental processes in relation to adolescents' social media use and adjustment. As the role of social media in adolescents' lives continues to expand, future research in this area will be essential to uncover the complexities of adolescents' social media experiences, and to inform clinical recommendations in this area.

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