The Effects of Instagram Use, Social Comparison, and Self-Esteem on Social Anxiety: A Survey Study in Singapore

Shaohai Jiang and Annabel Ngien

Abstract
Social media have been growing rapidly during the past decade. However, it remains unclear whether social media make people more emotionally healthy or less. This study aims to explore the effect of Instagram use on individuals’ social anxiety. With a general basis of the three-stage model of interactive media use for health promotion, we conducted a cross-sectional online survey study (N = 388) in the context of Singapore and empirically tested a mediation pathway linking Instagram use to social anxiety. The results indicated that Instagram use did not directly increase social anxiety. Instead, social comparison, a proximal outcome, and self-esteem, an intermediate outcome played mediating roles, supporting the complete mediation effects. This finding provides important theoretical and practical implications for the design of health campaigns and education in this digital era to enhance the positive effect of social media on health and emotional well-being.

Keywords
Instagram, social comparison, self-esteem, social anxiety, Singapore

Introduction
Today, social media have been increasingly used to connect with one another, consume news content, and share information. In the United States, about 70% of the public have used social media (Pew Research Center, 2018). In Singapore, the context of this study, a similar percentage was found. The Digital in a 2017 report found that 70% of Singaporeans use social media (A. Tan, 2017). The high adoption of social media is especially important to Singapore, given that the government’s “Smart Nation” initiative aims to utilize information communication technologies to improve living and build a closer community among Singaporeans (Hoe, 2016). As highlighted by the Prime Minister of Singapore, Lee Hsien Loong, at the Smart Nation launch, social media offer an ideal platform to keep in contact with family members, friends, and those whom we may not meet frequently (Smart Nation and Digital Government Office, 2014).

Congruent with the growth of social media use, there are also increasing worries that social media might lead to social anxiety in users (Jelenchick et al., 2013). Social anxiety is one’s state of avoiding social interactions and appearing inhibited in such interactions with other people (Schlenker & Leary, 1982). Scholars indicated that social anxiety could arise from managing a large network of social media friends, feeling jealous of their lives, and the “fear of missing out” on activities in online interactions (Hampton et al., 2015). Despite the concern about the negative effects of social media, in the current literature, there remains three important gaps. First, there is a lack of examination of mediating factors underlying the relationship between social media use and social anxiety. The focus on the direct effect ignores the complexity of how social media use influences emotional health. Street (2003) underscored the need to identify specific mediators that can influence the impact of interactive media on health outcomes. Without looking at this underlying process, important media effects may be obscured. Second, most studies have examined Facebook. As technological functions of social media have been evolving rapidly, it is important to examine emerging social media platforms. Instagram is considered to be one of the fastest-growing social media. As of April 2017, there were approximately 700 million users on Instagram (Zhan et al., 2018). A defining feature of Instagram is that it allows users to beautify...
their photos by applying a range of enhancement filters. This function changed the way people present themselves online, and the peer portrayal of idealized beauty may affect viewers’ emotional and psychological responses (Chua & Chang, 2016). Third, the large majority of prior research investigated this research topic in the United States and Europe, with limited empirical evidence found in the context of Singapore. Singapore has a unique mixed culture, which is a combination of the East and the West. On the one hand, ethnic Chinese make up over 75% of Singapore’s population. Thus, Eastern culture has exerted significant impacts, such as suppression of individuality to maintain harmonious relationships in the social context, high power distance, and personal achievement through diligence and perseverance (Leong et al., 2014). On the other hand, Western culture also has profound influences in Singapore. For example, Singapore remains a largely Anglophone country, where about 37% of residents cited English as their most-used language at home (Bolton & Ng, 2014). Also, Singapore’s modern administrative unit is a Western entity, originating in British colonialism (Ang & Stratton, 1995). In addition, young people in Singapore are frequent consumers of Western movie and music (Fu, 2014).

To fill the three abovementioned research gaps, this study aims to conduct a survey in the context of Singapore to investigate how Instagram use may affect individuals’ social anxiety, by exploring its underlying working mechanisms. In doing so, we proposed our conceptual framework with a general basis of the three-stage model of health promotion using interactive media (Street, 2003; Street & Rimal, 1997). Stage 1 is implementation and use of interactive media, which merges into Stage 2, user-media-message interaction. What unfolds during Stage 2 depends on the interplay of user, media, and message characteristics, such as users’ education level, health status, desire for information, media’s ease of use, degree of interactivity, modalities, and message’s topic, format, genre, readability, and credibility. The user-media-message interaction can then lead to intermediate outcomes (e.g., motivation, knowledge, self-efficacy, attitude change, and problem-solving skills), which in turn influence health outcomes at Stage 3 (e.g., health improvement, lifestyle change, and better emotional well-being). Specifically, in this study, we argued that Instagram use might affect individuals’ social anxiety indirectly, mediated by social comparison and self-esteem. The next section provides literature review to demonstrate the proposed mediation pathways.

**Literature Review**

**Path 1: Instagram Use to Social Comparison to Social Anxiety**

Social anxiety results from the personal evaluation of real or imagined social situations (Schlenker & Leary, 1982). Prior research indicated that social comparison could make people feel socially anxious. Social comparison consists of people’s biological inclination to evaluate their situation, skill, and overall identity in comparison to others, based on the information they receive about others (Festinger, 1954). P. Gilbert (2000) stated that upward social comparison (e.g., comparing with others who are perceived as better in a particular aspect) might lead to increased social anxiety. Some people rank lower than others, which could increase mental access to negative self-assessment and self-imagery during interactions with other people, resulting in greater social anxiety (Stein, 2015). Even downward social comparison (e.g., comparing oneself with others who are perceived to be inferior) could enhance one’s social anxiety. Antony et al. (2005) found that people with greater tendency toward either upward or downward social comparison were associated with greater concern about how one is being evaluated by others. Because of this concern, no matter whom they compare themselves with, they would make efforts to craft own behaviors to conform to certain standards or norms (P. Gilbert, 2001). Over time, this excessive self-consciousness as a result of social comparison could lead to one’s perception of lack of social skills, and even fear of social interactions (American Psychiatric Association, 2013).

Past empirical studies have documented the positive relationship between social comparison and social anxiety. For example, Weeks et al. (2009) in a survey study found that social comparison was positively related to social interaction anxiety, as well as the fear of public scrutiny. Mitchell and Schmidt (2014) conducted an experiment and supported the causal relationship between comparison and social anxiety. Gregory and Peters (2017) concluded in their systematic review of cognitive behavioral therapy that beliefs relating to social comparisons played an important role in influencing social anxiety disorder.

On social media, people often selectively reveal themselves and construct their preferred identities or characteristics (e.g., emotions, personality traits, opinions; Vogel et al., 2014). When users are notified about other people’s life updates through social media postings, they would spontaneously and unintentionally practice social comparison (D. T. Gilbert et al., 1995). Social media generates ubiquitous comparison information and accessible feedback, such as the number of followers, likes, comments, and retweets. Such information allows people to form impressions of others quickly. Compared with the offline setting, comparison information on social media is more salient and visible (Appel et al., 2016). In addition, social media support the maintenance of one’s offline social networks as well as building new online social networks, which could strengthen the effect of social media use on social comparison (Gross & Acquisti, 2005).

Empirical evidence has been found regarding the positive relationship between social media use and social comparison. For instance, de Vries and Kühne (2015) conducted a survey study among young adults in the Netherlands, and
demonstrated that higher intensity of Facebook use was associated with more social comparison. A similar relationship was also found in a study of Instagram, demonstrating that social media can predict individual differences in social comparison orientation and behavior (Stapleton et al., 2017). A systematic review of social media use in health care showed that patients use social media to compare themselves with other patients to find out how “bad” their health conditions are and how well the treatments work (Smailhodzic et al., 2016).

In the light of the above, one pathway linking Instagram use to social anxiety would likely be indirect, mediated by social comparison. Thus, the first hypothesis is proposed:

H1: Instagram use will have an indirect effect on social anxiety, mediated by social comparison.

**Path 2: Instagram Use to Social Comparison to Self-Esteem to Social Anxiety**

Self-esteem is a person’s positive or negative self-evaluation, or the degree to which he or she believes oneself to be worthwhile (Leary & Baumeister, 2000). Low self-esteem can increase social anxiety for several reasons. First, individuals with reduced self-esteem often have less interactions with others, hindering the development of intimate or supportive relationships that are important for one’s well-being (Fatima et al., 2017). Second, people with lower self-esteem tend to depend on extrinsic social approval for a better sense of self. They often perceive that they are looked down upon by others, and interpret responses from others to be hostile, which could lead to increased social anxiety (Cuming & Rapee, 2010). Third, people suffering from low self-esteem are prone to be self-victimizing and blaming others for their social failures, instead of taking responsibility for their personal decisions. Such tendencies would cause avoidance of people, unfamiliar contexts, and a general social detachment, increasing the risks of social anxiety (Tracy & Robins, 2003).

A couple of empirical studies illustrated the negative relationship between self-esteem and social anxiety. For instance, a survey study in Pakistan demonstrated that self-esteem negatively predicted social anxiety, and this effect was stronger among males (Fatima et al., 2017). Another study conducted in China also found that higher self-esteem was correlated with lower social anxiety, highlighting that self-esteem enhancement practice can be used as a preventive therapy to reduce social anxiety (J. Tan et al., 2016).

Social comparison is argued to be a contributing factor to low self-esteem. Since idealistic information presented through social media has increased social comparison norms, the more time people spent on social media, the more likely they would believe that others have better lives and are happier and more successful, reducing their self-esteem (Stapleton et al., 2017). Also, social comparison may result in one believing that external conditions or socially approved benchmarks are more important than internal and personal traits. As one perceives his or her inherent characteristics to be less important in gaining social recognition, the sense of self-esteem will be lowered (J. B. White et al., 2006).

Past studies offer ample support for the negative link between social comparison and self-esteem. In a survey study among college students, Vogel et al. (2014) found that participants who scored higher on social comparison orientation experienced reduced self-esteem and poorer self-perception balance. Another survey also showed that when people perceived their social media friends as having better lives, their self-reported self-esteem level was lower (Wang et al., 2017). The existing research has mainly examined Facebook use, while Instagram has some different technological features that may increase users’ social comparison and its effect on self-esteem. For example, with more options of enhancement filters, Instagram users exhibit more tendency to select and exaggerate positive life scenarios than Facebook users (Lup et al., 2015). Also, unlike Facebook that is more text-centered, where users often display their intellectual or literary finesse, Instagram is used mainly for photos and video sharing. Visual content creates higher impression formation.
by escalating social presence (Johnson & Knobloch-Westerwick, 2016), and visuals are also easier to recall than text-based information (Noldy et al., 1990). Thus, social comparison and its effects on self-esteem become more salient on Instagram.

As noted earlier, our second hypothesis related to another mediation pathway from Instagram use to social comparison, to self-esteem, and finally to social anxiety, is put forth:

H2: Instagram use will have indirect effects on social anxiety, mediated by social comparison and self-esteem.

In summary, as shown in Figure 1, this study tested a mediation pathway that Instagram use increased social comparison, which in turn led to reduced self-esteem, which finally resulted in greater social anxiety.

**Method**

**Sample**

These survey data were collected in July 2018 in Singapore. Convenience sampling was used. A weblink to the online questionnaire was disseminated through social networking sites to recruit participants. Snowballing method was also adopted to increase the sample size. The final sample consists of 388 participants. In our sample, the average age was 33.8 (ranging from 21 to 72), 46.9% were male, 75.3% had an annual income below $50,000, 78.1% had some college or have obtained college degrees. Details of descriptive statistics are shown in Table 1. Despite the use of a convenience sample, our respondents’ average age and gender ratio generally fit with the Singaporean population. According to the Department of Statistics Singapore (2019), the median age in the country is 40.8; 49% are males. However, the general population’s annual income level (medium = $53,000) is higher than that of our sample, and the education level at the population level (46.7% had some college or have obtained college degrees) is lower than that in our sample. Among the 388 respondents, 56.7% (N = 220) were Instagram users.

**Measurement**

**Instagram use** was measured in terms of usage frequency, by one single item drawn from prior research (Lup et al., 2015; Vannucci et al., 2017). Respondents first self-reported whether they have Instagram accounts. If yes, they were asked to indicate on average how many minutes per day they spend on Instagram. A six-point scale was adopted, ranging from 1 = less than 10 min to 6 = more than 180 min (M = 2.64, SD = 1.48).

**Social comparison** was measured by the Iowa-Netherlands Comparison Orientation Measure (Gibbons & Buunk, 1999). Respondents were required to rate the degree of agreement on 11 items, such as “I often compare myself with others with respect to what I have accomplished in life” and “I always like to know what others in a similar situation would do.” A five-point Likert-type scale was used, ranging from 1 = Strongly Disagree to 5 = Strongly Agree. These 11 items were added up and then averaged (M = 3.08, SD = 0.71, Cronbach’s alpha = .87).

**Self-esteem** was assessed using the Rosenberg Self-Esteem Scale (Rosenberg, 1965). Respondents reported the extent to which they agree with 10 statements of general feelings about themselves, on a five-point Likert-type scale where 1 = Strongly Disagree and 5 = Strongly Agree. Sample items include “I feel that I have a number of good qualities” and “On the whole, I am satisfied with myself.” The average of the 10 items was created for data analysis (M = 3.75, SD = 0.70, Cronbach’s alpha = .89).

**Social anxiety** was measured by the Social Interaction Anxiety Scale-6 that has been widely used in prior research (Mattick et al., 1989). Respondents were asked to identify their agreement with six statements on a five-point Likert-type scale, ranging from 1 = Strongly Disagree to 5 = Strongly Agree. Sample items include, “I tense up if I meet an acquaintance on the street,” and “I have difficulty making eye contact with others.” The mean for these six items was calculated (M = 2.12, SD = 0.77, Cronbach’s alpha = .82).

**Demographic variables** include age, gender (1 = male, 0 = female), education (ranging from 1 = below primary school to 6 = university or above), and personal annual income (ranging from 1 = below $20,000 to 3 = above $50,000), and are treated as control variables to reduce confounding effects.

**Statistical Analysis**

Path analysis with structural equation modeling (SEM) was performed to investigate the proposed mediation pathways. In the covariance structure analysis, maximum likelihood of estimation was used. In SEM, the exogenous variables were control variables, while Instagram use, social comparison, self-esteem, and social anxiety were endogenous variables. Paths were drawn from exogenous variables to

| Table 1. Descriptive Statistics. |
|----------------------------------|
| Variables                        | N=388               |
| **M**                             | **SD**              |
| Age                              | 33.80               | 13.84               |
| Gender (being male)*             | 46.9%               |                    |
| Education                        | 5.52                | 0.95                |
| Income                           | 1.81                | 0.81                |
| Instagram use                    | 2.64                | 1.48                |
| Social comparison                | 3.08                | 0.71                |
| Self-esteem                      | 3.75                | 0.70                |
| Social anxiety                   | 2.12                | 0.77                |

*Represents a frequency for dichotomous variable.
all endogenous variables. In line with Figure 1, paths were also drawn from Instagram use to social comparison, from social comparison to self-esteem, from self-esteem to social anxiety, and finally, from both Instagram use and social comparison to social anxiety. To examine the mediation effects more closely, the PROCESS macro (Model 6 with two mediators) was employed to generate bootstrapped confidence interval (CI) (Preacher & Hayes, 2004). When the lower and upper 95% CIs do not include zero, the mediation effects can be supported.

### Results

Hu and Bentler (1999) indicated that a good SEM model should achieve Comparative Fit Index (CFI) ≥ 0.96, Standardized Root Mean Square Residual (SRMR) ≤ 0.10, and Root Mean Square Error of Approximation (RMSEA) ≤ 0.06. Our initial SEM model failed to meet these criteria, as the RMSEA is larger than 0.06, $\chi^2 (1) = 2.718, p = .229$; RMSEA = 0.088 (90% CI = [0.000, 0.222]); CFI = 0.990; and SRMR = 0.014. We found that only the path from Instagram use on social anxiety was not significant ($\beta = -.03, p = .632$). This results showed that Instagram use failed to directly influence social anxiety. Prior research suggested that to seek a more parsimonious explanation for a given phenomenon, non-significant paths can be trimmed (McCoach, 2003). Thus, this insignificant path was pruned to maintain a more parsimonious model. The pruned model had a satisfactory fit: $\chi^2 (2) = 2.950, p = .229$; RMSEA=0.046 (90% CI = [0.000, 0.150]); CFI=0.994; and SRMR=0.014.

H1 posited that social comparison mediated the effect of Instagram use on social anxiety. This hypothesis was supported. As indicated in Table 2, Instagram use was positively related to social comparison ($\beta = .23, p < .001$), which in turn increased social anxiety ($\beta = .28, p < .001$). The bootstrapping method offered support for this mediation path (95% CI = [0.0151, 0.0729]).

H2 proposed another pathway from Instagram use to social comparison, to self-esteem, and finally, to social anxiety. This hypothesis was also supported. As displayed in Table 2, the relationship between social comparison and self-esteem was negative and significant ($\beta = -.22, p < .01$), and self-esteem also had a negative and significant effect on social anxiety ($\beta = -.27, p < .001$). The bootstrapping approach offered support for this indirect pathway that involved two mediators (95% CI = [0.0010, 0.0144]).

Given that the direct path from Instagram use to social anxiety was insignificant, our finding demonstrated that social comparison and self-esteem completely mediated the effect of Instagram use on social anxiety.

### Discussion

Instagram has been growing rapidly since its launch in 2010. However, academic research related to this media platform still remains limited (Djafarova & Rushworth, 2017). Only a few studies investigated the effect of Instagram use on users’ emotional health status. This study has broken new ground in exploring the social mechanism that underlies the impact of Instagram use on social anxiety in the context of Singapore.

An important result pertains to the mediation effect of social comparison. Our data revealed that more frequent Instagram use was associated with a higher level of social comparison. Social media allow users to create personal profiles, and offer opportunities to get exposure to information about other people’s lives (Fardouly et al., 2015). As a photo and video sharing social networking site, Instagram offers abundant opportunity for self-presentation that may increase viewers’ social comparison (Yang et al., 2018). Also, it is common to keep public profiles on Instagram, which enables users to follow, view, like, and comment on people they do not know personally, including influencers and celebrities. And the use of hashtags can further drive social comparison, given that all photos with the hashtag are searchable, making it more accessible to a larger amount of people (Lup et al., 2015).

Our results also showed that social comparison increased one’s social anxiety. Social media users often compare themselves with others’ appearance, ability, popularity, and social skills (Feinstein et al., 2013). Such comparisons trigger

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**Table 2. Predictors of Endogenous Variables in SEM.**

| Effect              | Age          | Gender | Education | Income | Instagram use | Social comparison | Self-esteem |
|---------------------|--------------|--------|-----------|--------|---------------|-------------------|-------------|
| Instagram use       | Direct       | $-0.30^{***}$ | $-0.08$  | 0.11   | $-0.01$       |                   |             |
|                     | Indirect     | NA     | NA        | NA     | NA            |                   |             |
| Social comparison   | Direct       | $-0.30^{***}$ | 0.06     | $-0.05$ | $-0.07$       | 0.23^{***}       |             |
|                     | Indirect     | $-0.07^{**}$  | $-0.02$  | 0.03   | $-0.01$       | NA               |             |
| Self-esteem         | Direct       | 0.18^{*}  | 0.10      | 0.22^{**} | 0.10       | NA                | $-0.22^{**}$ |
|                     | Indirect     | 0.08^{**}  | $-0.01$  | 0.01   | 0.02         | $-0.05^{***}$    | NA          |
| Social anxiety      | Direct       | $-0.10$   | $-0.04$  | $-0.07$ | 0.03          | P                 | 0.28^{***}  | $-0.27^{***}$ |
|                     | Indirect     | $-0.17^{***}$ | $-0.01$  | $-0.07^{*}$ | $-0.05$  | 0.08^{***}       | 0.06^{**}  | NA          |

*Note. Coefficients are standardized.*

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

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**Table 2. Predictors of Endogenous Variables in SEM.**

| Effect              | Age          | Gender | Education | Income | Instagram use | Social comparison | Self-esteem |
|---------------------|--------------|--------|-----------|--------|---------------|-------------------|-------------|
| Instagram use       | Direct       | $-0.30^{***}$ | $-0.08$  | 0.11   | $-0.01$       |                   |             |
|                     | Indirect     | NA     | NA        | NA     | NA            |                   |             |
| Social comparison   | Direct       | $-0.30^{***}$ | 0.06     | $-0.05$ | $-0.07$       | 0.23^{***}       |             |
|                     | Indirect     | $-0.07^{**}$  | $-0.02$  | 0.03   | $-0.01$       | NA               |             |
| Self-esteem         | Direct       | 0.18^{*}  | 0.10      | 0.22^{**} | 0.10       | NA                | $-0.22^{**}$ |
|                     | Indirect     | 0.08^{**}  | $-0.01$  | 0.01   | 0.02         | $-0.05^{***}$    | NA          |
| Social anxiety      | Direct       | $-0.10$   | $-0.04$  | $-0.07$ | 0.03          | P                 | 0.28^{***}  | $-0.27^{***}$ |
|                     | Indirect     | $-0.17^{***}$ | $-0.01$  | $-0.07^{*}$ | $-0.05$  | 0.08^{***}       | 0.06^{**}  | NA          |
Due to this process, social media can exert effects on users' emotional states (Street, 2003). Therefore, a general statement that social media use is associated with good or poor emotional health would be uninformative, because it fails to specify under what underlying mechanism social media can play a role.

Our finding that social comparison mediated the effect of social media on social anxiety is particularly important to the context of Singapore. On the one hand, Singaporeans' emotional health is concerning. According to a 2017 survey of students from 72 countries by the Organization for Economic Cooperation and Development, 76% of respondents in Singapore reported that they felt very anxious even if they are well prepared for a test. This percentage is significantly higher than the global average of 55% (Davie, 2017). In addition, the mental health for working adults in Singapore is also problematic. The 2016 Working in Asia Survey showed that 52% of Singaporean workers said that their stress level has gone up over the past 6 months, exceeding the percentages in other Asian countries such as Hong Kong (43%) and China (45%) (Siow, 2016). On the other hand, social comparison tendency is more salient in Singapore than that in Western countries. The Singaporean culture has a strong focus on material life and peer comparison (Chua & Chang, 2016). Scholars found that this is a common phenomenon among Asian populations that sought more social comparisons, particularly with those perceived to be better (White & Lehman, 2005). Wajda et al. (2008) contended that the difference in the level of social comparison was rooted in the individualism–collectivism cultural difference. Individuals from Eastern societies, with a Collectivist culture, are more apt to hold an interdependent view of self and others. Therefore, an individual's self-conception of his or her role, function, and status might be a result of comparisons with others.

Limitations and Future Research Directions

Despite these key findings, our study has several limitations. First, the cross-sectional design made it hard to test causal relationships. To confirm the causal directions, future research should use longitudinal design. For example, studies can collect data about social media use at Time 1, mediating variables at Time 2, and finally social anxiety at Time 3. Cross-lagged panel analysis can be used to ascertain the directionality. Second, the study participants were recruited from convenience samples, limiting the generalization of our findings. A common problem associated with convenience samples is the homogeneity of study participants. As illustrated in this study, our sample is skewed toward highly educated people. Thus, readers need to be cautious not to overgeneralize the results to people with lower levels of education. To overcome this limitation, future research should ideally use probability samples that cover a wider range of study participants. Third, this study only measured the strong psychological responses, particularly when others selectively present more positive information (Yang & Robinson, 2018). Instagram provides various filters to edit and enhance photos, and the exposure to these idealized images of others can activate negative emotions, contributing to poor psychological well-being such as social anxiety (Sherlock & Wagstaff, 2018).

Also, the mediation effect of self-esteem is significant to note. Our finding indicated that social comparison significantly decreased self-esteem. This result is consistent with previous studies showing that individuals with higher social comparison orientation reported poorer self-perception, lower self-esteem, and more negative feelings (Jang et al., 2016). The identity processing theory explains that social comparison contributes to low self-esteem by prompting adoption of identity processing styles (Berzonsky, 1988, 2008). For example, with the normative style, social comparison increases awareness of certain salient norms (e.g., beauty standard, correctness of opinion). When users perceive that they are different from the norms, they are likely to have a negative evaluation of themselves, which motivates them to make changes to follow expectations and values of the referent group. Also, with the diffuse-avoidant style, social media users choose to ignore online voices, as a way to protect their self-images. However, such avoidance in the long term would isolate people from online communities, lowering their self-esteem (Yang et al., 2018). Our study also found that lower self-esteem was associated with greater social anxiety, a finding that echoes with prior research (de Jong, 2002; Ritter et al., 2013). As one’s self-esteem falls, the person’s perceived inferiority may prompt negative navigation and interpretation of reactions from social networks, and such perceived disapproving responses would increase social anxiety (Heatherton & Wyland, 2003). McCarroll et al. (2009) concluded that self-esteem is one factor that accounts for individual differences in emotional states when interacting with others, with high self-esteem helping to overcome negative feelings about reactions of others and reducing the likelihood of negative social interactions.

Another crucial finding pertains to the insignificant direct effect. Our results demonstrated that Instagram use failed to directly influence social anxiety. Instead, its impact was completely mediated by social comparison and self-esteem. This finding is generally in line with the core principle of the three-stage model, and other derivative research (Jiang & Street, 2017; Street, 2003). The process of using social media is complex, involving users’ interactions with media platform and message content (Jung et al., 2016; Oh & Sundar, 2015). In our study, Instagram use affects social anxiety, through social comparison, which is considered as a user-media-message interaction process. Specifically, when users see other people’s beautified photos and videos (media feature), they would mentally compare themselves with what is shown in the photos and videos (message processing), and due to this process, social media can exert effects on users’
frequency of Instagram use, using one single item. Future research can focus on other operationalizations of this variable (e.g., attention, diversity), and use multiple items to enhance the reliability of measurement. Fourth, this study only examined one mediation pathway. A variety of mediators that tap into the user-media-message interaction process can be at play as well. For example, degree of interactivity on social media and the readability of online messages can influence how users process information they see from social media, which in turn, affects outcomes of interest. Therefore, it should be noted that this study is exploratory in its nature. Future studies can continue the investigation of mechanisms underlying the effect of social media on health outcomes. Finally, the use of Singapore sample in this study might limit the generalizability of our findings to other countries, due to different cultural and societal characteristics. Given the increasing popularity of Instagram around the globe, we call for more future research on its usage and impact in various cultural contexts.

**Theoretical Implications**

Despite the limitations, this study has important theoretical implications. First, this study incorporated the social comparison perspective into the three-stage model. This offers a more comprehensive theoretical framework to explore how interactive media use exerts health impact. Social comparison is considered as a user-message-media interaction process that explores how individual users cognitively process and elaborate the content (e.g., photos or video) seen from media (e.g., Instagram).

Second, this study supports that the three-stage model, which was proposed in Western societies, can be well applied to a different context. Our findings are in line with the basic tenet of the three-stage model, demonstrating that in spite of differences in economic, political, media, and cultural environment, the applicability of this model for understanding interactive media use and its effect on health outcomes can be realized in the context of Singapore. This opens up a new research trajectory to applying the three-stage model in different cultural contexts.

Third, this study also contributes to the social media literature by identifying a mediation pathway that includes proximal and intermediate outcomes, underlying the effect of social media on emotion-related outcomes. It is important to explore steps along the pathway from communication to more distal outcomes. To identify the social mechanisms, our project highlights the need to situate social media use within the context of social (e.g., social comparison) and personal (e.g., self-esteem) determinants of health. Future research should continue exploring mediating factors by taking into account a broader context, such as technological, media, organizational, and political factors that may have subsequent health impacts.

**Practical Implications**

This study also offers significant practical implications. First, regarding social media users, particularly those with greater inclination for social comparison, they should be mindful of social media use and try to avoid frequently comparing abilities and opinions with others. If they experience unpleasant feelings resulting from social comparison, they should understand that other people’s online self-presentation might only reflect a partial image. To combat comparison-triggered emotions, social media users can also utilize cognitive reframing strategies, such as viewing others’ triumphs or beautiful moments shared on social media as inspirations, or taking a step back to think about their own strengths and achievements (Hobfoll, 2001).

Second, for health educators and promoters, enhancing emotional well-being is of significance. Our study demonstrated that improving self-esteem is an effective way to reduce anxiety. Thus, we call for more targeted health education programs to strengthen people’s sense of self-acceptance and facilitate a more optimistic attitude toward themselves. These programs need strong partnerships between health educators and communities. For example, a self-esteem intervention on school-age children in the United States was based on the collaboration between health centers and elementary schools. Health educators organized a series of programs for participants to discuss examples from age-appropriate magazines and television to identify activities they can do at home and school to raise their self-esteem (Dalgas-Pelish, 2006).

Third, for health communicators, it is crucial to implement campaigns to increase people’s self-esteem in the digital era. A good example is the body positivity movement on Instagram. A group of Instagram influencers celebrated their bodies without using filters or strategic enhancement to fit societal ideals of body perfection; they shared their photos and thoughts and created body-positive hashtags to spread their messages (Cwynar-Horta, 2016). Campaigners can also circulate media articles, share stories to foster self-love, and collaborate with popular reality TV shows to boost self-esteem.

Fourth, given the particular popularity of Instagram among younger populations (e.g., students in middle school, high school, and college), school educators should take some responsibility to guide the appropriate use of Instagram to enhance students’ emotional health. For example, schools can invite students and their parents for screenings of documentaries such as “LIKE” and “Angst,” which explore social media, technology, and anxiety. Also, many schools have used hashtags such as #examstress and #GramFam to help students through difficult revision and exam seasons. In addition, Instagram can serve as an online supportive environment where students can learn from their peers and support each other (Thompson, 2019).
Conclusion

Instagram has become one of the fastest-growing social media platforms, particularly among younger populations. With its increasing popularity, many people are concerned about whether Instagram might lead to greater emotional burdens, such as stress and anxiety, or to better emotional well-being. This study examined how Instagram use could influence one’s social anxiety. Our findings showed that Instagram use alone would not directly increase social anxiety. Instead, its effect was completely mediated by social comparison and self-esteem. Future research should continue the investigation of mechanisms underlying the impacts of social media on emotional well-being, and help health educators and campaigners design better programs to support the public’s positive development of wellness in this digital era.

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ORCID iD
Shaohai Jiang https://orcid.org/0000-0002-8265-9778

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Author Biographies
Shaohai Jiang (PhD Texas A&M University) is an assistant professor of communication at the National University of Singapore. His research interests include health communication, new media, and strategic communication.
Annabel Ngien (BA National University of Singapore) is a student of communication at the National University of Singapore. Her research interests include health communication, social media, and emotional well-being.