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**The Association Between Social Media Use and Loneliness Among Adolescents:**

**A Meta-Analysis**

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## **Abstract**

Social media is of growing importance when children become adolescents. Its social function and the fact that loneliness is very common in the adolescents life phase, makes it interesting to examine the association between social media use and loneliness. Moreover, there is controversy in theories and in the empirical field regarding the association between loneliness and social media use among adolescents. Therefore, this study aims to shed light on the association by conducting a meta-analysis. In this meta-analysis, 42 studies were included with adolescents from 12-25 years old, in 18 countries. Random-effects analyses and regression analyses were conducted. The results showed no significant association between social media use and loneliness. Furthermore, the influence of several moderators on the association were examined: gender, age, used loneliness questionnaire, country and social media platform. All those categories did not significantly predict the strength of the association between adolescents' social media use and loneliness. Separate meta-analyses were conducted for active and passive social media use. These meta-analyses were also not significant. Further research should focus on more specific motivations and mechanisms of social media use, rather than broad categories and time spent on social media.

*Keywords:* loneliness, social media use, adolescents, meta-analysis

## **Samenvatting**

Sociale media worden belangrijker wanneer kinderen zich ontwikkelen tot adolescenten. De sociale functie van sociale media en het aandeel eenzame adolescenten maken het interessant om de associatie tussen sociale media gebruik en eenzaamheid te onderzoeken. Bovendien is er controverse in theorieën en het empirische veld als het gaat om de associatie tussen eenzaamheid en sociale media gebruik bij adolescenten, dus is besloten om een meta-analyse uit te voeren. In deze studie zijn 42 studies geïncludeerd met adolescenten van 12 tot 25 jaar, in 18 landen. Random-effects analyses en regressie analyses zijn hiervoor uitgevoerd. Dit heeft geresulteerd in een niet significante associatie tussen sociale media gebruik en eenzaamheid. Tevens zijn de invloeden van verschillende categorieën op de associatie onderzocht: sekse, leeftijd, gebruikte eenzaamheidsvragenlijst, land en sociale media platform. Alle categorieën voorspelden niet significant de sterkte van het verband tussen het sociale media gebruik van adolescenten en hun gevoelens van eenzaamheid. Tot slot zijn er twee aparte meta-analyses uitgevoerd voor actief en passief sociale media gebruik en ook deze analyses waren niet significant. Vervolgonderzoek zou zich moet focussen op specifiekere functies van sociale media gebruik in plaats van algemene categorieën en het

meten in tijd.

*Sleutelwoorden:* eenzaamheid, sociale media gebruik, adolescenten, meta-analyse

One of the most important developmental tasks during the period of adolescence is creating and maintaining social relationships (Kagan & Coles, 1972; Twenge et al., 2019). When adolescents feel a sense of belonging, they feel happy and satisfied with their life (Allen & Bowles, 2012; O'Brien & Bowles, 2013). Despite the need to belong, there is a large number of adolescents that experience loneliness during this life phase (Goossens, 2006). Loneliness can be defined as “a situation experienced by the individual as one where there is an unpleasant or inadmissible lack of (quality of) certain relationships” (De Jong-Gierveld, 1998, p. 73). Adolescents are especially vulnerable to feelings of loneliness, because of changes in their social network and the need to explore their identity (Qualter et al., 2013). Furthermore, they feel the tension between having a social life and being independent of others (Qualter et al., 2015). Loneliness in the adolescent life phase is associated with a range of negative outcomes, like poorer academic achievement, high school dropout, depression and suicide (Benner, 2011; Page et al., 2006). This underlies how loneliness in adolescence is an important concern for society.

The social life of adolescents is not only set in the real world, but also online. In the US, children get their first smartphone on the average age of ten years. As a consequence, the use of social media increases (CNBC, 2018). On the one hand, it has been argued that social media use (SMU) is associated with negative outcomes such as depression, cyber bullying and loneliness. On the other hand, it has been argued that SMU is related to positive elements, like staying connected with friends and expressing thoughts and emotions (Allen et al., 2014; Siddiqui & Singh, 2016). Besides, parents are receiving diverse media messages about the impact of social media on their children, containing positive and negative elements. This makes it hard for parents to draw conclusions and as a consequence, they can be insecure about their parenting strategies (Nederlands Jeugdinstituut, 2015). Thus, social connectedness in adolescence is important, there is a diverse range of outcomes for SMU and media messages are contradictory. This makes it interesting to investigate the association between SMU and loneliness in adolescents.

### **SMU and Loneliness**

Loneliness might be associated with SMU for several reasons. The displacement theory states that people feel lonely because they displace offline relationships with online

relationships (Kraut et al., 1998; Valkenburg & Peter, 2007). As a result of communicating through social media, adolescents will spend less time with friends in the offline world. This in turn will reduce the quality of these friendships. In contrast, the stimulation hypothesis states that social media can support social interaction and therefore the quality of friendships (Valkenburg & Peter, 2007). In addition, social media can be an opportunity for adolescents to explore their identity and to make online friends, which can be associated with less loneliness (Teppers et al., 2014). However, when social media is used to compensate adolescents' lack of social skills in the real world, it is stated to be associated with more loneliness (Teppers et al., 2014).

Previous research has not yet led to consensus, but it is important to notice that a lot of studies measured SMU as the amount of time spent on social media platforms, the number of logins or the numbers of friends one has on a platform (Nowland et al., 2018). Some studies found no association between SMU and loneliness (Guo et al., 2014; Neto et al., 2015). Other studies found a positive association between amount of time spent on social media and loneliness (Kross et al., 2013; Lemieux et al., 2013; Matsuba, 2006). Some studies found a negative association: the more time adolescents spend online (Lou et al., 2012; Valkenburg & Peter, 2007), or the more friends adolescents have on a platform (Lemieux et al., 2013; Skues et al., 2012), the less lonely they felt. It is becoming clear that measuring SMU in frequency does not lead to a consistent link with adolescents' loneliness (Nowland et al., 2018). This implies that it is more relevant to look at specific uses and functions of SMU for adolescents (Nowland et al., 2018). Examples of specific uses and functions are: active and passive use, self-focused use, relational use and addictive use (Luo & Hancock, 2020; Nowland et al., 2018; Sarmiento et al., 2018). The distinction between active and passive use has been viewed by researchers as an important moderator (Sarmiento et al., 2018). Therefore, passive social media use (PSMU) versus active social media use (ASMU) will be discussed below.

### **PSMU versus ASMU**

In several studies it was found that PSMU, meaning scrolling through content and viewing others' posts, is associated with a depressed mood, lower well-being (Frison & Eggermont, 2017; Verduyn et al., 2017) and loneliness (Matook et al., 2015). This finding can be explained by the social comparison theory (Festinger, 1954), stating that people compare themselves to similar others, in order to receive feedback on how to behave, look and who to be. In this way, they make up their self-evaluation. The tendency to socially compare is especially present in adolescence (Myers & Crowther, 2009). When presenting oneself on social media, people try to post the ideal version of themselves (Yau & Reich, 2019). Pictures

are carefully chosen and posts are carefully written, which makes it more likely that adolescents will engage in upward social comparison. This results in the belief that other people have more success, are happier and look better (Vogel et al., 2014). This can lead to a social discrepancy between what one has and one desires, which in turn can lead to feelings of loneliness.

In contrast to PSMU, ASMU entails all activities on social media in which one actively engages. This can be done by updating your own profile, posting something yourself and interacting with people (Verduyn et al., 2017). ASMU is associated with better overall well-being (Verduyn et al., 2017) and less loneliness (Lin, 2020). This can be explained by the mediating role of social support (Lin, 2020). Social support, through interpersonal communication, can enhance the quality and maintenance of relationships (Canary et al., 1993), and therefore lower loneliness (Lin, 2020). In addition, it was found that the majority of people received positive feedback on their profile and posts, which enhances adolescents' social self-esteem, including the ability to initiate and maintain friendships (Valkenburg et al., 2006). It is likely that adolescents with this ability are not so vulnerable for loneliness compared to adolescents without this ability.

## **Gender**

Literature shows inconsistent findings with regard to the association between SMU and loneliness, which is why another moderator will be examined that may explain differences in findings. This study will examine whether there is a difference between boys and girls in the association between SMU and loneliness. There is no literature found in which gender is examined as a moderator for the association between SMU and loneliness. However, there are gender differences found in the association between SMU and other types of well-being, like self-esteem and depression. First, Steinsbekk et al. (2021) found that SMU predicts a decrease in appearance self-esteem, but this association was only valid for girls. Girls' appearance self-esteem is significantly more important than it is for boys (Wichstrøm & von Soest, 2016). It is also found that girls internalize body ideals provided by the media more than boys do (Knauss et al., 2007). Furthermore, girls use social media significantly more than boys as a way to compare themselves to others (Haferkamp et al., 2012). In addition, social comparison has a stronger negative effect on the body image of girls than of boys (Myers & Crowther, 2009). The same gender difference is found for depressive symptoms. Social comparison and feedback seeking on social media is associated with more depressive symptoms, and this effect was stronger for girls than for boys (Nesi & Prinstein, 2015).

Deriving from various studies, it is known that loneliness and depression tend to be comorbid (Heinrich & Gullone, 2006; McHugh Power et al., 2020). Also, various studies confirm the relationship between having low self-esteem and loneliness (Mahon et al., 2006; Vanhalst et al., 2013). Therefore, this study will examine whether gender differences on the association between SMU and depression and SMU and self-esteem also applies to loneliness.

### **Explorative Moderators**

In order to be able to generalize the findings of this study, the association between SMU and loneliness will be investigated through several other moderators. These moderators are age, SES, used loneliness questionnaire, country and social media platform. These moderators will be investigated in an explorative way, which means there are no hypotheses for the moderations.

### **The Current Study**

In this study, the adolescent life phase will range from 12 to 25 years old, as this range is the most all-encompassing (Dahl et al., 2018; Sawyer et al., 2018). Because of the high rates of loneliness in adolescence, and the rise and importance of social media during this phase, the current study will examine the following research question:

*“What is the association between social media use and loneliness during adolescence?”*

The association will be examined by doing a meta-analysis on this topic, integrating relevant articles published to the most recent date. The controversy within this topic makes it valuable to look at this association using a meta-analysis. Also, because of the controversy, no hypothesis will be constructed for the main research question. Furthermore, this study will distinguish several moderators, resulting in the following hypotheses:

H1: The association between adolescents’ social media use and loneliness is negative when using social media in a passive way, and the association is positive when using social media in an active way.

H2: The association between adolescents’ social media use and loneliness is stronger for girls compared to boys.

For the explorative moderators there are no hypotheses constructed.

## **Method**

### **Literature Search**

The MASLO (A Meta-Analytic Study on Loneliness) database has been used in this study. This is an already existing database including studies that measured loneliness with standardized questionnaires, that is, Asher, DLS, HOZA, LACA, RPLQ, RTLS, SELSA and UCLA. The studies included in the MASLO database are found by making use of several online databases: PsychInfo, ERIC, PubMed, and Web of Science. A list of the used key terms can be found through <https://osf.io/tzg32/>. More information on the search can be found elsewhere (Maes et al., 2019).

### **Selection of Studies**

The included studies in the current study contained associations between SMU and loneliness. The researchers made several including steps before creating the final sample. In the MASLO database, there were 375 effect sizes ( $k$ ) consisting of a diverse range of topics related to technology. First, effect sizes that not specifically addressed SMU were excluded ( $k = 229$ ). These were associations related to watching TV, gaming, overall internet use, internet addiction, smartphone usage, e-mail, cyberbullying and internet use for communication, entertainment and information. Specifically, cyberbullying was excluded because the researchers viewed it as more related to bullying in general than SMU. In the end, the sample consisted of effect sizes regarding general SMU (often referred to as social networking sites), SMU on specific platforms like Facebook, Twitter, Instagram, and Snapchat, and texting behavior (which also includes the platform Whatsapp). Second, the effect sizes were checked on the right age category: 12-18 and 18-25 years old. After this step the database consisted of 116 effect sizes out of 42 studies. When running a regular meta-analysis with multiple associations per study, it implies there is dependency in your data. This means that per study it was considered to choose the most fitting association or to compute a (weighted) mean of the available associations within a study. The final database consisted of 42 effect sizes out of 42 studies ( $n$ ).

### **Coding of Studies**

The researcher of the current study coded several new studies to the MASLO database related to SMU and loneliness. However, it is important to note that not all available studies were coded. In addition, information regarding the variable SMU was coded with a piloted coding manual, designed by researchers at KU Leuven.

### **Description of Current Data Base**

The data base consisted of 42 studies, containing in total 20,881 adolescents. The

publication year ranged from 2002 to 2020. The studies were conducted in different countries, like the United States ( $n = 12$ ), the Netherlands ( $n = 4$ ) and Poland ( $n = 4$ ). The remaining studies ( $n = 22$ ) were too diverse to name here. Across all studies, on average 41.2% of the participants was male. The mean age ranged from 14 to 25 years old. Several categories regarding social media platforms were included, namely Facebook ( $n = 20$ ), Instagram ( $n = 2$ ), two or more platforms integrated ( $n = 3$ ) and general use ( $n = 17$ ).

### **Included Variables**

#### ***Gender***

Gender is the percentage of males in the sample. Ranging from 19 to 71.7%, on average 41.2% of the participants was male ( $n = 41$ ).

#### ***Age***

The variable age consists of multiple categories, but in this study only the categories 12-18 years old ( $n = 9$ ) and 18-25 years old ( $n = 33$ ) are used. Choosing an age category is based on the mean age of each sample.

#### ***Socioeconomic status (SES)***

SES can be coded into one of three categories. The first category indicates that 75% or more of the participants have a low SES. The second category indicates that 75% or more of the participants have a middle or high SES ( $n = 2$ ). The third category applies for studies in which no more than 75% of the participants are of high or middle/low SES, but there is a mix of different levels of SES ( $n = 1$ ). In this study, the number of studies in which SES could be coded was limited ( $n = 3$ ). Therefore, SES is excluded as an explorative moderator.

#### ***Used Loneliness Questionnaire***

The standardized loneliness questionnaires used are RTLIS ( $n = 10$ ), SELSA ( $n = 3$ ) and UCLA ( $n = 28$ ). For one study it was not clear which loneliness questionnaire was used.

#### ***Country***

There were not enough studies available per country to function as separate moderators, except for the US ( $n = 13$ ). The diversity of countries where the studies were conducted resulted in the coding of two broader categories: US ( $n = 13$ ) and non-US ( $n = 29$ ).

#### ***Social Media Platform***

Because of too little studies per category, broader categories were formed. In this study, social media platform could be coded as Facebook ( $n = 20$ ), general use ( $n = 17$ ) or other ( $n = 5$ ). The category 'other' was formed with the two remaining original categories: platforms integrated and Instagram.

#### ***PSMU versus ASMU***

PSMU refers to passive browsing and number of photos and/or messages read in a week ( $n = 5$ ). ASMU refers to how often one posts pictures and status updates, shares posts and/or interacts with people on social media ( $n = 17$ ).

### **Effect Sizes**

The effect sizes used in this study are Pearson correlations. A weighted mean of all effect sizes is computed, which means that studies with a larger sample size, as reflected by a smaller standard error, automatically add more weight to the estimate. The effect size of each association was computed into a Fisher's Z, an often used strategy to recode correlations in meta-analyses. In this way, correlations become more normally distributed (Borenstein, 2009). The formula of Fisher's Z score is:  $0,5 * (\ln(1+r/1-r))$ . The corresponding standard error is computed by taking the root of the standard variance:  $\sqrt{(1/n-3)}$ .

### **Statistical Analyses**

Analyses were performed by using the statistical analysis program JASP, version 0.14.1 (JASP team, 2020). At first, the possible presence of publication bias was checked by conducting a funnel plot and the Egger's test (Sedgwick, 2013). It is examined if a considerable number of small studies with a non-significant result is not reported. When the test is not significant, it means there is no clear evidence that the sample size depends on the effect size, and so that there is no strong reason to believe that there is publication bias. Heterogeneity of the meta-analysis was checked to see the amount of variance between studies. When there is a lot of variance, it is a strong indicator that moderators need to be investigated.

Next, a random-effects model was carried out to analyze the main association between SMU and loneliness. A random-effects model is chosen over a fixed-effect model, because a random effects model can be used to generalize findings beyond included studies (Field & Gillet, 2010). This has been done with the Restricted Maximum Likelihood as the standard method. The investigation of moderators has been done by conducting a regression analysis separately for each moderator.

At last, we were also interested in the effect of the moderator 'PSMU versus ASMU' on the association between SMU and loneliness. However, it was not possible to examine this association with a moderation analysis, because most studies examined both PSMU and ASMU as indicators. As said before, we intended to avoid dependency in the data by only using one effect size per study. Therefore, we conducted separate analyses for PSMU and ASMU. In this way, all effect sizes with passive and active use could be included. Hence, we conducted three separate meta-analysis: one for the main association between SMU and

loneliness, one for the association between PSMU and loneliness and one for the association between ASMU and loneliness. After having done the analyses, the estimate of the Fisher's Z score for the three associations is computed back to a Pearson correlation for easier interpretation.

## Results

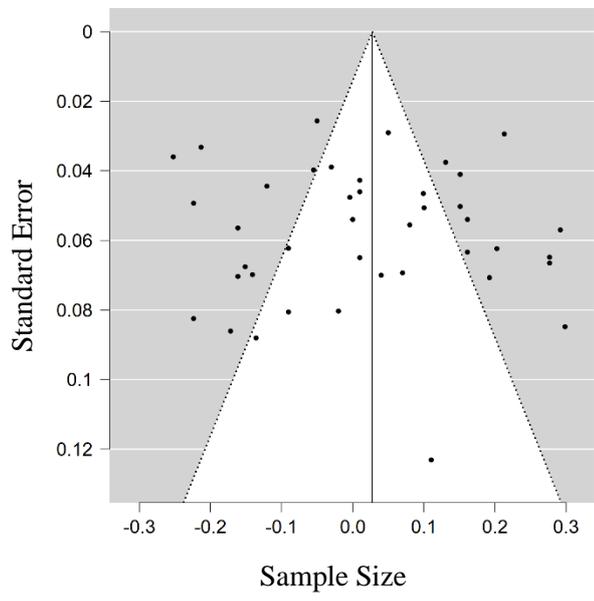
In total, there are 42 effect sizes included in the main analysis. First, we examined the possible presence of publication bias. A funnel plot was created to visually present the possible influence of publication bias (Figure 1). This funnel plot is somewhat symmetrical, meaning there is no evidence for publication bias. Second, the Egger's test was conducted. Based on this test there was also no evidence for publication bias ( $p = .601$ ). Second, there was a regression analysis conducted for the main effect between SMU and loneliness. Based on the Omnibus test, there was no significant result found for this association ( $r = .028$ ,  $SE = 0.025$ ,  $p = .272$ , and 95% CI [-0.022, 0.077]). This test also gives a result of the presence of heterogeneity in the data, meaning the presence of variance between effect sizes. Heterogeneity among effect sizes was significant ( $Q = 697.834$ ,  $p = < .001$ ). In addition, the percentage of variability in effect sizes that is not caused by sampling error is 91.7%.

The moderators are all separately tested with a regression analysis. The moderator gender did not predict the strength of the association between SMU and loneliness (Table 1). Furthermore, the explorative moderators were not significant, including age, questionnaire, country and social media platform (Table 1).

Besides the main analysis there were two additional separate meta-analyses conducted for PSMU and ASMU. There was no significant effect found between PSMU and loneliness ( $r = .001$ ,  $SE = 0.095$ ,  $p = .988$  and 95% CI [-0.185, 0.188]). The same is true for active SMU ( $r = .013$ ,  $SE = 0.039$ ,  $p = .748$  and 95% CI [-0.064, 0.089]).

**Figure 1**

*Funnel plot presenting all included effect sizes ( $k = 42$ )*



**Table 1**

*Separate Moderation Regression Analyses for the Association Between Social Media Use and Loneliness*

Moderator	B	SE B	95% CI	<i>p</i>
Gender (male)				
Intercept	-0.024	0.081	-0.182, 0.134	.766
Male	0.121	0.184	-0.240, 0.483	.511
Age				
Intercept	0.097	0.052	-0.004, 0.198	.061
18-24 years	-0.090	0.059	-0.205, 0.025	.127
Questionnaire				
Intercept	0.042	0.050	-0.057, 0.140	.406
SELSA SOC	-0.167	0.110	-0.382, 0.048	.128
UCLA	0.001	0.059	-0.115, 0.116	.990
Country				
Intercept	0.058	0.029	0.001, 0.114	.047
US	-0.104	0.054	-0.211, 0.002	.054
Social media platform				
Intercept	0.020	0.037	-0.053, 0.093	.591
General use	0.022	0.055	-0.085, 0.129	.689
Other	-0.013	0.086	-0.181, 0.156	.883

*Note.* All values are based on Z-values. For the categorical variables, the reference categories were (from top to bottom): 12-18 years, RTLS, Non-US and Facebook.

## **Discussion**

The current meta-analysis examined the association between SMU and loneliness among adolescents. The main reasons for examining this association are the inconsistency in literature, the increased use of social media in adolescents' life and its social function. The association between SMU and loneliness was not significant. Furthermore, no significant effects were found for all included moderators, that is, gender, age, used loneliness questionnaire, country and social media platform. Lastly, there was no significant association found between PSMU and loneliness and ASMU and loneliness.

### **SMU and Loneliness**

Because of the inconsistency in empirical evidence and the diversity of theories, the researchers of this study had no expectations for the association between SMU and loneliness. For example, the displacement theory suggests that social media displaces the quality of offline relationships, and therefore increases loneliness (Kraut et al., 1998; Valkenburg & Peter, 2007). In contrast, the stimulation theory states that social media can support social interaction and therefore decreases loneliness (Valkenburg & Peter, 2007). From the present results, it can be concluded that the main association between SMU and loneliness was not significant, suggesting that, in a broad sense, loneliness in adolescents is not related to using social media. One explanation for this result could be that the effects were cancelling each other out. When there are positive and negative associations taken together, it can result in the absence of an effect because of the diversity of results (Watt & Collins, 2019, p. 247). Also, from a recent study it has been concluded that different adolescents experience different effects of SMU on their well-being, and a large group of adolescents experienced neither a positive or negative effect (Beyens et al., 2021)

In the present study, there was an hypothesis constructed for two moderators separately. First, it is stated that girls are more at risk for loneliness when using social media, because compared to boys they engage more in upward social comparison (Haferkamp et al., 2012; Myers & Crowther, 2009; Nesi & Prinstein, 2015). Social comparison is found to be associated with lower self-esteem (Myers & Crowther, 2009) and depressive symptoms (Nesi & Prinstein, 2015), and these in turn are associated with loneliness (Heinrich & Gullone, 2006; Mahon et al., 2006). Therefore, this study hypothesized that the association between SMU and loneliness is stronger for girls compared to boys. The results of this study show no significant effect of gender on the association between loneliness and SMU. This finding may suggest that SMU is associated with upward social comparison, low self-esteem and depressive symptoms, but not loneliness. This is in line with findings that suggest loneliness

is an internalizing problem that can be seen as separate from other internalizing problems and does not follow the same developmental pattern as other internalizing problems (Mund et al., 2019). A second explanation for this result could be that SMU in this association is too broad defined. In order to examine the social comparison theory, it should focus on the specific behavior 'social comparing on social media'.

Second, it is hypothesized that PSMU is positively associated with loneliness. This is partly substantiated by the theory that adolescents have a strong tendency to socially compare when passively viewing social media content, resulting in a social discrepancy between what one has and what one desires (Vogel et al., 2014). This in turn can lead to loneliness. In contrast, active use was expected to be negatively associated with loneliness, as this is proved to be associated with social support and a higher social self-esteem, which stimulates respectively friendship quality and friendship initiation. The hypothesis is not supported by the results of this study, meaning there was no significant association between PSMU and loneliness. The same is true for ASMU and loneliness. This result may be due to a limited number of PSMU ( $n = 5$ ) and ASMU studies ( $n = 17$ ) included. It can also be stated that PSMU and ASMU are not specific enough as functions of SMU. The category PSMU could be more specific by including the reason for passively viewing content as a moderator. Examples of motivations are: entertainment (Whiting & Williams, 2013), keeping up with friends, family and relatives (Whiting & Williams, 2013), boredom (Whiting & Williams, 2013) and avoiding reality and regulate negative emotions (Liu & Ma, 2019; Myrick, 2015). It could be that loneliness is positively associated with the avoidance of reality and negatively associated with keeping up with friends and family. Likewise, ASMU can also be divided into different motivations, for example self-disclosure (Luo & Hancock, 2020), strategic self-presentation (Seidman, 2013) and social interaction (Whiting & Williams, 2013). In research it is stated that self-disclosure is common in lonely emerging adults (Hood et al., 2018), and it could be that social interaction is negatively associated with loneliness. Furthermore, in a recent review study it has also been criticized that a lot of studies don't make the distinction between private and public use in PSMU and ASMU, as it is hypothesized that private use is more intimate and therefore can have different effects on well-being (Beyens et al., 2021).

Besides examining motivations as moderators, there are thought patterns that could play a mediating role in the association between SMU and loneliness. As mentioned before, upward social comparison and body comparison are thought patterns that are very common within adolescents (Vogel et al., 2014). These thought patterns could be influenced by personality characteristics or the kind of content adolescents' browse through (Beyens et al.,

2021).

Furthermore, in the main analysis there were several explorative moderators examined. All the explorative moderators did not show a significant effect, meaning we can generalize the absence of an association between SMU and loneliness across different contexts.

### **Strengths and Limitations**

There are a few strengths in this study. First, different samples from different countries are included, which makes it more likely that the results do not depend on the circumstances participants were in when filling out the questionnaire. However, it is important to note that most samples come from the European and North-American population, so we cannot draw conclusions for the populations on other continents. Second, a sample is assigned to one of the two age groups based on the mean age of each sample. Age was reasonable homogeneous across included studies, which means that the range was limited and most studies fitted into that range.

Despite strengths, there are some limitations that can be mentioned. First, one association per study was used to avoid dependency in the data. This means that not all available associations could be included. The alternative would be that there were multiple associations per study included with multi-level modelling. However, there was a lack of time and knowledge and this led to the decision to only use one association per study. Second, the operationalization of SMU in the included studies was highly diverse, which implies heterogeneity in the data. Heterogeneity is a limitation in this study, because the amount of studies per specific category was not sufficient. This makes it hard to draw conclusions about specific SMU. Besides, diversity in operationalization may lower the reliability of the study, as it is likely that other researchers will find different results because of different inclusion criteria for SMU. For example, smartphone usage was excluded, but other researchers might find it relevant to include because social media plays a great role in smartphone usage.

### **Recommendations for Future Research**

Overall, it can be concluded there are still a lot of studies measuring SMU in time spent on social media and chatting hours. Future research should focus more on distinctions in conceptualizations, motivations and psychological processes when looking at the association between passive or active SMU and loneliness. In addition, the social context in which the adolescent finds himself should be included in the questionnaire. For example, researchers can focus on offline friendships and the satisfaction and interaction that comes from those friendships. The online and offline world can be experienced as intertwined or as two

different worlds. For example, the association between SMU and loneliness may be stronger for adolescents who feel a lack in their friendship satisfaction in real life. When adding the social context to research there could be drawn conclusions for specific groups of adolescents. Furthermore, little longitudinal research has been done, but mostly cross-sectional. It would be good if more longitudinal research is available to see if individual effects of SMU differ between different moments of time in adolescence. Furthermore, longitudinal studies are more likely to make statements about causality than cross-sectional studies. In this way we would gain more knowledge on the question whether loneliness leads to (certain types of) SMU, or (certain types of) SMU leads to loneliness.

### **Practical Implications**

From this study it cannot be derived under which circumstances SMU might be associated with loneliness. Researchers, practitioners and policy makers should know that it is likely that SMU on itself is not associated with adolescents' feelings of loneliness. Therapists treating loneliness in adolescents should have a look at the social media usage of their clients. Moreover, they should lay the foundation of their treatment on the reason why adolescents use social media, what they do on those platforms and the psychological processes. They should also be open minded about the possible positive outcomes of SMU for adolescents. Researchers should therefore focus more on those positive outcomes and, again, under which circumstances these outcomes may be applicable. When SMU is specified in more categories and positive and negative outcomes are investigated, a meta-analysis can integrate this empirical evidence and make more valid conclusions for several categories. In this way, different treatments can be designed for groups of adolescents with different needs. educationalist and psychologists can integrate this knowledge into educational programs in schools and parenting programs regarding adolescents' SMU.

### **Conclusion**

Social media is a medium that is being used a lot by adolescents these days. There are concerns about the influence of social media on adolescents' social life, possibly resulting in loneliness. This meta-analysis examined the association between SMU and loneliness among adolescents aged 12 to 25 years old. There may be evidence for a robust effect on the absence of an association between SMU and loneliness, because every moderator results in the same non-significant outcome: there is no association between SMU and loneliness. However, one should take in mind that the available literature was limited, meaning most indicators of SMU are in frequency (i.e. time spent and chatting hours). Moreover, not all available studies were coded and more specific categories could not be made. Future research should focus on more

specific functions of SMU, including why adolescents use social media, what they do on those platforms and the psychological processes behind it. Only when researchers can make more specific categories, there can be drawn more validated conclusions for policy makers, practitioners, teachers, parents and most of all, adolescents themselves.

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