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Types of smartphone usage and problematic smartphone use among adolescents: A review of literature

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ABSTRACT

This review aimed to provide an overview of the influence of social and process smartphone use on problematic smartphone use (PSU) among adolescents aged between 10-24 years old. Social smartphone use comprises three types of smartphone features: social networking sites, chatting/texting/instant messaging, and video/phone calls. On the other hand, categories of process smartphone use include watching videos/television/movies, web surfing, playing games, listening to music/podcasts/radio, and educational learning. There were 42 studies with a total of 139,389 adolescents met the criteria for inclusion after a thorough search of academic databases. Overall, the evidence from the studies included in this review revealed that chatting/texting, video/phone calls, watching videos/television/movies and music/podcasts/radio were positively and significantly linked to and predicted problematic smartphone use. Social networking sites use, instant messaging, gaming, web surfing and educational learning yielded inconsistent results. They could have a positive or negative relationship with PSU and play a role in predicting PSU. More research is needed for music/podcasts/radio and video/phone calls because the results are still scarce.

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1. INTRODUCTION

Smartphones are touchscreen gadgets with a wide range of applications (apps). It is a game-changing invention because it integrates the features of the traditional phone and a computer into a single small device. Smartphones have become indispensable tools for people of all ages worldwide, and it is hard to imagine life without a smartphone. Smartphone use becomes problematic when users cannot control their use and thus suffer from impaired daily functioning. Problematic smartphone use (PSU) is frequently viewed as a form of technology addiction. An operational definition of technology addiction is "non-chemical, behavioral addictions involving human-machine interactions" [1]. The terms problematic smartphone use and smartphone addiction appear to be used interchangeably based on the researchers' interpretation of the underlying concept. The term "smartphone addiction" is frequently used by researchers who believe that the observed behaviors fulfill addiction criteria [2]. On the other hand, researchers who do not consider excessive smartphone use as addictive behavior choose to use the term "problematic smartphone use" [3], [4].

Although problematic smartphone use is not listed in the diagnostic and statistical manual of mental disorders, fifth edition (DSM-5) or the international classification of diseases 11th revision (ICD-11), there are many similarities between the behavior and other behavioral addictions. As Gutiérrez, Fonseca, and

Rubio [5] demonstrated in their study, each of the eight DSM-5 symptoms of substance use disorders corresponds to similar PSU symptoms. PSU has been linked to a variety of detrimental health and functional outcomes. Sleep difficulties induced by late-night overuse [6] and musculoskeletal pain affecting the shoulder, hand and neck [7] are associated with PSU. PSU is also related to poor physical fitness [8] and academic difficulties [9].

Problematic smartphone use is on the rise across the world [10]. Adolescents, especially those sensitive to new media and technologies, are a high-risk group for PSU. In this study, a description of adolescents based on that by Sawyer *et al.* [11] was employed, in which 10-24 years corresponds more closely to adolescents' development and popular understandings of this life stage would facilitate extended investments across a wider range of settings. Adolescents have a strong attachment to their smartphone and view it as a second self. Studies revealed that the average age at which adolescents get their first smartphone is 10 years old [12]. In Switzerland, 97% of adolescents own a smartphone [13]. In the United Kingdom, 60% of adolescents are heavily dependent on their smartphones. As the use and ownership of smartphones among adolescents across the world have grown up rapidly in recent years [10], it is crucial to study PSU in this age group because they go through fundamental developmental challenges that impact them in various ways (the formation of self-worth and self-concept, acceptance by peers and family, emotion regulation, sexual maturation and a desire for autonomy) [14]. These developmental changes have made smartphones an essential tool for adolescents. They are more interested in and adept at using new technology than adults. As digital natives, adolescents share their thoughts online, stay up with trends, use various applications, and look for emotional support and connections. Adolescents who display these characteristics, including novelty seeking and paired with immature control competence, are vulnerable to PSU.

In many prior studies, smartphone usage time, which is one of the key predictors of PSU, is incorporated into the prediction model of PSU. However, many studies have recently focused on smartphone usage types [15]. A smartphone has numerous functions and features. Mobile phone usage has changed significantly in the past two decades ago when phones were primarily used for communication. Now, they are instrumental. Because of the portability, sophistication and connectivity of today's phones, users are constantly surrounded by multiple applications on their phones. In addition to productivity enhancement (reminders and email), smartphone technology is used for information seeking (browsing the news and web surfing) as well as to establish and maintain social ties (messaging and social media). Others include relaxation and diversion (music), entertainment (video games and movies), financial compensation (finding consumer deals) and personal status [16], [17]

Internet use has been divided into two categories: process use and social use [17]. Deursen *et al.* [16] expanded this classification to include smartphone usage. Process utilization is primarily concerned with content-based media consumption. Gaming, listening to music, browsing news websites and watching movies are content-based media consumption activities. Social use comprises communicating with one's social network via phone calls, instant messaging, and social media interaction.

According to the uses and gratifications (U&G) theory, people satisfy their psychological and social needs by seeking out specific media. These specific needs are the primary determinants of various media selections [18], [19]. The pleasurable experience of smartphone content provides gratification to smartphone users, and this gratification is realized during consumption. Because of the convenience and variety of functions provided by smartphones, users can also become overly attached to and preoccupied with their devices. Based on the UGT applied to the context of problematic smartphone use, individuals' problematic smartphone behaviors may differ according to the specific types of smartphones uses they favor. There is an increasing number of studies examining the relationships and influence of smartphone usage types on PSU among adolescents. Nevertheless, research on the impact of smartphone usage types on PSU yielded inconclusive results. Although both process and social smartphone usage could lead to PSU, there is a lack of information addressing the relative influence of the two smartphone usage types on PSU. Thus, this paper aims to give an overview of studies on the relationship between types of smartphone usage and PSU. The findings of this literature review could be beneficial in determining research gaps that need to be addressed in future studies.

2. RESEARCH METHOD

An extensive search was undertaken on numerous online databases, such as Web of Science (WoS), Scopus, SAGE Journals, ScienceDirect, and Springer Link, for studies that investigated the association between smartphone use and problematic smartphone use. Figure 1 depicts the several stages in the screening process and specific conditions that were applied to the literature search. In addition, this review also has a list of inclusion criteria.

First, only publications from 2011 onward were searched to maximize the possibility of finding research that focused on smartphones rather than older types of mobile phones without internet connection. A literature search was conducted in databases regarding the paper published between January 2011 and May 2021. The articles were gathered from various geographical areas to understand better how these two smartphone usage types were related to PSU across different countries and cultures. The parameters for the search were 'problematic', 'addiction', 'overuse', 'dependency', 'nomophobia' in combination with 'smartphone', 'cellphone', 'mobile device', 'mobile phone', 'digital media', and 'adolescents', 'youth' as well as 'types of smartphone use'. Articles were limited to English-language, peer-reviewed journals using quantitative or mixed methodologies and focused primarily on adolescents (10-24 years). If a clear differentiation between age groups could be made, studies on college students were also included. Reviews, dissertations, book chapters, editorial articles, case studies and commentaries, as well as articles concentrating on the positive and negative outcomes of smartphones were excluded. Articles about problematic networking services use, problematic Internet use or media/screen use in general were omitted too. Before reviewing full-text articles, titles and abstracts retrieved in the search were evaluated for relevance.

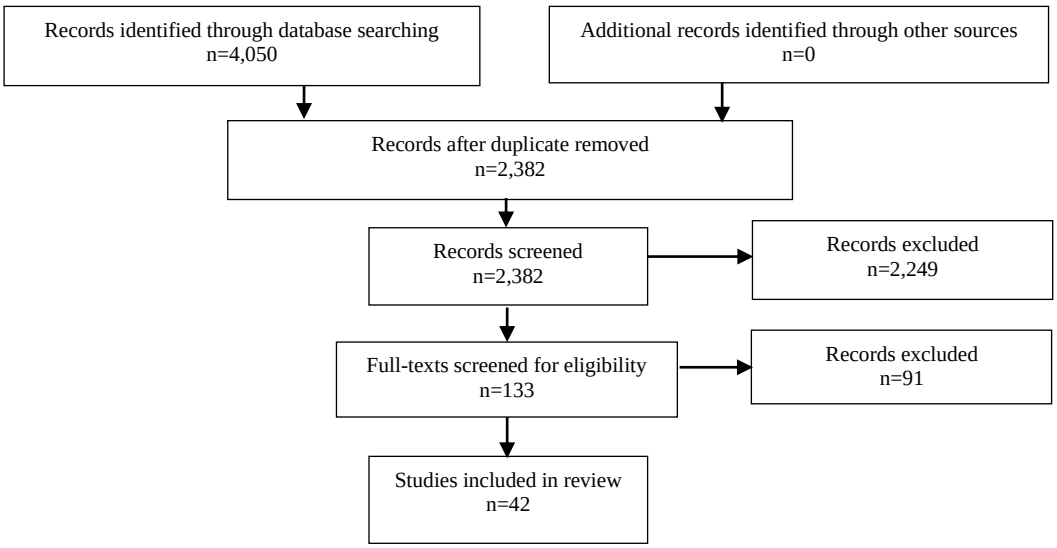

Figure 1. The flow of information through the different phases of a review

3. RESULTS

3.1. Sample of included studies

The initial search yielded 4,050 articles, following duplicate removal, produced 2,382 articles. It was then determined that 2,340 articles were eliminated because they did not or did not primarily focus on adolescents. Besides, those eliminated articles were not peer-reviewed, were not published in English, did not meet the criteria for originality, or merely looked at media use or Internet addiction in general. Publications about problematic mobile phone or cell phone use were also included in the search despite being focused on smartphones. It is reasonable to assume that at least some participants used cell/mobile phones from 2011 onward.

This review covered 42 articles in all. There were 30.95% (n=13) of the included studies carried out in South Korea and 14.29% (n=6) in China. Four studies (9.52%) were conducted in the United States. Other studies were from Singapore, Malaysia, Columbia, Brazil, Pakistan, Saudi Arabia, Northeast Asia, and European regions (each of these accounting for 2.38%). There were two studies (4.76%) carried out in Italy and another two studies were conducted in Switzerland (4.76%). Three studies (7.14%) were from Taiwan, and four additional studies (9.52%) were from Turkey. Although the types of smartphone use constructs studied in each study were different, the research findings revealed that social and process smartphone use was frequently related to PSU. Social smartphone use comprises three types of smartphone features: social networking sites (SNS), chatting/texting/instant messaging, and video/phone calls. On the other hand, commonly investigated categories of process smartphone use included watching videos/television/movies, web surfing, games, music/podcasts/radio, and educational learning. The research findings were presented in Table 1.

Table 1. Summary of research findings of the included studies

Type of content	References
Social use	
Using a smartphone for social purposes	i) Social smartphone use was positively related to problematic smartphone use [20], [21]; ii) Use patterns of interpersonal communication correlated positively with problematic mobile phone use [22], [23]; iii) The direct impact of alexithymia on PSU was moderated by interpersonal communication patterns [23].
Social networking sites (Facebook, Instagram, Snapchat)	i) The risk factors for smartphone addiction included frequent use of smartphone/tablet SNSs [24], [25]; ii) SNS and social media use predicted problematic smartphone use [26]–[30]; iii) SNS was positively related to symptoms of smartphone addiction/nomophobic behavior [31]–[36]; iv) SNS application usage is more prominent in the addicted group [37]; v) Users who access the Internet for SNSs were linked to a higher smartphone addiction tendency [38]–[46]; vi) SNS use was not related to smartphone dependence [47]; vii) Social network usage purposes were negatively correlated with nomophobic behavior [48].
Chatting (WhatsApp, Facebook Messenger) and Texting/Instant messaging	i) The risk factors for smartphone addiction included frequent use of smartphone/tablet instant messaging [24], [25]; ii) Social-recreational onliners (frequently involved in social media activities and instant messaging) showed significantly higher levels of PSU over time [49]; iii) Mobile messenger use predicted problematic smartphone use [50] iv) Smartphone use for texting was significantly associated with higher smartphone addiction behaviors [25], [45]; v) Addiction groups show significantly higher scores on "online chat" [51]; vi) The use of instant messenger was unrelated to smartphone dependence [47], [52].
Video and phone calls	Using traditional phone activities (call and short message) positively affects smartphone dependency symptoms [29].
Process use	
Using a smartphone for non-social purposes such as entertainment, relaxation, news consumption and other primarily non-social purposes	i) Problematic smartphone use is related to process smartphone use [21], [53]; ii) Use patterns of entertainment correlated positively with problematic smartphone use [20], [22], [47]; iii) The use of the smartphone for instrumental, entertainment, relational, expressive and informational purposes predicted overall PSU [46], [47], [54], [55]; iv) Hedonic smartphone use motivation (to gain pleasure) was positively related to PSU via more time spent on entertainment [56]; v) Process-oriented smartphone use mediated the relationship between materialism and problematic smartphone dependency [57]; vi) Process smartphone use mediated relations between expressive suppression and PSU severity [58]; vii) The relationship between uncertainty intolerance and PSU levels was mediated by non-social smartphone use [59]; viii) The impact of alexithymia on PSU was partially mediated by entertainment patterns [23].
Gaming	i) Playing video games predicted problematic smartphone use [25], [27]–[29]; ii) Games apps were positively related to symptoms of smartphone addiction [31], [47]; iii) Playing games was associated with a higher smartphone addiction tendency [38], [41], [42], [44], [45]; vi) In female subsamples, time spent using mobile phones for video gaming negatively predicted mobile phone addiction symptoms [32]; v) Mobile phone gaming mediated the association between autonomy need dissatisfaction and problematic mobile phone use [60].
Watching videos/ TV/Movies	i) Mobile videos predicted PSU [29]; ii) Watching videos was positively related to symptoms of addiction [31]; iii) Watching videos was significantly associated with higher smartphone addiction [45], [61]; vi) Senior high school students who use the internet to watch online videos have lower smartphone addiction levels [38]; v) Watching online TV predicted PSU [25]; vi) Social-recreational online users (those who frequently engage in watching online TV) had significantly higher levels of PSU over time [49].
Web surfing	i) Web content consumption predicted problematic smartphone use [46], [52]; ii) Using a smartphone for information seeking was linked to smartphone dependence [47]; iii) "Use to follow the news" decreased the risk of addiction [30]; iv) Instrumental smartphone use motivation (i.e., acquiring information or expanding knowledge) was negatively related to PSU via more time spent on the learning and less time spent on entertainment and communication [56].
Music/podcasts/ radio	PSU levels were significantly higher in social-recreational onliners (those who spend a lot of time in listening to music) [49].
Educational learning	i) Learning applications were associated with severe smartphone dependence [61]; ii) The risk of smartphone addiction is lower when using the Internet for academic purposes [30], [38].

4. DISCUSSION

This review aims to assemble findings on the influence of types of smartphones use such as process and social smartphone usage on PSU. Through a systematic overview of research, several conclusions could be drawn from the included studies. It may be noticed that the majority of the studies (30.95%) that met the inclusion criteria were conducted in South Korea. South Korea has the highest smartphone ownership rate compared to other countries [62]. According to a survey conducted in South Korea between August and October 2020, 35.8% of young people in South Korea are at risk of becoming overly reliant on smartphones. Compared to 18.4% in 2012, the figures have nearly doubled [63]. All of the studies included in this review were conducted among adolescents. One explanation for this focus is that adolescents and teens are the first generations to have grown up in such a technologically advanced world, making them more susceptible to PSU than adults. Besides, adolescents are more likely to have behavioral problems and substance use as they have less self-control when it comes to pursuing pleasure [64]. In addition, adolescents go through many physical and psychological changes during their development. While they are reliant on their parents in terms of their lives and identities, they are also attempting to be independent, develop their own identities, and carve out an independent space for themselves. During these changes, a smartphone has become an absolute necessity for adolescents [27].

Smartphones perform various functions, including providing a user-friendly interface for information, entertainment, communication and education. Among these various functions that may associate with or in predicting PSU, most types of smartphone use produced contradictory findings. Research on social networking site use, instant messaging, gaming, web surfing and educational learning remain inconclusive. However, both gaming and social networking sites have been identified as significant types of content that may lead to PSU. PSU was positively and significantly related to and predicted by social smartphone usage [20]–[23]. Most studies [24]–[46] concurred that PSU was positively and significantly associated with and predicted by using a smartphone for social networking regardless of a few inconsistencies. In recent years, social network services (SNS) have emerged as one of the most widely used applications. SNS is utilized to maintain and build social relationships, as well as for personal self-promotion [65]. Adolescents rely heavily on social networks to satisfy needs such as peer communication, belonging, popularity and social support [66]. Facebook and Instagram, for instance, are not just used for social communication but also for self-presentation and recording users' daily lives, much like a diary.

Several prior evidence [20]–[22], [46], [47], [53]–[56] also revealed that the process of smartphone use which involves primarily non-social purposes (e.g., entertainment or relaxation) could be positively associated with or in predicting PSU. Smartphones are regarded as incredibly beneficial and effective for a variety of recreational activities including gaming, photography, video production, GPS navigation, movie viewing, YouTube viewing, radio listening and other activities [67]. According to Wang *et al*. [67], using a smartphone to access entertainment can help to decrease mental and physical stress. Problematic users use their smartphones for self-entertainment, such as watching movies online and playing video games.

In relation to gaming, most studies [25], [27]–[29] revealed that using a smartphone for gaming was a potential risk factor for PSU or associated with it [31], [38], [41], [42], [44], [45], [47]. The mobile gaming industry is expanding rapidly and is attracting an increasing number of consumers. Mobile application developers are broadening the target market of this industry by releasing a variety of mobile games such as action, role-playing, adventure, educational, leisure games, strategy, sports and cards, drawing an increasing number of mobile users, particularly youngsters with a variety of tastes [68]. Using the smartphone for video/phone calls and listening to music/podcasts/ radio are the two least types of smartphone usage studied in relation to PSU, and more research is needed. Pertaining to the phone calls, weak evidence [29] indicated that phone calls are positively associated with PSU. Concerning using the smartphone for listening to music, there was strong evidence [49] which demonstrated that social-recreational online users (those who frequently engage in social media activities, instant messaging, music listening, and watching online TV) had significantly higher levels of PSU over time.

The first limitation of the review is that cause-and-effect relationships between the variables are not statistically consistent over time. Most of the included studies were cross-sectional and correlational research. As a result, assertions concerning the directionality of the relationship can neither be made nor supported. Longitudinal research is required to debunk the question of directionality and the causal pathways involved in these relationships. The second limitation is related to the sensitivity of the search strategy and the inclusion and exclusion criteria used. As the focus was on types of smartphone use, it is possible that some relevant studies were missed during the screening or some studies may not have been retrieved in the search.

Another significant limitation discovered in the studies is the tools used to assess PSU levels and types of smartphone use. Most of the studies included in the review did not provide enough information on the psychometric properties of the tools used, nor did they provide enough detail on the tools used. These findings do not necessarily imply that the tools used lack adequate psychometric properties. Still, they may indicate that researchers place less emphasis on the biases that assessment tools can introduce into studies. PSU assessment should be based on reliable instruments with good internal consistency and demonstrate adequate content validity to measure dependency (loss of control, preoccupation, attempts at appetitive need fulfillment, undesired consequences) [69]. Furthermore, such a measure should consider the specific repercussions of PSU such as use while driving and use in social situations where it upsets a speaker or disrupts the flow of conversation.

5. CONCLUSION

The current research provides a quantitative review of the literature about smartphone use and types of smartphones use among adolescents. Young people exposed to extensive and irrational technology use are only aware of the benefits it provides and unaware of the risks they may face a consequence. Therefore, it is timely to examine the state of the literature on this topic given its rapid growth. More research is needed to discover, investigate, and note the most critical factors that influence this modern pathology. The findings reveal that not only is there a link between different types of smartphones use and problematic smartphone use, but this link is moderated and mediated by a few factors. These significant mediators and moderators suggest future research directions. Despite the difficulties in interpretation caused by different

operationalizations, this review explicitly demonstrated how types of smartphone use were associated with PSU among adolescents. Based on this, future research implications could include the following: More crucially, a clear definition of the construct, as well as standard nomenclature and operationalization, would make the results more comparable.

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